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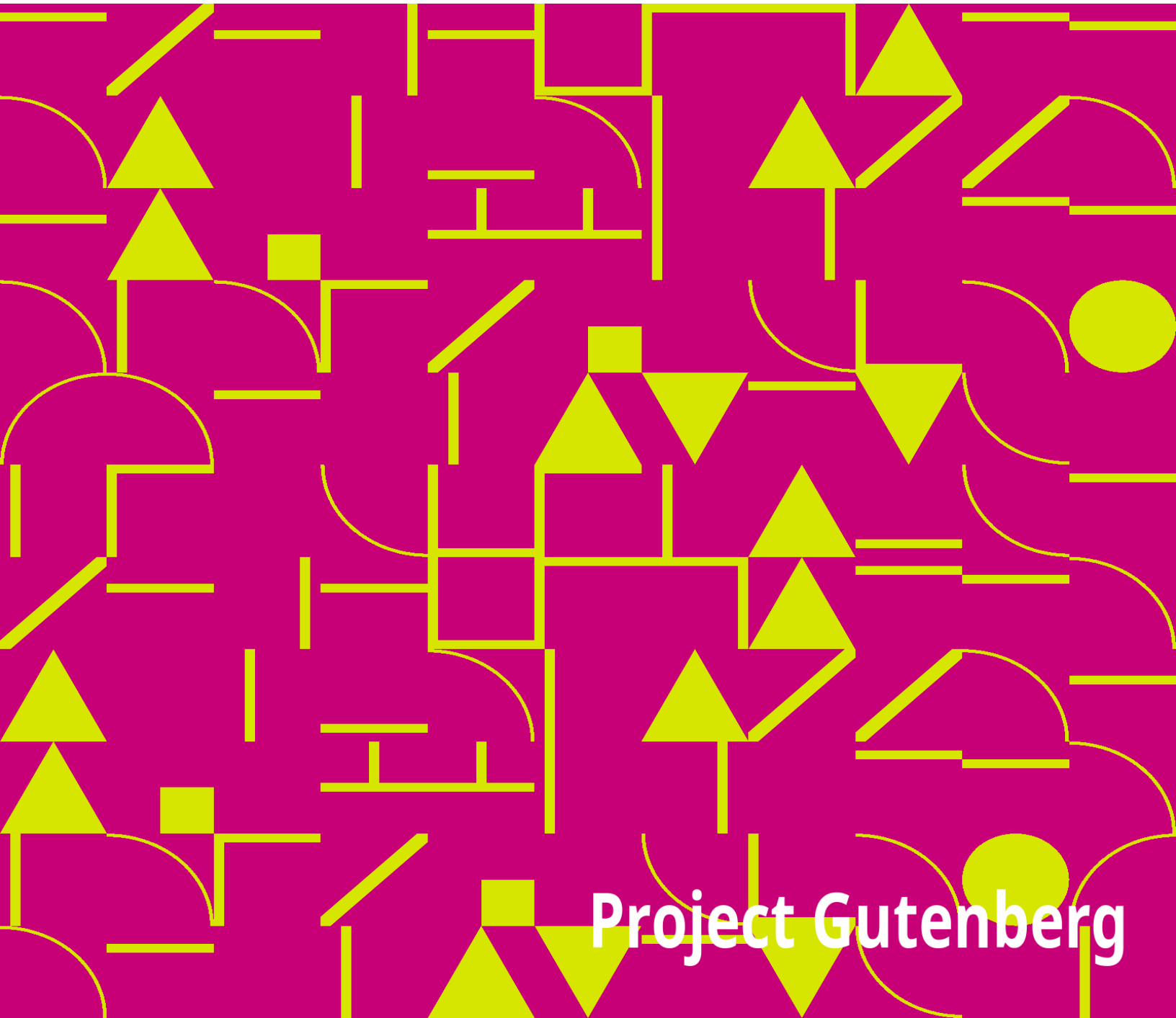

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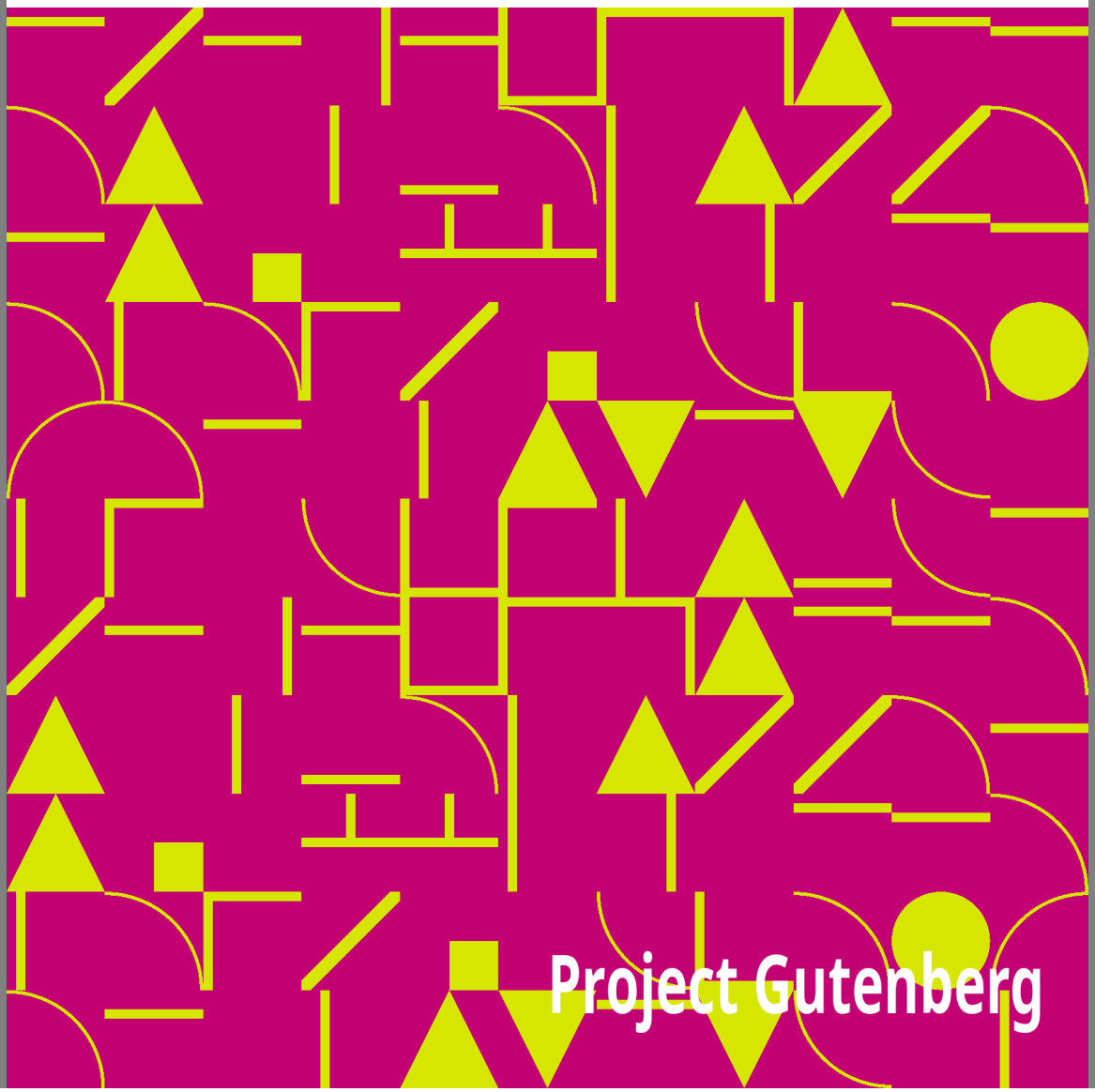

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Title: Encyclopaedia Britannica, 11th Edition, "Liquid Gases" to "Logar"

Author: Various

Release date: February 23, 2013 [eBook #42173]
Most recently updated: October 23, 2024

Language: English

Other information and formats: www.gutenberg.org/ebooks/42173

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THE ENCYCLOPÆDIA BRITANNICA

A DICTIONARY OF ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION

ELEVENTH EDITION

VOLUME XVI SLICE VII

Liquid Gases to Logar

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LIQUID GASES.[1]

Though Lavoisier remarked that if the earth were removed to very cold regions of space, such as those of Jupiter or Saturn, its atmosphere, or at least a portion of its aeriform constituents, would return to the state of liquid (*Œuvres*, ii. 805), the history of the liquefaction of gases may be said to begin with the observation made by John Dalton in his essay "On the Force of Steam or Vapour from Water and various other Liquids" (1801): "There can scarcely be a doubt entertained respecting the reducibility of all elastic fluids of whatever kind

into liquids; and we ought not to despair of effecting it in low temperatures and by strong pressures exerted on the unmixed gases." It was not, however, till 1823 that the question was investigated by systematic experiment. In that year Faraday, at the suggestion of Sir Humphry Davy, exposed hydrate of chlorine to heat under pressure in the laboratories of the Royal Institution. He placed the substance at the end of one arm of a bent glass tube, which was then hermetically sealed, and decomposing it by heating to 100° F., he saw a yellow liquid distil to the end of the other arm. This liquid he surmised to be chlorine separated from the water by the heat and "condensed into a dry fluid by the mere pressure of its own abundant vapour," and he verified his surmise by compressing chlorine gas, freed from water by exposure to sulphuric acid, to a pressure of about four atmospheres, when the same yellow fluid was produced (*Phil. Trans.*, 1823, 113, pp. 160-165). He proceeded to experiment with a number of other gases subjected in sealed tubes to the pressure caused by their own continuous production by chemical action, and in the course of a few weeks liquefied sulphurous acid, sulphuretted hydrogen, carbonic acid, euchlorine, nitrous acid, cyanogen, ammonia and muriatic acid, the last of which, however, had previously been obtained by Davy. But he failed with hydrogen, oxygen, fluoboric, fluosilicic and phosphuretted hydrogen gases (*Phil. Trans.*, ib. pp. 189-198). Early in the following year he published an "Historical statement respecting the liquefaction of gases" (*Quart. Journ. Sci.*, 1824, 16, pp. 229-240), in which he detailed several recorded cases in which previous experimenters had reduced certain gases to their liquid state.

In 1835 Thilorier, by acting on bicarbonate of soda with sulphuric acid in a closed vessel and evacuating the gas thus obtained under pressure into a second vessel, was able to accumulate large quantities of liquid carbonic acid, and found that when the liquid was suddenly ejected into the air a portion of it was solidified into a snow-like substance (*Ann. chim. phys.*, 1835, 60, pp. 427-432). Four years later J. K. Mitchell in America, by mixing this snow with ether and exhausting it under an air pump, attained a minimum temperature of 146° below zero F., by the aid of which he froze sulphurous acid gas to a solid.

Stimulated by Thilorier's results and by considerations arising out of the work of J. C. Cagniard de la Tour (*Ann. chim. phys.*, 1822, 21, pp. 127 and 178, and 1823, 22, p. 410), which appeared to him to indicate that gases would pass by some simple law into the liquid state, Faraday returned to the subject about 1844, in the "hope of seeing nitrogen, oxygen and hydrogen either as liquid or solid bodies, and the latter probably as a metal" (*Phil. Trans.*, 1845, 135, pp. 155-157). On the basis of Cagniard de la Tour's observation that at a certain temperature a liquid under sufficient pressure becomes a vapour or gas having the same bulk as the liquid, he inferred that "at this temperature or one a little higher, it is not likely that any increase of pressure, except perhaps one exceedingly great, would convert the gas into a liquid." He further surmised that the Cagniard de la Tour condition might have its point of temperature for oxygen, nitrogen, hydrogen, &c., below that belonging to the bath of solid carbonic acid and ether, and he realized that in that case no pressure which any apparatus would be able to bear would be able to

bring those gases into the liquid or solid state, which would require a still greater degree of cold. To fulfil this condition he immersed the tubes containing his gases in a bath of solid carbonic acid and ether, the temperature of which was reduced by exhaustion under the air pump to −166° F., or a little lower, and at the same time he subjected the gases to pressures up to 50 atmospheres by the use of two pumps working in series. In this way he added six substances, usually gaseous, to the list of those that could be obtained in the liquid state, and reduced seven, including ammonia, nitrous oxide and sulphuretted hydrogen, into the solid form, at the same time effecting a number of valuable determinations of vapour tensions. But he failed to condense oxygen, nitrogen and hydrogen, the original objects of his pursuit, though he found reason to think that "further diminution of temperature and improved apparatus for pressure may very well be expected to give us these bodies in the liquid or solid state." His surmise that increased pressure alone would not suffice to bring about change of state in these gases was confirmed by subsequent investigators, such as M. P. E. Berthelot, who in 1850 compressed oxygen to 780 atmospheres (*Ann. chim. phys.*, 1850, 30, p. 237), and Natterer, who a few years later subjected the permanent gases to a pressure of 2790 atmospheres, without result; and in 1869 Thomas Andrews (*Phil. Trans.*, 11) by his researches on carbonic acid finally established the conception of the "critical temperature" as that temperature, differing for different bodies, above which no gas can be made to assume the liquid state, no matter what pressure it be subjected to (see CONDENSATION OF GASES).

About 1877 the problem of liquefying the permanent gases was taken up by L. P. Cailletet and R. P. Pictet, working almost simultaneously though independently. The former relied on the cold produced by the sudden expansion of the gases at high compression. By means of a specially designed pump he compressed about 100 cc. of oxygen in a narrow glass tube to about 200 atmospheres, at the same time cooling it to about −29° C., and on suddenly releasing the pressure he saw momentarily in the interior of the tube a mist (*brouillard*), from which he inferred the presence of a vapour very near its point of liquefaction. A few days later he repeated the experiment with hydrogen, using a pressure of nearly 300 atmospheres, and observed in his tube an exceedingly fine and subtle fog which vanished almost instantaneously. At the time when these experiments were carried out it was generally accepted that the mist or fog consisted of minute drops of the liquefied gases. Even had this been the case, the problem would not have been completely solved, for Cailletet was unable to collect the drops in the form of a true stable liquid, and at the best obtained a "dynamic" not a "static" liquid, the gas being reduced to a form that bears the same relation to a true liquid that the partially condensed steam issuing from the funnel of a locomotive bears to water standing in a tumbler. But subsequent knowledge showed that even this proximate liquefaction could not have taken place, and that the fog could not have consisted of drops of liquid hydrogen, because the cooling produced by the adiabatic expansion would give a temperature of only 44° abs., which is certainly above the critical temperature of hydrogen. Pictet again announced that on opening the tap of a vessel containing hydrogen at a

pressure of 650 atmospheres and cooled by the cascade method (see CONDENSATION OF GASES) to −140° C., he saw issuing from the orifice an opaque jet which he assumed to consist of hydrogen in the liquid form or in the liquid and solid forms mixed. But he was no more successful than Cailletet in collecting any of the liquid, which—whatever else it may have been, whether ordinary air or impurities associated with the hydrogen—cannot have been hydrogen because the means he employed were insufficient to reduce the gas to what has subsequently been ascertained to be its critical point, below which of course liquefaction is impossible. It need scarcely be added that if the liquefaction of hydrogen be rejected a fortiori Pictet's claim to have effected its solidification falls to the ground.

After Cailletet and Pictet, the next important names in the history of the liquefaction of gases are those of Z. F. Wroblewski and K. S. Olszewski, who for some years worked together at Cracow. In April 1883 the former announced to the French Academy that he had obtained oxygen in a completely liquid state and (a few days later) that nitrogen at a temperature of −136° C., reduced suddenly from a pressure of 150 atmospheres to one of 50, had been seen as a liquid which showed a true meniscus, but disappeared in a few seconds. But with hydrogen treated in the same way he failed to obtain even the mist reported by Cailletet. At the beginning of 1884 he performed a more satisfactory experiment. Cooling hydrogen in a capillary glass tube to the temperature of liquid oxygen, he expanded it quickly from 100 atmospheres to one, and obtained the appearance of an instantaneous ebullition. Olszewski confirmed this result by expanding from a pressure of 190 atmospheres the gas cooled by liquid oxygen and nitrogen boiling under reduced pressure, and even announced that he saw it running down the walls of the tube as a colourless liquid.

Wroblewski, however, was unable to observe this phenomenon, and Olszewski himself, when seven years later he repeated the experiment in the more favourable conditions afforded by a larger apparatus, was unable to produce again the colourless drops he had previously reported: the phenomenon of the appearance of sudden ebullition indeed lasted longer, but he failed to perceive any meniscus such as would have been a certain indication of the presence of a true liquid. Still, though neither of these investigators succeeded in reaching the goal at which they aimed, their work was of great value in elucidating the conditions of the problem and in perfecting the details of the apparatus employed. Wroblewski in particular devoted the closing years of his life to a most valuable investigation of the isothermals of hydrogen at low temperatures. From the data thus obtained he constructed a van der Waals equation which enabled him to calculate the critical temperature, pressure and density of hydrogen with very much greater certainty than had previously been possible. Liquid oxygen, liquid nitrogen and liquid air—the last was first made by Wroblewski in 1885—became something more than mere curiosities of the laboratory, and by the year 1891 were produced in such quantities as to be available for the purposes of scientific research. Still, nothing was added to the general principles upon which the work of Cailletet and Pictet was based, and the "cascade" method, together with

adiabatic expansion from high compression (see CONDENSATION OF GASES), remained the only means of procedure at the disposal of experimenters in this branch of physics.

In some quarters a certain amount of doubt appears to have arisen as to the sufficiency of these methods for the liquefaction of hydrogen. Olszewski, for example, in 1895 pointed out that the succession of less and less condensible gases necessary for the cascade method breaks down between nitrogen and hydrogen, and he gave as a reason for hydrogen not having been reduced to the condition of a static liquid the non-existence of a gas intermediate in volatility between those two. By 1894 attempts had been made in the Royal Institution laboratories to manufacture an artificial gas of this nature by adding a small proportion of air to the hydrogen, so as to get a mixture with a critical point of about −200° C. When such a mixture was cooled to that temperature and expanded from a high degree of compression into a vacuum vessel, the result was a white mass of solid air together with a clear liquid of very low density. This was in all probability hydrogen in the true liquid state, but it was not found possible to collect it owing to its extreme volatility. Whether this artificial gas might ultimately have enabled liquid hydrogen to be collected in open vessels we cannot say, for experiments with it were abandoned in favour of other measures, which led finally to a more assured success.

Vacuum Vessels.—The problem involved in the liquefaction of hydrogen was in reality a double one. In the first place, the gas had to be cooled to such a temperature that the change to the liquid state was rendered possible. In the second, means had to be discovered for protecting it, when so cooled, from the influx of external heat, and since the rate at which heat is transferred from one body to another increases very rapidly with the difference between their temperatures, the question of efficient heat insulation became at once more difficult and more urgent in proportion to the degree of cold attained. The second part of the problem was in fact solved first. Of course packing with non-conducting materials was an obvious expedient when it was not necessary that the contents of the apparatus should be visible to the eye, but in the numerous instances when this was not the case such measures were out of the question. Attempts were made to secure the desired end by surrounding the vessel that contained the cooled or liquid gas with a succession of other vessels, through which was conducted the vapour given off from the interior one. Such devices involved awkward complications in the arrangement of the apparatus, and besides were not as a rule very efficient, although some workers, *e.g.* Dr Kamerlingh Onnes, of Leiden, reported some success with their use. In 1892 it occurred to Dewar that the principle of an arrangement he had used nearly twenty years before for some calorimetric experiments on the physical constants of hydrogenium, which was a natural deduction from the work of Dulong and Petit on radiation, might be employed with advantage as well to protect cold substances from heat as hot ones from cold. He therefore tried the effect of surrounding his liquefied gas with a highly exhausted space. The result was entirely successful. Experiment showed that liquid air contained in a glass vessel with two walls, the space between which was a high vacuum, evaporated at only one fifth the rate it did when in an ordinary vessel surrounded with air at

atmospheric pressure, the convective transference of heat by means of the gas particles being enormously reduced owing to the vacuum. But in addition these vessels lent themselves to an arrangement by which radiant heat could still further be cut off, since it was found that when the inner wall was coated with a bright deposit of silver, the influx of heat was diminished to one-sixth of the amount existing without the metallic coating. The total effect, therefore, of the high vacuum and silvering is to reduce the in-going heat to one-thirtieth part. In making such vessels a mercurial vacuum has been found very satisfactory. The vessel in which the vacuum is to be produced is provided with a small subsidiary vessel joined by a narrow tube with the main vessel, and connected with a powerful air-pump. A quantity of mercury having been placed in it, it is heated in an oil- or air-bath to about 200° C., so as to volatilize the mercury, the vapour of which is removed by the pump. After the process has gone on for some time, the pipe leading to the pump is sealed off, the vessel immediately removed from the bath, and the small subsidiary part immersed in some cooling agent such as solid carbonic acid or liquid air, whereby the mercury vapour is condensed in the small vessel and a vacuum of enormous tenuity left in the large one. The final step is to seal off the tube connecting the two. In this way a vacuum may be produced having a vapour pressure of about the hundred-millionth of an atmosphere at 0° C. If, however, some liquid mercury be left in the space in which the vacuum is produced, and the containing part of the vessel be filled with liquid air, the bright mirror of mercury which is deposited on the inside wall of the bulb is still more effective than silver in protecting the chamber from the influx of heat, owing to the high refractive index, which involves great reflecting power, and the bad heat-conducting powers of mercury.

With the discovery of the remarkable power of gas absorption possessed by charcoal cooled to a low temperature (see below), it became possible to make these vessels of metal. Previously this could not be done with success, because gas occluded in the metal gradually escaped and vitiated the vacuum; but now any stray gas may be absorbed by means of charcoal so placed in a pocket within the vacuous space that it is cooled by the liquid in the interior of the vessel. Metal vacuum vessels (fig. 1), of a capacity of from 2 to 20 litres, may be formed of brass, copper, nickel or tinned iron, with necks of some alloy that is a bad conductor of heat, silvered glass vacuum cylinders being fitted as stoppers. Such flasks, when properly constructed, have an efficiency equal to that of the chemically-silvered glass vacuum vessels now commonly used in low temperature investigations, and they are obviously better adapted for transport. The principle of the Dewar vessel is utilized in the Thermos flasks which are now extensively manufactured and employed for keeping liquids warm in hospitals, &c.

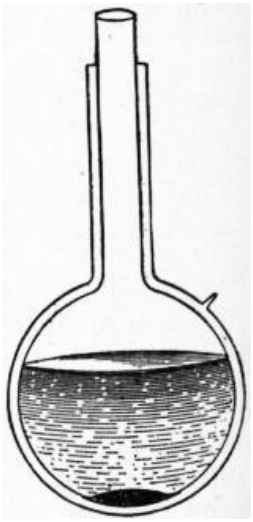

FIG. 1.—Metallic Vacuum Vessel.

Thermal Transparency at Low Temperatures.—The proposition, once enunciated by Pictet, that at low temperatures all substances have practically the same thermal transparency, and are equally ineffective as non-conductors of heat, is based on erroneous observations. It is true that if the space between the two walls of a double-walled vessel is packed with substances like carbon, magnesia, or silica, liquid air placed in the interior will boil off even more quickly than it will when the space merely contains air at atmospheric pressure; but in such cases it is not so much the carbon, &c., that bring about the transference of heat, as the air contained in their interstices. If this air be pumped out such substances are seen to exert a very considerable influence in stopping the influx of heat, and a vacuum vessel which has the space between its two walls filled with a non-conducting material of this kind preserves a liquid gas even better than one in which that space is simply exhausted of air. In experiments on this point double-walled glass tubes, as nearly identical in shape and size as possible, were mounted in sets of three on a common stem which communicated with an air-pump, so that the degree of exhaustion in each was equal. In two of each three the space between the double walls was filled with the powdered material it was desired to test, the third being left empty and used as the standard. The time required for a certain quantity of liquid air to evaporate from the interior of this empty bulb being called 1, in each of the eight sets of triple tubes, the times required for the same quantity to boil off from the other pairs of tubes were as follows:—

Charcoal	5	Lampblack	5
Magnesia	2	Silica	4
Graphite	1.3	Lampblack	4
Alumina	3.3	Lycopodium	2.5
Calcium carbonate	2.5	Barium carbonate	1.3
Calcium fluoride	1.25	Calcium phosphate	2.7
Phosphorus (amorphous)	1	Lead oxide	2
Mercuric iodide	1.5	Bismuth oxide	6

Other experiments of the same kind made—(*a*) with similar vacuum vessels, but with the powders replaced by metallic and other septa; and (*b*) with vacuum vessels having their walls silvered, yielded the following results:—

(*a*)	Vacuum space empty	1
	Three turns silver paper, bright surface inside	4
	Three turns silver paper, bright surfaceoutside	4
	Vacuum space empty	1
	Three turns black paper, black outside	3

	Three turns black paper, black inside	3
	Vacuum space empty	1
	Three turns gold paper, gold outside	4
	Some pieces of goldleaf put in so as to make contact between walls of vacuum-tube	0.3
	Vacuum space empty	1
	Three turns, not touching, of sheet lead	4
	Three turns, not touching, of sheet aluminium	4
(*b*)	Vacuum space empty, silvered on inside surfaces	1
	Silica in silvered vacuum space	1.1
	Empty silvered vacuum	1
	Charcoal in silvered vacuum	1.25

It appears from these experiments that silica, charcoal, lampblack, and oxide of bismuth all increase the heat insulations to four, five and six times that of the empty vacuum space. As the chief communication of heat through an exhausted space is by molecular bombardment, the fine powders must shorten the free path of the gaseous molecules, and the slow conduction of heat through the porous mass must make the conveyance of heat-energy more difficult than when the gas molecules can impinge upon the relatively hot outer glass surface, and then directly on the cold one without interruption. (See *Proc. Roy. Inst.* xv. 821-826.)

Density of Solids and Coefficients of Expansion at Low Temperatures.—The facility with which liquid gases, like oxygen or nitrogen, can be guarded from evaporation by the proper use of vacuum vessels (now called Dewar vessels), naturally suggests that the specific gravities of solid bodies can be got by direct weighing when immersed in such fluids. If the density of the liquid gas is accurately known, then the loss of weight by fluid displacement gives the specific gravity compared to water. The metals and alloys, or substances that can be got in large crystals, are the easiest to manipulate. If the body is only to be had in small crystals, then it must be compressed under strong hydraulic pressure into coherent blocks weighing about 40 to 50 grammes. Such an amount of material gives a very accurate density of the body about the boiling point of air, and a similar density taken in a suitable liquid at the ordinary temperature enables the mean coefficient of expansion between +15° C. and −185° C. to be determined. One of the most interesting results is that the density of ice at the boiling point of air is not more than 0.93, the mean coefficient of expansion being therefore 0.000081. As the value of the same coefficient between 0° C. and −27° C. is 0.000155, it is clear the rate of contraction is diminished to about one-half of what it was above the melting point of the ice. This suggests that by no possible cooling at our command is it likely we could ever make ice as dense as water at 0° C., far less 4° C. In other words, the volume of ice at the zero of temperature would not be the minimum volume of the water molecule, though we have every reason to believe it would be so in the case

of the majority of known substances. Another substance of special interest is solid carbonic acid. This body has a density of 1.53 at −78° C. and 1.633 at −185° C., thus giving a mean coefficient of expansion between these temperatures of 0.00057. This value is only about 1/6 of the coefficient of expansion of the liquid carbonic acid gas just above its melting point, but it is still much greater at the low temperature than that of highly expansive solids like sulphur, which at 40° C. has a value of 0.00019. The following table gives the densities at the temperature of boiling liquid air (−185° C.) and at ordinary temperatures (17° C.), together with the mean coefficient of expansion between those temperatures, in the case of a number of hydrated salts and other substances:

TABLE I.

	Density at −185° C.	Density at +17° C.	Mean coefficient of expansion between −185° C. and +17° C.
Aluminium sulphate (18)*	1.7194	1.6913	0.0000811
Sodium biborate (10)	1.7284	1.6937	0.0001000
Calcium chloride (6)	1.7187	1.6775	0.0001191
Magnesium chloride (6)	1.6039	1.5693	0.0001072
Potash alum (24)	1.6414	1.6144	0.0000813
Chrome alum (24)	1.7842	1.7669	0.0000478
Sodium carbonate (10)	1.4926	1.4460	0.0001563
Sodium phosphate (12)	1.5446	1.5200	0.0000787
Sodium thiosulphate (5)	1.7635	1.7290	0.0000969
Potassium ferrocyanide (3)	1.8988	1.8533	0.0001195
Potassium ferricyanide	1.8944	1.8109	0.0002244
Sodium nitro-prusside (4)	1.7196	1.6803	0.0001138
Ammonium chloride	1.5757	1.5188	0.0001820
Oxalic acid (2)	1.7024	1.6145	0.0002643
Methyl oxalate	1.5278	1.4260	0.0003482
Paraffin	0.9770	0.9103	0.0003567
Naphthalene	1.2355	1.1589	0.0003200
Chloral hydrate	1.9744	1.9151	0.0001482
Urea	1.3617	1.3190	0.0001579
Iodoform	4.4459	4.1955	0.0002930

Iodine	4.8943	4.6631	0.0002510
Sulphur	2.0989	2.0522	0.0001152
Mercury	14.382	..	0.0000881**
Sodium	1.0056	0.972	0.0001810
Graphite (Cumberland)	2.1302	2.0990	0.0000733

* The figures within parentheses refer to the number of molecules of water of crystallization.

** −189° to −38.85° C.

It will be seen from this table that, with the exception of carbonate of soda and chrome alum, the hydrated salts have a coefficient of expansion that does not differ greatly from that of ice at low temperatures. Iodoform is a highly expansive body like iodine, and oxalate of methyl has nearly as great a coefficient as paraffin, which is a very expansive solid, as are naphthalene and oxalic acid. The coefficient of solid mercury is about half that of the liquid metal, while that of sodium is about the value of mercury at ordinary temperatures. Further details on the subject can be found in the *Proc. Roy. Inst.* (1895), and *Proc. Roy. Soc.* (1902).

Density of Gases at Low Temperatures.—The ordinary mode of determining the density of gases may be followed, provided that the glass flask, with its carefully ground stop-cock sealed on, can stand an internal pressure of about five atmospheres, and that all the necessary corrections for change of volume are made. All that is necessary is to immerse the exhausted flask in boiling oxygen, and then to allow the second gas to enter from a gasometer by opening the stop-cock until the pressure is equalized. The stop-cock being closed, the flask is now taken out of the liquid oxygen and left in the balance-room until its temperature is equalized. It is then weighed against a similar flask used as a counterpoise. Following such a method, it has been found that the weight of 1 litre of oxygen vapour at its boiling point of 90.5° absolute is 4.420 grammes, and therefore the specific volume is 226.25 cc. According to the ordinary gaseous laws, the litre ought to weigh 4.313 grammes, and the specific volume should be 231.82 cc. In other words, the product of pressure and volume at the boiling point is diminished by 2.46%. In a similar way the weight of a litre of nitrogen vapour at the boiling point of oxygen was found to be 3.90, and the inferred value for 78° absolute, or its own boiling point, would be 4.51, giving a specific volume of 221.3.

Regenerative Cooling.—One part of the problem being thus solved and a satisfactory device discovered for warding off heat in such vacuum vessels, it remained to arrange some practically efficient method for reducing hydrogen to a temperature sufficiently low for liquefaction. To gain that end, the idea naturally occurred of using adiabatic expansion, not intermittently, as when gas is allowed to expand suddenly from a high compression, but in a continuous process, and an obvious way of attempting to carry out this condition was to enclose the orifice at which

expansion takes place in a tube, so as to obtain a constant stream of cooled gas passing over it. But further consideration of this plan showed that although the gas jet would be cooled near the point of expansion owing to the conversion of a portion of its sensible heat into dynamical energy of the moving gas, yet the heat it thus lost would be restored to it almost immediately by the destruction of this mechanical energy through friction and its consequent reconversion into heat. Thus the net result would be *nil* so far as change of temperature through the performance of external work was concerned. But the conditions in such an arrangement resemble that in the experiments of Thomson and Joule on the thermal changes which occur in a gas when it is forced under pressure through a porous plug or narrow orifice, and those experimenters found, as the former of them had predicted, that a change of temperature does take place, owing to internal work being done by the attraction of the gas molecules. Hence the effective result obtainable in practice by such an attempt at continuous adiabatic expansion as that suggested above is to be measured by the amount of the "Thomson-Joule effect," which depends entirely on the internal, not the external, work done by the gas. To Linde belongs the credit of having first seen the essential importance of this effect in connexion with the liquefaction of gases by adiabatic expansion, and he was, further, the first to construct an industrial plant for the production of liquid air based on the application of this principle.

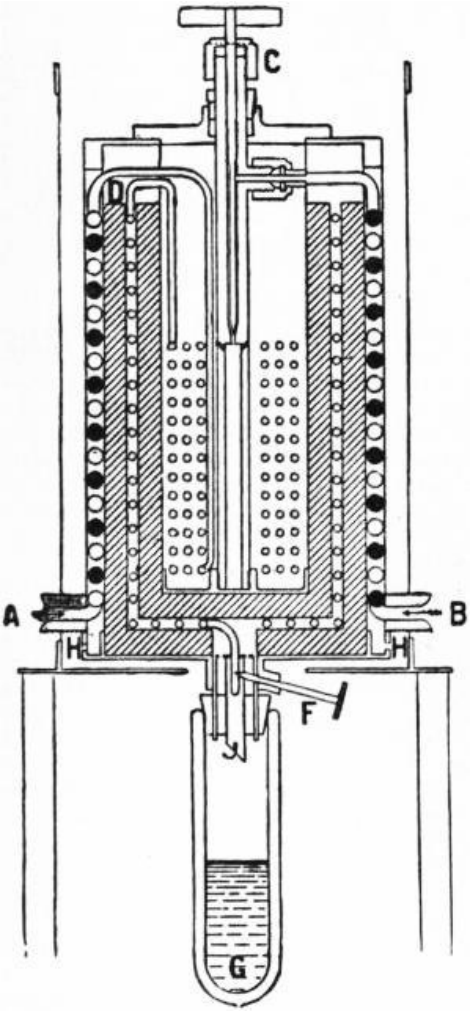

FIG. 2.—Laboratory Liquid Air Machine.

A, Air or oxygen inlet.
B, Carbon dioxide inlet.
C, Carbon dioxide valve.
D, Regenerator coils.
F, Air or oxygen expansion valve.
G, Vacuum vessel with liquid air or oxygen.
H, Carbon dioxide and air outlet.
O, Air coil.
O, Carbon dioxide coil.

The change of temperature due to the Thomson-Joule effect varies in amount with different gases, or rather with the temperature at which the operation is conducted. At ordinary temperatures oxygen and carbonic acid are cooled, while hydrogen is slightly heated. But hydrogen also is cooled if before being passed through the nozzle or plug it is brought into a thermal condition comparable to that of other gases at ordinary temperatures—that is to say, when it is initially cooled to a temperature having the same ratio to

its critical point as their temperatures have to their critical points—and similarly the more condensible gases would be heated, and not cooled, by passing through a nozzle or plug if they were employed at a temperature sufficiently above their critical points. Each gas has therefore a point of inversion of the Thomson-Joule effect, and this temperature is, according to the theory of van der Waals, about 6.75 times the critical temperature of the body. Olszewski has determined the inversion-point in the case of hydrogen, and finds it to be 192.5° absolute, the theoretical critical point being thus about 28.5° absolute. The cooling effect obtained is small, being for air about ¼° C. per atmosphere difference of pressure at ordinary temperatures. But the decrement of temperature is proportional to the difference of pressure and inversely as the absolute temperature, so that the Thomson-Joule effect increases rapidly by the combined use of a lower temperature and greater difference of gas pressure. By means of the "regenerative" method of working, which was described by C. W. Siemens in 1857, developed and extended by Ernest Solvay in 1885, and subsequently utilized by numerous experimenters in the construction of low temperature apparatus, a practicable liquid air plant was constructed by Linde. The gas which has passed the orifice and is therefore cooled is made to flow backwards round the tube that leads to the nozzle; hence that portion of the gas that is just about to pass through the nozzle has some of its heat abstracted, and in consequence on expansion is cooled to a lower temperature than the first portion. In its turn it cools a third portion in the same way, and so the reduction of temperature goes on progressively until ultimately a portion of the gas is liquefied. Apparatus based on this principle has been employed not only by Linde in Germany, but also by Tripler in America and by Hampson and Dewar in England. The last-named experimenter exhibited in December 1895 a laboratory machine of this kind (fig. 2), which when supplied with oxygen initially cooled to −79° C., and at a pressure of 100-150 atmospheres, began to yield liquid in about a quarter of an hour after starting. The initial cooling is not necessary, but it has the advantage of reducing the time required for the operation. The efficiency of the Linde process is small, but it is easily conducted and only requires plenty of cheap power. When we can work turbines or other engines at low temperatures, so as to effect cooling through the performance of external work, then the economy in the production of liquid air and hydrogen will be greatly increased.

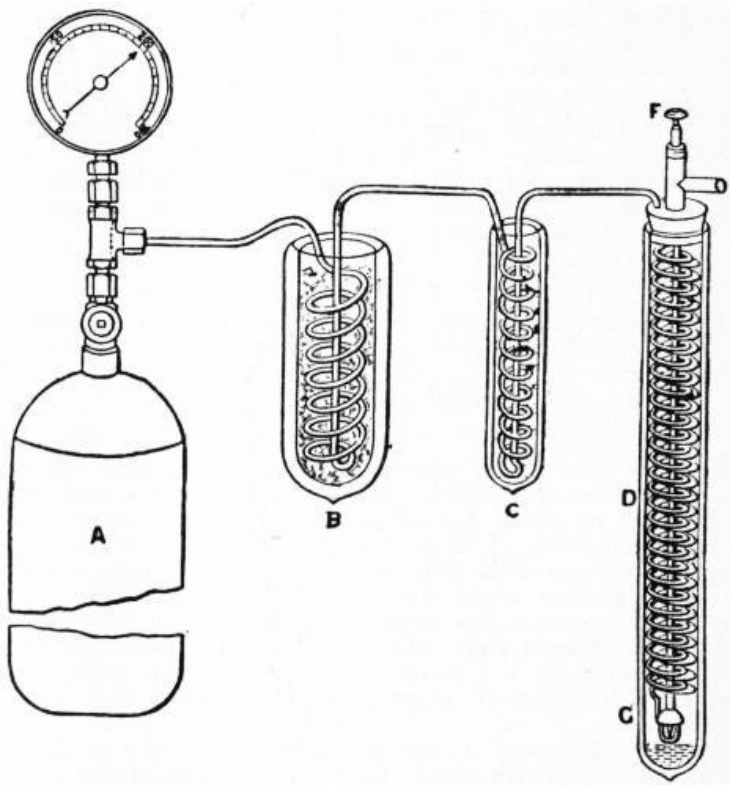

FIG. 3.—Hydrogen Jet Apparatus. A, Cylinder containing compressed hydrogen. B and C, Vacuum vessels containing carbonic acid under exhaustion and liquid air respectively. D, Regenerating coil in vacuum vessel. F, Valve. G, Pin-hole nozzle.

This treatment was next extended to hydrogen. For the reason already explained, it would have been futile to experiment with this substance at ordinary temperatures, and therefore as a preliminary it was cooled to the temperature of boiling liquid air, about −190° C. At this temperature it is still 2½ times above its critical temperature, and therefore its liquefaction in these circumstances would be comparable to that of air, taken at +60° C., in an apparatus like that just described. Dewar showed in 1896 that hydrogen cooled in this way and expanded in a regenerative coil from a pressure of 200 atmospheres was rapidly reduced in temperature to such an extent that after the apparatus had been working a few minutes the issuing jet was seen to contain liquid, which was sufficiently proved to be liquid hydrogen by the fact that it was so cold as to freeze liquid air and oxygen into hard white solids. Though with this apparatus, a diagrammatic representation of which is shown in fig. 3, it was now found possible at the time to collect the liquid in an open vessel, owing to its low specific gravity and the rapidity of the gas-current, still the general type of the arrangement seemed so promising that in the next two years there was laid down in the laboratories of the Royal

FIG. 4.—Bottom of Vacuum Vessel.

Institution a large plant—it weighs 2 tons and contains 3000 ft. of pipe—which is designed on precisely the same principles, although its construction is far more elaborate. The one important novelty, without which it is practically impossible to succeed, is the provision of a device to surmount the difficulty of withdrawing the liquefied hydrogen after it has been made. The desideratum is really a means of forming an aperture in the bottom of a vacuum vessel by which the contained liquid may be run out. For this purpose the lower part of the vacuum vessel (D in fig. 3) containing the jet is modified as shown in fig. 4; the inner vessel is prolonged in a fine tube, coiled spirally, which passes through the outer wall of the vacuum vessel, and thus sufficient elasticity is obtained to enable the tube to withstand without fracture the great contraction consequent on the extreme cold to which it is subjected. Such peculiarly shaped vacuum vessels were made by Dewar's directions in Germany, and have subsequently been supplied to and employed by other experimenters.

With the liquefying plant above referred to liquid hydrogen was for the first time collected in an open vessel on the 10th of May 1898. The gas at a pressure of 180 atmospheres was cooled to −205° C. by means of liquid air boiling *in vacuo*, and was then passed through the nozzle of the regenerative coil, which was enclosed in vacuum vessels in such a way as to exclude external heat as perfectly as possible. In this way some 20 cc. of the liquid had been collected when the experiment came to a premature end, owing to the nozzle of the apparatus becoming blocked by a dense solid—air-ice resulting from the congelation of the air which was present to a minute extent as an impurity in the hydrogen. This accident exemplifies what is a serious trouble encountered in the production of liquid hydrogen, the extreme difficulty of obtaining the gas in a state of sufficient purity, for the presence of 1% of foreign matters, such as air or oxygen, which are more condensible than hydrogen, is sufficient to cause complete stoppage, unless the nozzle valve and jet arrangement is of special construction. In subsequent experiments the liquid was obtained in larger quantities—on the 13th of June 1901 five litres of it were successfully conveyed through the streets of London from the laboratory of the Royal Institution to the rooms of the Royal Society—and it may be said that it is now possible to produce it in any desired amount, subject only to the limitations entailed by expense. Finally, the reduction of hydrogen to a solid state was successfully undertaken in 1899. A portion of the liquid carefully isolated in vacuum-jacketed vessels was suddenly transformed into a white mass resembling frozen foam, when evaporated under an air-pump at a pressure of 30 or 40 mm., and subsequently hydrogen was obtained as a clear transparent ice by immersing a tube containing the liquid in this solid foam.

Liquefaction of Helium.—The subjection of hydrogen completed the experimental proof that all gases can be reduced to the liquid and solid states by the aid of pressure and low temperature, at least so far as regards those in the hands of the chemist at the beginning of the last decade of the 19th century. But a year or so before hydrogen was obtained in the liquid form, a substance known to exist in the sun from spectroscopic researches carried out by Sir Edward Frankland and

Sir J. Norman Lockyer was shown by Sir William Ramsay to exist on the earth in small quantities. Helium (*q.v.*), as this substance was named, was found by experiment to be a gas much less condensable than hydrogen. Dewar in 1901 expanded it from a pressure of 80-100 atmospheres at the temperature of solid hydrogen without perceiving the least indication of liquefaction. Olszewski repeated the experiment in 1905, using the still higher initial compression of 180 atmospheres, but he equally failed to find any evidence of liquefaction, and in consequence was inclined to doubt whether the gas was liquefiable at all, whether in fact it was not a truly "permanent" gas. Other investigators, however, took a different and more hopeful view of the matter. Dewar, for instance (*Pres. Address Brit. Assoc.*, 1902), basing his deductions on the laws established by van der Waals and others from the study of phenomena at much higher temperatures, anticipated that the boiling-point of the substance would be about 5° absolute, so that the liquid would be about four times more volatile than liquid hydrogen, just as liquid hydrogen is four times more volatile than liquid air; and he expressed the opinion that the gas would succumb on being subjected to the process that had succeeded with hydrogen, except that liquid hydrogen, instead of liquid air, evaporating under exhaustion must be employed as the primary cooling agent, and must also be used to surround the vacuum vessel in which the liquid was collected.

Various circumstances combined to prevent Dewar from actually carrying out the operation thus foreshadowed, but his anticipations were justified and the sufficiency of the method he indicated practically proved by Dr H. Kamerlingh Onnes, who, working with the splendid resources of the Leiden cryogenic laboratory, succeeded in obtaining helium in the liquid state on the 10th of July 1908. Having prepared 200 litres of the gas (160 litres in reserve) from monazite sand,[2] he cooled it with exhausted liquid hydrogen to a temperature of 15 or 16° abs., and expanded it through a regenerative coil under a pressure of 50 to 100 atmospheres, making use of the most elaborate precautions to prevent influx of heat and securing the absence of less volatile gases that might freeze and block the tubes of the apparatus by including in the helium circuit charcoal cooled to the temperature of liquid air. Operations began at 5.45 in the morning with the preparation of the necessary liquid hydrogen, of which 20 litres were ready by 1.30. The circulation of the helium was started at 4.30 in the afternoon and was continued until the gas had been pumped round the circuit twenty times; but it was not till 7.30, when the last bottle of liquid hydrogen had been brought into requisition, that the surface of the liquid was seen, by reflection of light from below, standing out sharply like the edge of a knife against the glass wall of the vacuum vessel. Its boiling-point has been determined as being 4° abs., its critical temperature 5°, and its critical pressure not more than three atmospheres. The density of the liquid is found to be 0.015 or about twice that of liquid hydrogen. It could not be solidified even when exhausted under a pressure of 2 mm., which in all probability corresponds to a temperature of 2° abs. (see *Communications from the physical laboratory at the University of Leiden, 1908-1909*).

The following are brief details respecting some of the more important liquid gases that have become available for study within recent years. (For argon, neon, krypton, &c., see ARGON.)

Oxygen.—Liquid oxygen is a mobile transparent-liquid, possessing a faint blue colour. At atmospheric pressure it boils at −181.5° C.; under a reduced pressure of 1 cm. of mercury its temperature falls to −210° C. At the boiling point it has a density of 1.124 according to Olszewski, or of 1.168 according to Wroblewski; Dewar obtained the value 1.1375 as the mean of twenty observations by weighing a number of solid substances in liquid oxygen, noting the apparent relative density of the liquid, and thence calculating its real density, Fizeau's values for the coefficients of expansion of the solids being employed. The capillarity of liquid oxygen is about one-sixth that of water; it is a non-conductor of electricity, and is strongly magnetic. By its own evaporation it cannot be reduced to the solid state, but exposed to the temperature of liquid hydrogen it is frozen into a solid mass, having a pale bluish tint, showing by reflection all the absorption bands of the liquid. It is remarkable that the same absorption bands occur in the compressed gas. Dewar gives the melting-point as 38° absolute, and the density at the boiling-point of hydrogen as 1.4526. The refractive index of the liquid for the D sodium ray is 1.2236.

Ozone.—This gas is easily liquefied by the use of liquid air. The liquid obtained is intensely blue, and on allowing the temperature to rise, boils and explodes about −120° C. About this temperature it may be dissolved in bisulphide of carbon to a faint blue solution. The liquid ozone seems to be more magnetic than liquid oxygen.

Nitrogen forms a transparent colourless liquid, having a density of 0.8042 at its boiling-point, which is −195.5° C. The refractive index for the D line is 1.2053. Evaporated under diminished pressure the liquid becomes solid at a temperature of −215° C., melting under a pressure of 90 mm. The density of the solid at the boiling-point of hydrogen is 1.0265.

Air.—Seeing that the boiling-points of nitrogen and oxygen are different, it might be expected that on the liquefaction of atmospheric air the two elements would appear as two separate liquids. Such, however, is not the case; they come down simultaneously as one homogeneous liquid. Prepared on a large scale, liquid air may contain as much as 50% of oxygen when collected in open vacuum-vessels, but since nitrogen is the more volatile it boils off first, and as the liquid gradually becomes richer in oxygen the temperature at which it boils rises from about −192° C. to about −182° C. At the former temperature it has a density of about 0.910. It is a non-conductor of electricity. Properly protected from external heat, and subjected to high exhaustion, liquid air becomes a stiff transparent jelly-like mass, a magma of solid nitrogen containing liquid oxygen, which may indeed be extracted from it by means of a magnet, or by rapid rotation of the vacuum vessel in imitation of a centrifugal machine. The temperature of this solid under a vacuum of about 14 mm. is −216°. At the still lower temperatures attainable by the aid of liquid hydrogen it becomes a white solid, having, like solid oxygen, a faint blue tint. The refractive index of liquid air is 1.2068.

Fluorine, prepared in the free state by Moissan's method of electrolysing a solution of potassium fluoride in anhydrous hydrofluoric acid, was liquefied in the laboratories of the Royal Institution, London, in 1897. Exposed to the temperature of quietly-boiling liquid oxygen, the gas did not change its state, though it lost much of its chemical activity, and ceased to attack glass. But a very small vacuum formed over the oxygen was sufficient to determine liquefaction, a result which was also obtained by cooling the gas to the temperature of freshly-made liquid air boiling at atmospheric pressure. Hence the boiling-point is fixed at about −187° C. The liquid is of a clear yellow colour, possessing great mobility. Its density is 1.14, and its capillarity rather less than that of liquid oxygen. The liquid, when examined in a thickness of 1 cm., does not show any absorption bands, and it is not attracted by a magnet. Cooled in liquid hydrogen it is frozen to a white solid, melting at about 40° abs.

Hydrogen.—Liquid hydrogen is the lightest liquid known to the chemist, having a density slightly less than 0.07 as compared with water, and being six times lighter than liquid marsh-gas, which is next in order of lightness. One litre weighs only 70 grammes, and 1 gramme occupies a volume of 14-15 cc. In spite of its extreme lightness, however, it is easily seen, has a well-defined meniscus and drops well. At its boiling-point the liquid is only 55 times denser than the vapour it is giving off, whereas liquid oxygen in similar condition is 258 times denser than its vapour, and nitrogen 177 times. Its atomic volume is about 14.3, that of liquid oxygen being 13.7, and that of liquid nitrogen 16.6, at their respective boiling-points. Its latent heat of vaporization about the boiling-point is about 121 gramme-calories, and the latent heat of fluidity cannot exceed 16 units, but may be less. Hydrogen appears to have the same specific heat in the liquid as in the gaseous state, about 3.4. Its surface tension is exceedingly low, about one-fifth that of liquid air at its boiling-point, or one-thirty-fifth that of water at ordinary temperatures, and this is the reason that bubbles formed in the liquid are so small as to give it an opalescent appearance during ebullition. The liquid is without colour, and gives no absorption spectrum. Electric sparks taken in the liquid between platinum poles give a spectrum showing the hydrogen lines C and F bright on a background of continuous spectrum. Its refractive index at the boiling-point has theoretically the value 1.11. It was measured by determining the relative difference of focus for a parallel beam of light sent through a spherical vacuum vessel filled successively with water, liquid oxygen and liquid hydrogen; the result obtained was 1.12. Liquid hydrogen is a non-conductor of electricity. The precise determination of its boiling-point is a matter of some difficulty. The first results obtained from the use of a platinum resistance thermometer gave −238° C., while a similar thermometer made with an alloy of rhodium-platinum indicated a value 8 degrees lower. Later, a gold thermometer indicated about −249° C., while with an iron one the result was only −210° C. It was thus evident that electrical resistance thermometers are not to be trusted at these low temperatures, since the laws correlating resistance and temperature are not known for temperatures at and below the boiling-point of hydrogen, though they are certainly not the same as those which hold good higher up the thermometric scale. The same remarks apply to

the use of thermo-electric junctions at such exceptional temperatures. Recourse was therefore had to a constant-volume hydrogen thermometer, working under reduced pressure, experiments having shown that such a thermometer, filled with either a simple or a compound gas (*e.g.* oxygen or carbonic acid) at an initial pressure somewhat less than one atmosphere, may be relied upon to determine temperatures down to the respective boiling-points of the gases with which they are filled. The result obtained was −252° C. Subsequently various other determinations were carried out in thermometers filled with hydrogen derived from different sources, and also with helium, the average value given by the experiments being −252.5° C. (See "The Boiling Point of Liquid Hydrogen determined by Hydrogen and Helium Gas Thermometers," *Proc. Roy. Soc.*, 7th February 1901.) The critical temperature is about 30° absolute (−243° C.), and the critical pressure about 15 atmospheres. Hydrogen has not only the lowest critical temperature of all the old permanent gases, but it has the lowest critical pressure. Given a sufficiently low temperature, therefore, it is the easiest gas to liquefy so far as pressure is concerned. Solid hydrogen has a temperature about 4° less. By exhaustion under reduced pressure a still lower depth of cold may be attained, and a steady temperature reached less than 16° above the zero of absolute temperature. By the use of high exhaustion, and the most stringent precautions to prevent the influx of heat, a temperature of 13° absolute (−260° C.) may be reached. This is the lowest steady temperature which can be maintained by the evaporation of solid hydrogen. At this temperature the solid has a density of about 0.077. Solid hydrogen presents no metallic characteristics, such as were predicted for it by Faraday, Dumas, Graham and other chemists and neither it nor the liquid is magnetic.

The Approach to the Absolute Zero.—The achievement of Kamerlingh Onnes has brought about the realization of a temperature removed only 3° from the absolute zero, and the question naturally suggests itself whether there is any probability of a still closer approach to that point. The answer is that if, as is not impossible, there exists a gas, as yet unisolated, which has an atomic weight one-half that of helium, that gas, liquefied in turn by the aid of liquid helium, would render that approach possible, though the experimental difficulties of the operation would be enormous and perhaps prohibitive. The results of experiments bearing on this question and of theory based on them are shown in table II. The third column shows the critical temperature of the gas which can be liquefied by continuous expansion through a regenerative cooling apparatus, the operation being started from the initial temperature shown in the second column, while the fourth column gives the temperature of the resulting liquid. It will be seen that by the use of liquid or solid hydrogen as a cooling agent, it should be possible to liquefy a body having a critical temperature of about 6° to 8° on the absolute scale, and a boiling point of about 4° or 5°, while with the aid of liquid helium at an initial temperature of 5° we could liquefy a body having a critical temperature of 2° and a boiling point of 1°.

TABLE II.

Substance.	Initial Temperature. Abs. Degrees.	Critical Temperature. Abs. Degrees.	Boiling Points. Abs. Degrees.
(Low red heat)	760	304	195 (CO_2)
(52° C.)	325	130	86 (Air)
Liquid air under exhaustion	75	30	20 (H)
Liquid hydrogen	20	8	5 (He)
Solid hydrogen	15	6	4
Liquid helium	5	2	1

It is to be remarked, however, that even so the physicist would not have attained the absolute zero, and he can scarcely hope ever to do so. It is true he would only be a very short distance from it, but it must be remembered that in a thermodynamic sense one degree low down the scale, say at 10° absolute, is equivalent to 30° at the ordinary temperature, and as the experimenter gets to lower and lower temperatures, the difficulties of further advance increase, not in arithmetical but in geometrical progression. Thus the step between the liquefaction of air and that of hydrogen is, thermodynamically and practically, greater than that between the liquefaction of chlorine and that of air, but the number of degrees of temperature that separates the boiling-points of the first pair of substances is less than half what it is in the case of the second pair. But the ratio of the absolute boiling-points in the first pair of substances is as 1 to 4, whereas in the second pair it is only 1 to 3, and it is this value that expresses the difficulty of the transition.

But though Ultima Thule may continue to mock the physicist's efforts, he will long find ample scope for his energies in the investigation of the properties of matter at the temperatures placed at his command by liquid air and liquid and solid hydrogen. Indeed, great as is the sentimental interest attached to the liquefaction of these refractory gases, the importance of the achievement lies rather in the fact that it opens out new fields of research and enormously widens the horizon of physical science, enabling the natural philosopher to study the properties and behaviour of matter under entirely novel conditions. We propose to indicate briefly the general directions in which such inquiries have so far been carried on, but before doing so will call attention to the power of absorbing gases possessed by cooled charcoal, which has on that account proved itself a most valuable agent in low temperature research.

TABLE III.—*Gas Absorption by Charcoal.*

	Volume absorbed at 0° Cent.	Volume absorbed at −185° Cent.

Helium	2 cc.	15 cc.
Hydrogen	4	135
Electrolytic gas	12	150
Argon	12	175
Nitrogen	15	155
Oxygen	18	230
Carbonic oxide	21	190
Carbonic oxide and oxygen	30	195

Gas Absorption by Charcoal.—Felix Fontana was apparently the first to discover that hot charcoal has the power of absorbing gases, and his observations were confirmed about 1770 by Joseph Priestley, to whom he had communicated them. A generation later Theodore de Saussure made a number of experiments on the subject, and noted that at ordinary temperatures the absorption is accompanied with considerable evolution of heat. Among subsequent investigators were Thomas Graham and Stenhouse, Faure and Silberman, and Hunter, the last-named showing that charcoal made from coco-nut exhibits greater absorptive powers than other varieties. In 1874 Tait and Dewar for the first time employed charcoal for the production of high vacua, by using it, heated to a red heat, to absorb the mercury vapour in a tube exhausted by a mercury pump; and thirty years afterwards it occurred to the latter investigator to try how its absorbing powers are affected by cooling it, with the result that he found them to be greatly enhanced. Some of his earlier observations are given in table III., but it must be pointed out that much larger absorptions were obtained subsequently when it was found that the quality of the charcoal was greatly influenced by the mode in which it was prepared, the absorptive power being increased by carbonizing the coco-nut shell slowly at a gradually increasing temperature. The results in the table were all obtained with the same specimen of charcoal, and the volumes of the gases absorbed, both at ordinary and at low temperatures, were measured under standard conditions—at 0° C., and 760 mm. pressure. It appears that at the lower temperature there is a remarkable increase of absorption for every gas, but that the increase is in general smaller as the boiling-points of the various gases are lower. Helium is conspicuous for the fact that it is absorbed to a comparatively slight extent at both the higher and the lower temperature, but in this connexion it must be remembered that, being the most volatile gas known, it is being treated at a temperature which is relatively much higher than the other gases. At −185° (= 88° abs.), while hydrogen is at about 4½ times its boiling-point (20° abs.), helium is at about 20 times its boiling-point (4.5° abs.), and it might, therefore, be expected that if it were taken at a temperature corresponding to that of the hydrogen, *i.e.* at 4 or 5 times its boiling-point, or say 20° abs., it would undergo much greater absorption. This expectation is borne out by the results shown in table IV., and it may be inferred that charcoal cooled in liquid helium would absorb helium as freely as charcoal cooled in liquid hydrogen absorbs hydrogen. It is found that a given specimen of charcoal cooled in liquid oxygen, nitrogen and hydrogen absorbs about equal volumes of those three gases (about 260 cc. per gramme); and, as the relation between volume and temperature is nearly lineal at the lowest portions of either the hydrogen or the helium absorption, it is a legitimate inference that at

a temperature of 5° to 6° abs. helium would be as freely absorbed by charcoal as hydrogen is at its boiling-point and that the boiling-point of helium lies at about 5° abs.

TABLE IV.—*Gas Absorption by Charcoal at Low Temperatures.*

Temperature.	Helium. Vols. of Carbon.	Hydrogen. Vols. of Carbon.
−185° C. (boiling-point of liquid air)	2½	137
−210° C. (liquid air under exhaustion)	5	180
−252° C. (boiling-point of liquid hydrogen)	160	258
−258° C. (solid hydrogen)	195	..

The rapidity with which air is absorbed by charcoal at −185° C. and under small pressures is illustrated by table V., which shows the reductions of pressure effected in a tube of 2000 cc. capacity by means of 20 grammes of charcoal cooled in liquid air.

TABLE V.—*Velocity of Absorption.*

Time of Exhaustion.	Pressure in mm.	Time of Exhaustion.	Pressure in mm.
0 sec.	2.190	60 sec.	0.347
10 ”	1.271	2 min.	0.153
20 ”	0.869	5 ”	0.0274
30 ”	0.632	10 ”	0.00205
40 ”	0.543	19 ”	0.00025
50 ”	0.435	..	..

TABLE VI.

Volume of Gas absorbed.	Occlusion Hydrogen Pressure.	Occlusion Nitrogen Pressure.
cc.	mm.	mm.
0	0.00003	0.00005
5	0.0228	..
10	0.0455	..
15	0.0645	..
20	0.0861	..
25	0.1105	..
30	0.1339	0.00031
35	0.1623	..
40	0.1870	..
130	..	0.00110
500	..	0.00314

1000	..	0.01756
1500	..	0.02920
2500	..	0.06172

Charcoal Occlusion Pressures.—For measuring the gas concentration, pressure and temperature, use may be made of an apparatus of the type shown in fig. 5. A mass of charcoal, E, immersed in liquid air, is employed for the preliminary exhaustion of the McLeod gauge G and of the charcoal C, which is to be used in the actual experiments, and is then sealed off at S. The bulb C is then placed in a large spherical vacuum vessel containing liquid oxygen which can be made to boil at any definite temperature under diminished pressure which is measured by the manometer R. The volume of gas admitted into the charcoal is determined by the burette D and the pipette P, and the corresponding occlusion pressure at any concentration and any temperature below 90° abs. by the gauge G. In presence of charcoal, and for small concentrations, great variations are shown in the relation between the pressure and the concentration of different gases, all at the same temperature. Table VI. gives the comparison between hydrogen and nitrogen at the temperature of liquid air, 25 grammes of charcoal being employed. It is seen that 15 cc. of hydrogen produce nearly the same pressure (0.0645 mm.) as 2500 cc. of nitrogen (0.06172 mm.). This result shows how enormously greater, at the temperature of liquid air, is the volatility of hydrogen as compared with that of nitrogen. In the same way the concentrations, for the same pressure, vary greatly with temperature, as is exemplified by table VII., even though the pressures are not quite constant. The temperatures employed were the boiling-points of hydrogen, oxygen and carbon dioxide.

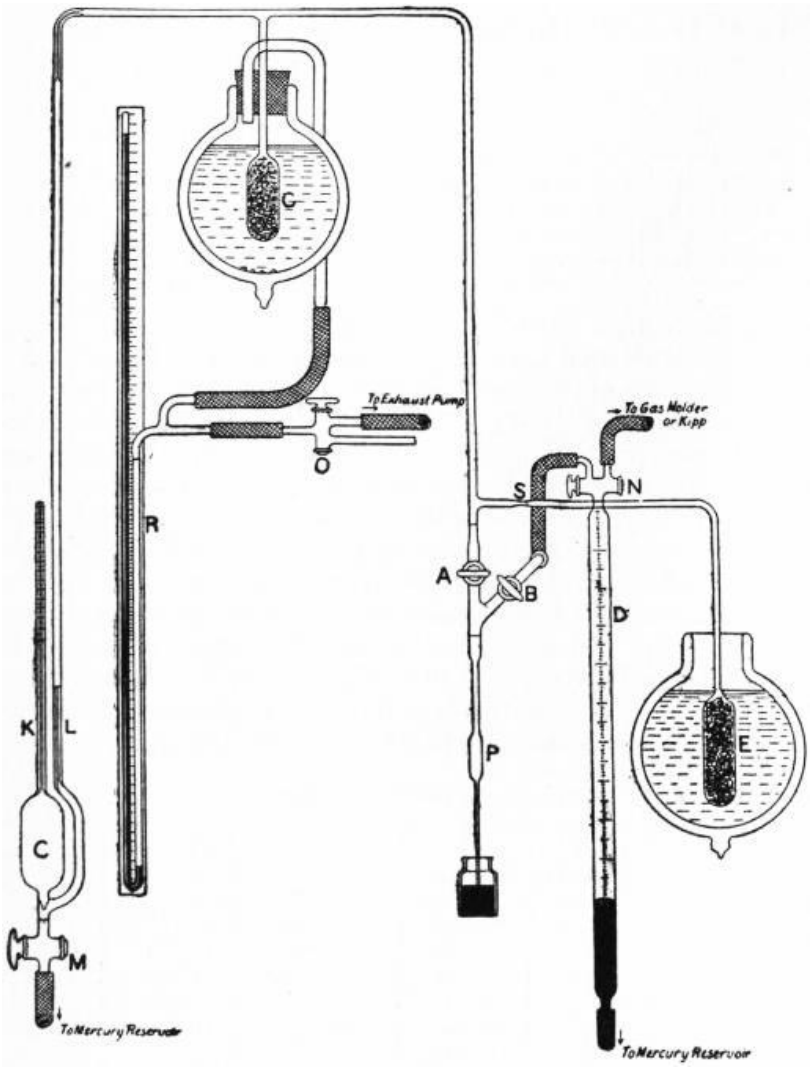

FIG. 5.

TABLE VII.

Gas.	Concentration in cc. per grm. of Charcoal.	Pressure in mm.	Temperature Absolute.
Helium	97	2.2	20°
Hydrogen	397	2.2	20°
Hydrogen	15	2.1	90°
Nitrogen	250	1.6	90°

Oxygen	300	1.0	90°
Carbon dioxide	90	3.6	195°

TABLE VIII.

Gas.	Concentration cc. per grm.	Molecular Latent Heat.	Mean Temperature. Absolute.
Helium	97	483.0	18°
Hydrogen	390	524.4	18°
Hydrogen	20	2005.6	78°
Nitrogen	250	3059.0	82°
Oxygen	300	3146.4	82°
Carbon dioxide	90	6099.6	180°

Heat of Occlusion.—In every case when gases are condensed to the liquid state there is evolution of heat, and during the absorption of a gas in charcoal or any other occluding body, as hydrogen in palladium, the amount of heat evolved exceeds that of direct liquefaction. From the relation between occlusion-pressure and temperature at the same concentration, the reaction being reversible, it is possible to calculate this heat evolution. Table VIII. gives the mean molecular latent heats of occlusion resulting from Dewar's experiments for a number of gases, having concentrations in the charcoal as shown. The concentrations were so regulated as to start with an initial pressure not exceeding 3 mm. at the respective boiling-points of hydrogen, nitrogen, oxygen and carbon dioxide.

Production of High Vacua.—Exceedingly high vacua can be obtained by the aid of liquid gases, with or without charcoal. If a vessel containing liquid hydrogen be freely exposed to the atmosphere, a rain of snow (solid air) at once begins to fall upon the surface of the liquid; similarly, if one end of a sealed tube containing ordinary air be immersed in the liquid, the same thing happens, but since there is now no new supply to take the place of the air that has been solidified and has accumulated in the cooled portion of the tube, the pressure is quickly reduced to something like one-millionth of an atmosphere, and a vacuum is formed of such tenuity that the electric discharge can be made to pass only with difficulty. Liquid air can be employed in the same manner if the tube, before sealing, is filled with some less volatile gas or vapour, such as sulphurous acid, benzol or water vapour. But if a charcoal condenser be used in conjunction with the liquid air it becomes possible to obtain a high vacuum when the tube contains air initially. For instance, in one experiment, with a bulb having a capacity of 300 cc. and filled with air at a

pressure of about 1.7 mm. and at a temperature of 15° C., when an attached condenser with 5 grammes of charcoal was cooled in liquid air, the pressure was reduced to 0.0545 mm. of mercury in five minutes, to 0.01032 mm. in ten minutes, to 0.000139 mm. in thirty minutes, and to 0.000047 mm. in sixty minutes. The condenser then being cooled in liquid hydrogen the pressure fell to 0.0000154 mm. in ten minutes, and to 0.0000058 mm. in a further ten minutes when solid hydrogen was employed as the cooling agent, and no doubt, had it not been for the presence of hydrogen and helium in the air, an even greater reduction could have been effected. Another illustration of the power of cooled charcoal to produce high vacua is afforded by a Crookes radiometer. If the instrument be filled with helium at atmospheric pressure and a charcoal bulb attached to it be cooled in liquid air, the vanes remain motionless even when exposed to the concentrated beam of an electric arc lamp; but if liquid hydrogen be substituted for the liquid air rapid rotation at once sets in. When a similar radiometer was filled with hydrogen and the attached charcoal bulb was cooled in liquid air rotation took place, because sufficient of the gas was absorbed to permit motion. But when the charcoal was cooled in liquid hydrogen instead of in liquid air, the absorption increased and consequently the rarefaction became so high that there was no motion when the light from the arc was directed on the vanes. These experiments again permit of an inference as to the boiling-point of helium. A fall of 75% in the temperature of the charcoal bulb, from the boiling-point of air to the boiling-point of hydrogen, reduced the vanes to rest in the case of the radiometer filled with hydrogen; hence it might be inferred that a fall of like amount from the boiling-point of hydrogen would reduce the vanes of the helium radiometer to rest, and consequently that the boiling-point of helium would be about 5° abs.

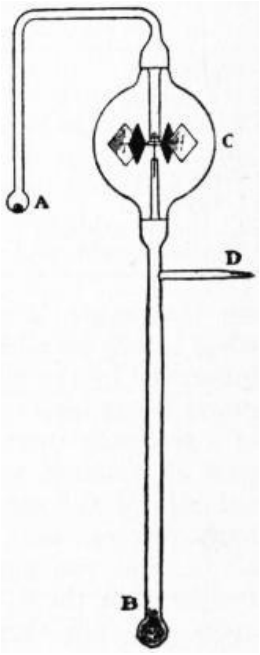

FIG. 6.

The vacua obtainable by means of cooled charcoal are so high that it is difficult to determine the pressures by the McLeod gauge, and the radiometer experiments referred to above suggested the possibility of another means of ascertaining such pressures, by determining the pressures below which the radiometer would not spin. The following experiment shows how the limit of pressure can be ascertained by reference to the pressures of mercury vapour which have been very accurately determined through a wide range of temperature. To a radiometer (fig. 6) with attached charcoal bulb B was sealed a tube ending in a small bulb A containing a globule of mercury. The radiometer and bulb B were heated, exhausted and repeatedly washed out with pure oxygen gas, and then the mercury was allowed to distil for some time into the charcoal cooled in liquid air. On exposure to the electric beam the vanes began to spin, but soon ceased when the bulb A was cooled in liquid air. When, however, the mercury was warmed by placing the bulb in

liquid water, the vanes began to move again, and in the particular radiometer used this was found to happen when the temperature of the mercury had risen to −23° C. corresponding to a pressure of about one fifty-millionth of an atmosphere.

For washing out the radiometer with oxygen the arrangement shown in fig. 7 is convenient. Here A is a bulb containing perchlorate of potash, which when heated gives off pure oxygen; C is again the radiometer and B the charcoal bulb. The side tube E is for the purpose of examining the gas given off by minerals like thorianite or the gaseous products of the transformation of radioactive bodies.

Analytic Uses.—Another important use of liquid gases is as analytic agents, and for this purpose liquid air is becoming an almost essential laboratory reagent. It is one of the most convenient agents for drying gases and for their purification. If a mixture of gases be subjected to the temperature of liquid air, it is obvious that all the constituents that are more condensable than air will be reduced to liquid, while those that are less condensable will either remain as a gaseous residue or be dissolved in the liquid obtained. The bodies present in the latter may be separated by fractional distillation, while the contents of the gaseous residue may be further differentiated by the air of still lower temperatures, such as are obtainable by liquid hydrogen. An apparatus such as the following can be used to separate both the less and the more volatile gases of the atmosphere, the former being obtained from their solution in liquid air by fractional distillation at low pressure and separation of the condensable part of the distillate by cooling in liquid hydrogen, while the latter are extracted from the residue of liquid air, after the distillation of the first fraction, by allowing it to evaporate gradually at a temperature rising only very slowly.

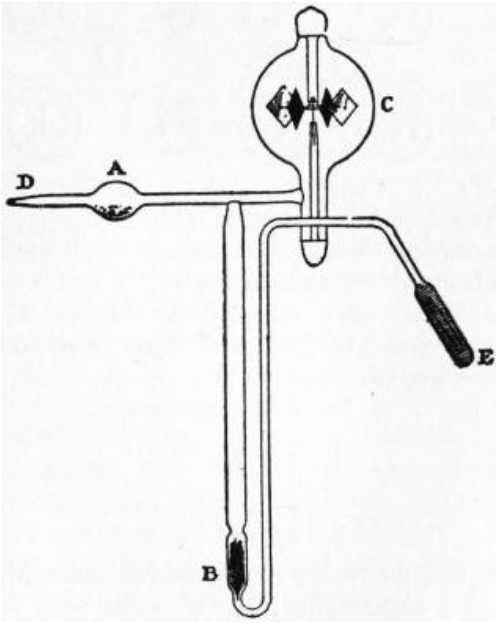

FIG. 7.

In fig. 8, A represents a vacuum-jacketed vessel, containing liquid air; this can be made to boil at reduced pressure and therefore be lowered in temperature by means of an air-pump, which is in communication with the vessel through the pipe *s*. The liquid boiled away is replenished when necessary from the reservoir C, *p* being a valve, worked by handle *q*, by which the flow along *r* is regulated. The vessel B, immersed in the liquid air of A, communicates with the atmosphere by *a*; hence when the temperature of A falls under exhaustion below that of liquid air, the contents of B condense, and if the stop-cock *m* is kept open, and *n* shut, air from the outside is continuously

sucked in until B is full of liquid, which contains in solution the whole of the most volatile gases of the atmosphere which have passed in through *a*. At this stage of the operation *m* is closed and *n* opened, a passage thus being opened along *b* from A to the remainder of the apparatus seen on the left side of the figure. Here E is a vacuum vessel containing liquid hydrogen, and *d* a three-way cock by which communication can be established either between *b* and D, between *b* and *e*, the tube leading to the sparking-tube *g*, or between D and *e*. If now *d* is arranged so that there is a free passage from *b* to D, and the stop-cock *n* also opened, the gas dissolved in the liquid in B, together with some of the most volatile part of that liquid, quickly distils over into D, which is at a much lower temperature than B, and some of it condenses there in the solid state. When a small fraction of the contents of B has thus distilled over, *d* is turned so as to close the passage between D and *b* and open that between D and *e*, with the result that the gas in D is pumped out by the mercury-pump, shown diagrammatically at *F*, along the tube *e* (which is immersed in the liquid hydrogen in order that any more condensable gas carried along by the current may be frozen out) to the sparking-tube or tubes *g*, where it can be examined spectroscopically. When the apparatus is used to separate the least volatile part of the gases in the atmosphere, the vessel E and its contents are omitted, and the tube *b* made to communicate with the pump through a number of sparking-tubes which can be sealed off successively. The nitrogen and oxygen which make up the bulk of the liquid in B are allowed to evaporate gradually, the temperature being kept low so as to check the evaporation of gases less volatile than oxygen. When most of the oxygen and nitrogen have thus been removed, the stop-cock *n* is closed, and the tubes partially exhausted by the pump; spectroscopic examination is made of the gases they contain, and repeated from time to time as more gas is allowed to evaporate from B. The general sequence of spectra, apart from those of nitrogen, oxygen and carbon compounds, which are never eliminated by the process of distillation alone, is as follows: The spectrum of argon first appears, followed by the brightest (green and yellow) rays of krypton. Then the intensity of the argon spectrum wanes and it gives way to that of krypton, until, as Runge observed, when a Leyden jar is in the circuit, the capillary part of the sparking-tube has a magnificent blue colour, while the wide ends are bright pale yellow. Without a jar the tube is nearly white in the middle and yellow about the poles. As distillation proceeds, the temperature of the vessel containing the residue of liquid air being allowed to rise slowly, the brightest (green) rays of xenon begin to appear, and the krypton rays soon die out, being superseded by those of xenon. At this stage the capillary part of the sparking-tube is, with a jar in circuit, a brilliant green, and it remains green, though less brilliant, if the jar is removed.

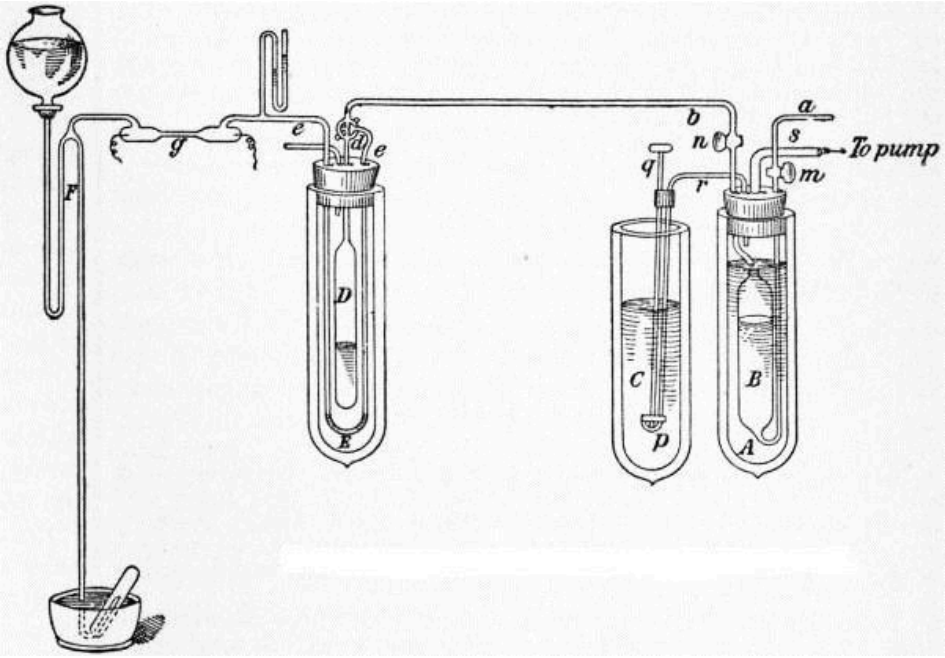

FIG. 8.—Apparatus for Fractional Distillation.

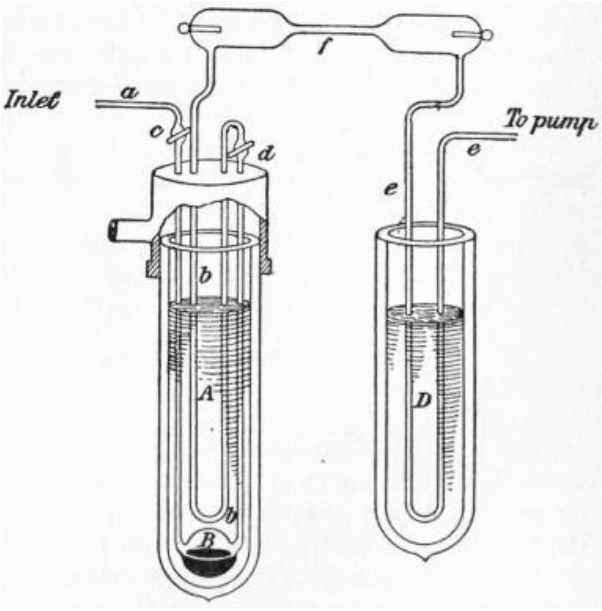

FIG. 9.—Apparatus for continuous Spectroscopic Examination.

An improved form of apparatus for the fractionation is represented in fig. 9. The gases to be separated, that is, the least volatile part of atmospheric air, enter the bulb B from a gasholder by

the tube *a* with stop-cock *c*. B, which is maintained at a low temperature by being immersed in liquid hydrogen, A, boiling under reduced pressure, in turn communicates through the tube *b* and stop-cock *d* with a sparking-tube or tubes *f*, and so on through *e* with a mercurial pump. To use the apparatus, stop-cock *d* is closed and *c* opened, and gas allowed to pass from the gasholder into B, where it is condensed in the solid form. Stop-cock *c* then being closed and *d* opened, gas passes into the exhausted tube *f*, where it is examined with the spectroscope. The vessel D contains liquid air, in which the tube *e* is immersed in order to condense vapour of mercury which would otherwise pass from the pump into the sparking-tube. The success of the operation of separating all the gases which occur in air and which boil at different temperatures, depends on keeping the temperature of B as low as possible, as will be understood from the following consideration:—

The pressure p, of a gas G, above the same material in the liquid state, at temperature T, is given approximately by the formula

$$\log p = \mathrm{A} - \frac{\mathrm{B}}{\mathrm{T}},$$

where A and B are constants for the same material. For some other gas G′ the formula will be

$$\log p_1 = \mathrm{A}_1 - \frac{\mathrm{B}_1}{\mathrm{T}},$$

and

$$\log \frac{p}{p_1} = \mathrm{A} - \mathrm{A}_1 + \frac{\mathrm{B}_1 - \mathrm{B}}{\mathrm{T}},$$

Now for argon, krypton and xenon respectively the values of A are 6.782, 6.972 and 6.963, and those of B are 339, 496.3 and 669.2; so that for these substances and many others $\mathrm{A} - \mathrm{A}_1$ is always a small quantity, while $(\mathrm{B}_1 - \mathrm{B})/\mathrm{T}$ is considerable and increases as T diminishes. Hence the ratio of p to p_1 increases rapidly as T diminishes, and by evaporating all the gases from the solid state, and keeping the solid at as low a temperature as possible, the gas that is taken off by the mercurial pump first consists mainly of the substance which has the lowest boiling point, in this case nitrogen, and is succeeded with comparative abruptness by the gas which has the next higher boiling point. Examination of the spectrum in the sparking-tube easily reveals the change from one gas to another, and when that is observed the reservoirs into which the gases are pumped can be changed and the fractions stored separately. Or several sparking-tubes may be arranged so as to form parallel communications between *b* and *e*, and can be successively sealed off at the desired stages of fractionation.

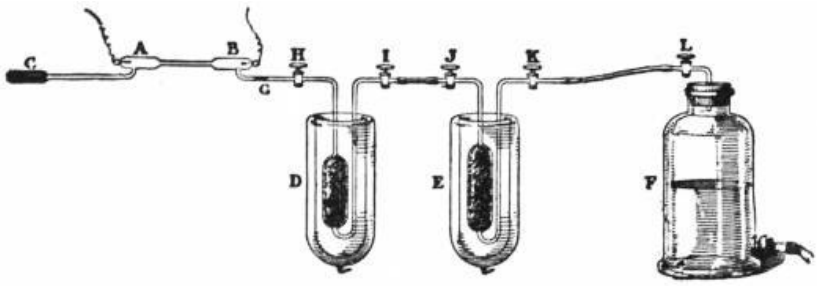

FIG. 10.

Analytical operations can often be performed still more conveniently with the help of charcoal, taking advantage of the selective character of its absorption, the general law of which is that the more volatile the gas the less is it absorbed at a given temperature. The following are some examples of its employment for this purpose. If it be required to separate the helium which is often found in the gases given off by a thermal spring, they are subjected to the action of charcoal cooled with liquid air. The result is the absorption of the less volatile constituents, *i.e.* all except hydrogen and helium. The gaseous residue, with the addition of oxygen, is then sparked, and the water thus formed is removed together with the excess of oxygen, when helium alone remains. Or the separation may be effected by a method of fractionation as described above. To separate the most volatile constituents of the atmosphere an apparatus such as that shown in fig. 10 may be employed. In one experiment with this, when 200 c.c. was supplied from the graduated gas-holder F to the vessel D, containing 15 grammes of charcoal cooled in liquid air, the residue which passed on unabsorbed to the sparking-tube AB, which had a small charcoal bulb C attached, showed the C and F lines of hydrogen, the yellow and some of the orange lines of neon and the yellow and green of helium. By using a second charcoal vessel E, with stop-cocks at H, I, J, K and L to facilitate manipulation, considerable quantities of the most volatile gases can be collected. After the charcoal in E has been saturated, the stop-cock K is closed and I and J are opened for a short time, to allow the less condensable gas in E to be sucked into the second condenser D along with some portion of air. The condenser E is then taken out of the liquid air, heated quickly to 15° C. to expel the occluded air and replaced. More air is then passed in, and by repeating the operation several times 50 litres of air can be treated in a short time, supplying sparking-tubes which will show the complete spectra of the volatile constituents of the air.

The less volatile constituents of the atmosphere, krypton and xenon, may be obtained by leading a current of air, purified by passage through a series of tubes cooled in liquid air, through a charcoal condenser also cooled in liquid air. The condenser is then removed and placed in solid carbon dioxide at −78° C. The gas that comes off is allowed to escape, but what remains in the charcoal is got out by heating and exhaustion, the carbon compounds and oxygen are removed and the residue, consisting of nitrogen with krypton and xenon, is separated into its constituents

by condensation and fractionation. Another method is to cover a few hundred grammes of charcoal with old liquid air, which is allowed to evaporate slowly in a silvered vacuum vessel; the gases remaining in the charcoal are then treated in the manner described above.

FIG. 11.

FIG. 12.

Charcoal enables a mixture containing a high percentage of oxygen to be extracted from the atmosphere. In one experiment 50 grammes of it, after being heated and exhausted were allowed to absorb air at −185° C.; some 5 or 6 litres were taken up in ten minutes, and it then presumably contained air of the composition of the atmosphere, *i.e.* 20% oxygen and 80% nitrogen, as shown in fig. 11. But when more air was passed over it, the portion that was not absorbed was found to consist of about 98% nitrogen, showing that excess of oxygen was being absorbed, and in the course of a few hours the occluded gas attained a new and apparently definite composition exhibited in fig. 12. When the charcoal containing this mixture was transferred to a vacuum vessel and allowed to warm up slowly, the successive litres of gas when collected and analyzed separately showed the following composition:—

1st litre	18.5%	oxygen
2nd litre	20.6%	”
3rd litre	53.0%	”
4th litre	72.0%	”
5th litre	79.0%	”
6th litre	84.0%	”

TABLE IX.

Liquid Gases.	Boiling Point.	Liquid Volume of 1 gram at Boiling Point in c.c.	Latent Heat in gram Calories.	Volume of Gas at 0° C. and 760 mm. per gram Calorie in c.c.
Sulphurous acid	+ 10°C.	0.7	97.0	3.6
Carbonic acid	− 78.0	0.65 (solid)	142.4	3.6
Ethylene	−103.0	1.7	119.0	7.0
Oxygen	−182.5	0.9	53.0	13.2
Nitrogen	−195.6	1.3	50.0	15.9

Hydrogen	−252.5	14.3	125.0	88.9
Helium	−269.0	7.0	13.0	450.0

Calorimetry.—Certain liquid gases lend themselves conveniently to the construction of a calorimeter, in which the heat in weighed quantities of any substance with which it is desired to experiment may be measured by the quantity of liquid gas they are able to evaporate. One advantage of this method is that a great range of temperature is available when liquid air, oxygen, nitrogen or hydrogen is employed as the calorimetric substance. Another is the relatively large quantity of gas yielded by the evaporation, as may be seen from table IX., which shows the special physical constants of the various gases that are of importance in calorimetry. In consequence it is easy to detect 1/50 gram calorie with liquid air and so little as 1/300 gram calorie with liquid hydrogen.

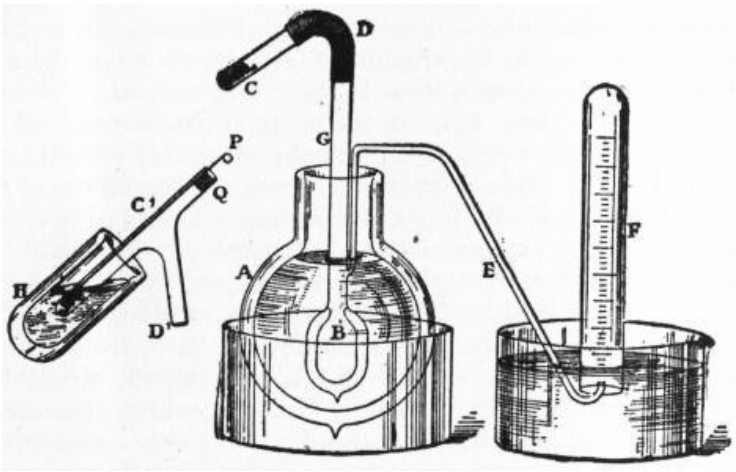

FIG. 13.—Calorimetric Apparatus.

The apparatus (fig. 13) consists of a large vacuum vessel A, of 2 or 3 litres' capacity, containing liquid air, in which is inserted a smaller vacuum vessel B, of 25-30 c.c. capacity, having sealed to it a long narrow tube G that projects above the mouth of A and is held in place by some loosely packed cotton wool. To the top of this tube the test tube C, containing the material under investigation, is connected by a piece of flexible rubber tubing D; this enables C to be tilted so as to throw a piece or pieces of the contained material into the calorimeter. An improved form of this receptacle, attached to B by a flexible tube at D′, is shown at C′. In this P is a wire movable through a cork Q and having at its end a hook by which a piece of the substance under examination can be pulled up and dropped into B. In the absence of other arrangements the substance is at the temperature of the room, but when lower initial temperatures are desired a vacuum vessel H containing solid carbonic acid, liquid ethylene, air or other gas,

can be placed to envelop C or C′, or higher temperatures may be obtained by filling the surrounding vessel with vapour of water or other liquids. The gas volatilized in B is conveyed by a side tube E to be collected in a graduated receiver F over water, oil or other liquid. If liquid hydrogen is to be used as the calorimetric substance the instrument must be so modified as to prevent the ordinary atmosphere from entering G, and to that end a current of hydrogen supplied from a Kipp apparatus is arranged to flow continuously through D and E until the moment of making the experiment, when it is cut off by a suitable stop-cock. In this case the outer vessel must contain liquid hydrogen instead of liquid air.

TABLE X.

Substance.	18° to −78° C., or, at −30° C.	−78° to −188° C., or, at −133° C.	−188° to −252° C., or, at −220° C.
Diamond	0.0794	0.0190	0.0043
Graphite	0.1341	0.0599	0.0133
Ice	0.463*	0.285	0.146

* This is from −18° to −78° in the ice experiment.

Dewar used pure metallic lead for the purpose of conveying definite amounts of heat to liquid gas calorimeters of this kind, that metal being selected on the ground of the small variation in its specific heat at low temperatures. He was thus able to determine the latent heats of evaporation of liquid oxygen, nitrogen and hydrogen directly at their boiling points, and he also ascertained the specific heats of a large number of inorganic and organic bodies, and of some gases in the solid state, such as carbon dioxide, sulphurous acid and ammonia. Perhaps his most interesting results were those which showed the variation in the specific heats of diamond, graphite and ice as typical bodies (table X.). With Professor Curie he used both the liquid oxygen and the liquid hydrogen calorimeter for preliminary measurements of the rate at which radium bromide gives out energy at low temperatures. The quantity of the salt available was 0.42 gram, and the thermal evolutions were as follows:—

	Gas evolved per minute.	Calories per hour.	
Liquid oxygen	5.5 cc.	22.8	
Liquid hydrogen	51.0 ”	31.6	Crystals.
Melting ice	..	24.1	
Liquid oxygen	2.0 ”	8.3	After fusion.
Liquid oxygen	2.5 ”	10.3	Emanation condensed.

The apparent increase of heat evolution at the temperature of liquid hydrogen was probably due to the calorimeter being too small; hydrogen spray was thus carried away with the gas, making the volume of gas too great and inferentially also the heat evolved.

Liquid air and liquid hydrogen calorimeters open up an almost unlimited field of research in the determination of specific heats and other thermal constants, and are certain to become common laboratory instruments for such purposes.

Chemical Action.—By extreme cold chemical action is enormously reduced, though it may not in all cases be entirely abolished even at the lowest temperatures yet attained; one reason for this diminution of activity may doubtless be sought in the fact that in such conditions most substances are solid, that is, in the state least favourable to chemical combination. Thus an electric pile of sodium and carbon ceases to yield a current when immersed in liquid oxygen. Sulphur, iron and other substances can be made to burn under the surface of liquid oxygen if the combustion is properly established before the sample is immersed, and the same is true of a fragment of diamond. Nitric oxide in the gaseous condition combines instantly with free oxygen, producing the highly-coloured gas, nitric peroxide, but in the solid condition it may be placed in contact with liquid oxygen without showing any signs of chemical action. If the combination of a portion of the mixture is started by elevation of temperature, then detonation may take place throughout the cooled mass. The stability of endothermic bodies like nitric oxide and ozone at low temperatures requires further investigation. The behaviour of fluorine, which may be regarded as the most active of the elements, is instructive in this respect. As a gas, cooled to −180° C. it loses the power of attacking glass; similarly silicon, borax, carbon, sulphur and phosphorus at the same temperature do not become incandescent in an atmosphere of the gas. Passed into liquid oxygen, the gas dissolves and imparts a yellowish tint to the liquid; if the oxygen has been exposed to the air for some hours, the fluorine produces a white flocculent precipitate, which if separated by filtering deflagrates with violence as the temperature rises. It appears to be a hydrate of fluorine. As a liquid at −210° fluorine attacks turpentine also cooled to that temperature with explosive force and the evolution of light, while the direction of a jet of hydrogen upon its surface is immediately followed by combination and a flash of flame. Even when the point of a tube containing solid fluorine is broken off under liquid hydrogen, a violent explosion ensues.

Photographic Action.—The action of light on photographic plates, though greatly diminished at −180°, is far from being in abeyance; an Eastman film, for instance, remains fairly sensitive at −210°. At the still lower temperature of liquid hydrogen the photographic activity is reduced to about half what it is at that of liquid air; in other words, about 10% of the original sensitivity remains. Experiments carried out with an incandescent lamp, a Röntgen bulb and the ultra-violet spark from magnesium and cadmium, to discover at what distances from the source of light the plates must be placed in order to receive an equal photographic impression, yielded the results shown in table XI.

TABLE XI.

Source of Light.	Cooled Plate.	Uncooled Plate.	Ratio of Intensities at Balance.
16 C.P. lamp	20 in.	50 in.	1 to 6
Röntgen bulb	10 in.	24¾ in.	1 to 6
Ultra-violet spark	22½ in.	90 in.	1 to 16

It appears that the photographic action of both the incandescent lamp and the Röntgen rays is reduced by the temperature of liquid air to 17% of that exerted at ordinary temperatures, while ultra-violet radiation retains only 6%. It is possible that the greater dissipation of the latter by the photographic film at low temperatures than at ordinary ones is due to its absorption and subsequent emission as a phosphorescent glow, and that if the plate could be developed at a low temperature it would show no effect, the photographic action taking place subsequently through an internal phosphorescence in the film during the time it is heating up. With regard to the transparency of bodies to the Röntgen radiation at low temperatures, small tubes of the same bore, filled with liquid argon and chlorine, potassium, phosphorus, aluminium, silicon and sulphur, were exposed at the temperature of liquid air (in order to keep the argon and chlorine solid), in front of a photographic plate shielded with a sheet of aluminium, to an X-ray bulb. The sequence of the elements as mentioned represents the order of increasing opacity observed in the shadows. Sodium and liquid oxygen and air, nitrous and nitric oxides, proved much more transparent than chlorine. Tubes of potassium, argon and liquid chlorine showed no very marked difference of density on the photographic plates. It appears that argon is relatively more opaque to the Röntgen radiation than either oxygen, nitrogen or sodium, and is on a level with potassium, chlorine, phosphorus, aluminium and sulphur. This fact may be regarded as supporting the view that the atomic weight of argon is twice its density relative to hydrogen, since in general the opacity of elements in the solid state increases with the atomic weight.

Phosphorescence.—Phosphorescing sulphides of calcium, which are luminous at ordinary temperatures, and whose emission of light is increased by heating, cease to be luminous if cooled to −80° C. But their light energy is merely rendered latent, not destroyed, by such cold, and they still retain the capacity of taking in light energy at the low temperature, to be evolved again when they are warmed. At the temperature of liquid air many bodies become phosphorescent which do not exhibit the phenomenon at all, or only to a very slight extent, at ordinary temperatures, *e.g.* ivory, indiarubber, egg-shells, feathers, cottonwool, paper, milk, gelatine, white of egg, &c. Of definite chemical compounds, the platinocyanides among the inorganic bodies seem to yield the most brilliant effects. Crystals of ammonium platinocyanide, if stimulated by exposure to the ultra-violet radiation of the electric arc—or better still of a mercury vapour lamp in quartz—while kept moistened with liquid air, may be seen in the dark to glow faintly so long as they are kept cold, but become exceedingly brilliant when the liquid air evaporates and the temperature rises. Among organic bodies the phenomenon is particularly well marked with the ketonic compounds and others of the same type. The chloro-, bromo-, iodo-, sulpho- and nitro-

compounds show very little effect as a rule. The activity of the alcohols, which is usually considerable, is destroyed by the addition of a little iodine. Coloured salts, &c., are mostly inferior in activity to white ones. When the lower temperature of liquid hydrogen is employed there is a great increase in phosphorescence under light stimulation as compared with that observed with liquid air. The radio-active bodies, like radium, which exhibit self-luminosity in the dark, maintain that luminosity unimpaired when cooled in liquid hydrogen.

Some crystals become for a time self-luminous when placed in liquid hydrogen, because the high electric stimulation due to the cooling causes actual electric discharges between the crystal molecules. This phenomenon is very pronounced with nitrate of uranium and some platinocyanides, and cooling such crystals even to the temperature of liquid air is sufficient to develop marked electrical and luminous effects, which are again observed, when the crystal is taken out of the liquid, during its return to normal temperature. Since both liquid hydrogen and liquid air are good electrical insulators, the fact that electric discharges take place in them proves that the electric potential generated by the cooling must be very high. A crystal of nitrate of uranium indeed gets so highly charged electrically that it refuses to sink in liquid air, although its density is 2.8 times greater, but sticks to the side of the vacuum vessel, and requires for its displacement a distinct pull on the silk thread to which it is attached. Such a crystal quickly removes cloudiness from liquid air by attracting all the suspended particles to its surface, just as a fog is cleared out of air by electrification. It is interesting to observe that neither fused nitrate of uranium nor its solution in absolute alcohol shows any of the remarkable effects of the crystalline state on cooling.

Cohesion.—The physical force known as cohesion is greatly increased by low temperatures. This fact is of much interest in connexion with two conflicting theories of matter. Lord Kelvin's view was that the forces that hold together the ultimate particles of bodies may be accounted for without assuming any other forces than that of gravitation, or any other law than the Newtonian. An opposite view is that the phenomena of cohesion, chemical union, &c., or the general phenomena of the aggregation of molecules, depend on the molecular vibrations as a physical cause (Tolver Preston, *Physics of the Ether*, p. 64). Hence at the zero of absolute temperature, this vibrating energy being in complete abeyance, the phenomena of cohesion should cease to exist and matter generally be reduced to an incoherent heap of "cosmic dust." This second view receives no support from experiment. Atmospheric air, for instance, frozen at the temperature of liquid hydrogen, is a hard solid, the strength of which gives no hint that with a further cooling of some 20 degrees it would crumble into powder. On the contrary, the lower the scale of temperature is descended, the more powerful become the forces which hold together the particles of matter. A spiral of fusible metal, which at ordinary temperatures cannot support the weight of an ounce without being straightened out, will, when cooled to the temperature of liquid oxygen, and so long as it remains in that cooled condition, support several pounds and vibrate like a steel spring. Similarly a bell of fusible metal at −182° C. gives a distinct metallic ring when struck.

Balls of iron, lead, tin, ivory, &c., thus cooled, exhibit an increased rebound when dropped from a height; an indiarubber ball, on the other hand, becomes brittle, and is smashed to atoms by a very moderate fall. Tables XII. and XIII., which give the mean results of a large number of experiments, show the increased breaking stress gained by metals while they are cooled to the temperature of liquid oxygen.

TABLE XII.—*Breaking Stress in Pounds of Metallic Wires 0.098 inch in diameter.*

	+15° C.	−182° C.
Steel (soft)	420	700
Iron	320	670
Copper	200	300
Brass	310	440
German silver	470	600
Gold	255	340
Silver	330	420

TABLE XIII.—*Breaking Stress in Pounds of Cast Metallic Testpieces; diameter of rod-0.2 inch.*

	+15° C.	−182° C.
Tin	200	390
Lead	77	170
Zinc	35	26
Mercury	0	31
Bismuth	60	30
Antimony	61	30
Solder	300	645
Fusible, metal (Wood)	140	450

In the second series of experiments the test-pieces were 2 in. long and were all cast in the same mould. It will be noticed that in the cases of zinc, bismuth and antimony the results appear to be abnormal, but it may be pointed out that it is difficult to get uniform castings of crystalline bodies, and it is probable that by cooling such stresses are set up in some set of cleavage planes as to render rupture comparatively easy. In the case of strong steel springs the rigidity modulus does not appear to be greatly affected by cold, for although a number were examined, no measurable differences could be detected in their elongation under repeated additions of the same load. No quantitative experiments have been made on the cohesive properties of the metals at the temperature of boiling hydrogen (−252°), owing to the serious cost that would be involved. A lead wire cooled in liquid hydrogen did not become brittle, as it could be bent backwards and forwards in the liquid.

Electrical Resistivity.—The first experiments on the conductivity of metals at low temperatures appear to have been made by Wroblewski (*Comptes rendus*, ci. 160), and by Cailletet and Bouty (*Journ. de phys.* 1885, p. 297). The former's experiments were undertaken to test the suggestion made by Clausius that the resistivity of pure metals is sensibly proportional to the absolute temperature; he worked with copper having a conductibility of 98%, and carried out measurements at various temperatures, the lowest of which was that given by liquid nitrogen boiling under reduced pressure. His general conclusion was that the resistivity decreases much more quickly than the absolute temperature, so as to approach zero at a point not far below the temperature of nitrogen evaporating *in vacuo*. Cailletet and Bouty, using ethylene as the refrigerant, and experimenting at temperatures ranging from 0° C. to −100° C. and −123° C., constructed formulae intended to give the coefficients of variation in electrical resistance for mercury, tin, silver, magnesium, aluminium, copper, iron and platinum. Between 1892 and 1896 Dewar and Fleming carried out a large number of experiments to ascertain the changes of conductivity that occur in metals and alloys cooled in liquid air or oxygen to −200° C. The method employed was to obtain the material under investigation in the form of a fine regular wire and to wind it in a small coil; this was then plunged in the liquid and its resistance determined. The accompanying chart (fig. 14) gives the results in a compendious form, the temperatures being expressed not in degrees of the ordinary air-thermometer scale, but in platinum degrees as given by one particular platinum resistance thermometer which was used throughout the investigation. A table showing the value of these degrees in degrees centigrade according to Dickson will be found in the *Phil. Mag.* for June 1898, p. 527; to give some idea of the relationship, it may be stated here that −100° of the platinum thermometer = −94°.2 C., −150° plat. = −140°.78 C., and −200° plat. = −185°.53 C. In general, the resistance of perfectly pure metals was greatly decreased by cold—so much so that, to judge by the course of the curves on the chart, it appeared probable that at the zero of absolute temperature resistance would vanish altogether and all pure metals become perfect conductors of electricity. This conclusion, however, has been rendered very doubtful by subsequent observations by Dewar, who found that with the still lower temperatures attainable with liquid hydrogen the increases of conductivity became less for each decrease of temperature, until a point was reached where the curves bent sharply round and any further diminution of resistance became very small; that is, the conductivity remained finite. The reduction in resistance of some of the metals at the boiling point of hydrogen is very remarkable. Thus copper has only $\frac{1}{105}$th, gold $\frac{1}{30}$th, platinum $\frac{1}{35}$th to $\frac{1}{17}$th, silver $\frac{1}{24}$th the resistance at melting ice, but iron is only reduced to $\frac{1}{8}$th part of the same initial resistance. Table XIV. shows the progressive decrease of resistance for certain metals and one alloy as the temperature is lowered from that of boiling water down to that of liquid hydrogen boiling under reduced pressure; it also gives the "vanishing temperature," at which the conductivity would become perfect if the resistance continued to decrease in the same ratio with still lower temperatures, the values being derived from the extrapolation curves of the relation between resistance and temperature, according to Callendar and Dickson. It will be seen that

many of the substances have actually been cooled to a lower temperature than that at which their resistance ought to vanish.

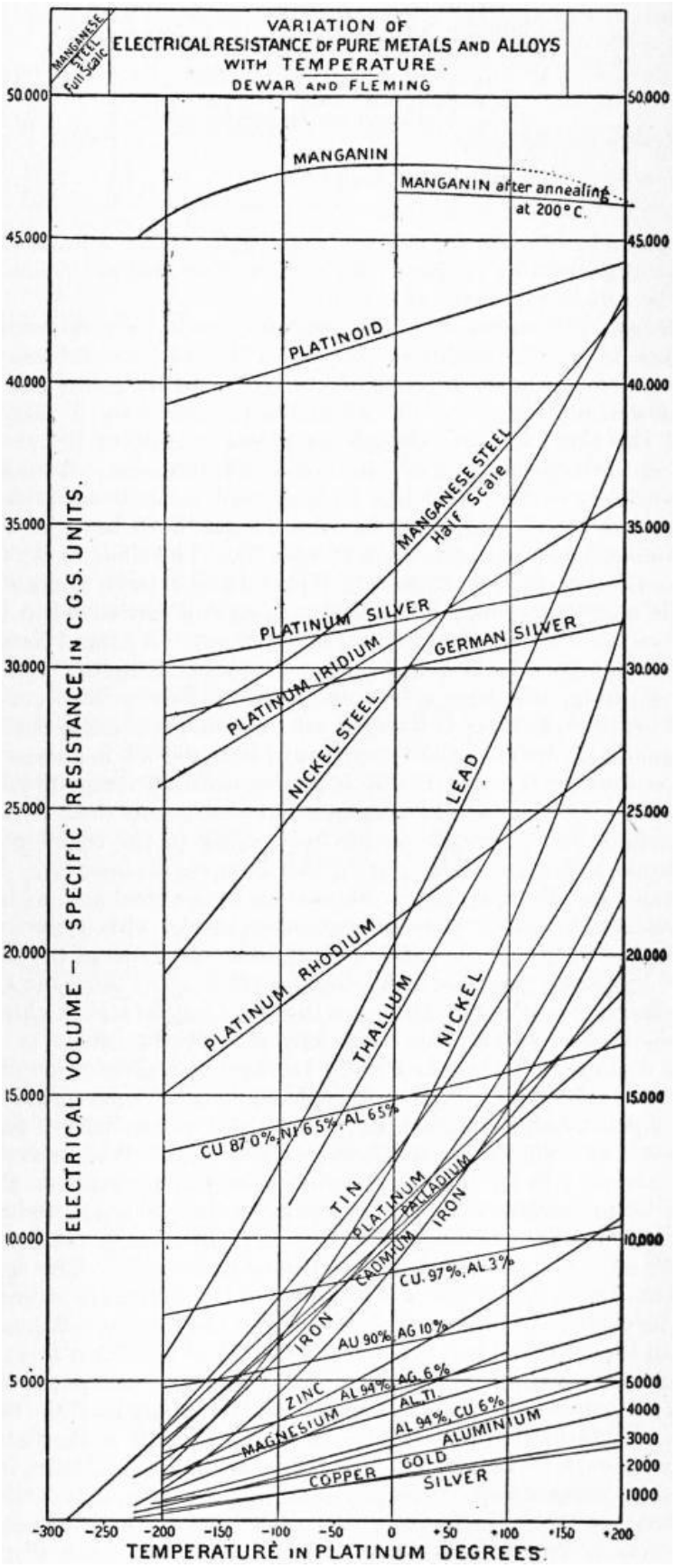
VARIATION OF
ELECTRICAL RESISTANCE OF PURE METALS AND ALLOYS
WITH TEMPERATURE.
DEWAR AND FLEMING
MANGANESE STEEL Full Scale
ELECTRICAL VOLUME — SPECIFIC RESISTANCE IN C.G.S. UNITS.
TEMPERATURE IN PLATINUM DEGREES.
MANGANIN
MANGANIN after annealing at 200° C.
PLATINOID
MANGANESE STEEL Half Scale
PLATINUM SILVER
GERMAN SILVER
PLATINUM IRIDIUM
NICKEL STEEL
LEAD
PLATINUM RHODIUM
THALLIUM
NICKEL
CU 87 0%, NI 6 5%, AL 6 5%
TIN
PLATINUM
PALLADIUM
CADMIUM
IRON
CU. 97%, AL 3%
IRON
AU 90% AG 10%
ZINC
AL 94% AG 6%
MAGNESIUM
AL. TI.
AL 94%, CU 6%
ALUMINIUM
COPPER
GOLD
SILVER
50.000
45.000
40.000
35.000
30.000
25.000
20.000
15.000
10.000
5 000
5000
4000
3000
2000
1000
-300 -250 -200 -150 -100 -50 0 +50 +100 +150 +200

FIG. 14.—Chart of the Variation of Electrical Resistance of Pure Metals and Alloys with Temperature. (Dewar and Fleming.)

In the case of alloys and impure metals, cold brings about a much smaller decrease in resistivity, and the continuations of the curves at no time show any sign of passing through the zero point. The influence of the presence of impurities in minute quantities is strikingly shown in the case of bismuth. Various specimens of the metal, prepared with great care by purely chemical methods, gave in the hands of Dewar and Fleming some very anomalous results, appearing to reach at −80° C. a maximum of conductivity, and thereafter to increase in resistivity with decrease of temperature. But when the determinations were carried out on a sample of really pure bismuth prepared electrolytically, a normal curve was obtained corresponding to that given by other pure metals. As to alloys, there is usually some definite mixture of two pure metals which has a maximum resistivity, often greater than that of either of the constituents. It appears too that high, if not the highest, resistivity corresponds to possible chemical compounds of the two metals employed, *e.g.* platinum 33 parts with silver 66 parts = $PtAg_4$; iron 80 with nickel 20 = Fe_4Ni; platinum 80 with iridium 20 = $IrPt_4$; and copper 70 with manganese 30 = Cu_2Mn. The product obtained by adding a small quantity of one metal to another has a higher specific resistance than the predominant constituent, but the curve is parallel to, and therefore the same in shape as, that of the latter (cf. the curves for various mixtures of Al and Cu on the chart). The behaviour of carbon and of insulators like gutta-percha, glass, ebonite, &c., is in complete contrast to the metals, for their resistivity steadily increases with cold. The thermo-electric properties of metals at low temperatures are discussed in the article THERMOELECTRICITY.

TABLE XIV.

Metals.	Platinum.	Platinum-rhodium Alloy.	Gold.	Silver.	Copper.	Iron.
Resistance at 100°	39.655	36.87	16.10	8.336	11.572	4.290
Resistance at 0° C	28.851	31.93	11.58	5.990	8.117	2.765
Resistance at carbonic acid	19.620	..	..	..	..	..
Resistance at liquid oxygen	7.662	22.17	3.380	1.669	1.589	0.633
Resistance at liquid nitrogen	..	..	..	..	1.149	..
Resistance at liquid oxygen under exhaustion	4.634	20.73	..	..	..	..
Resistance at liquid hydrogen	0.826	18.96	0.381	0.244	0.077	0.356
Resistance at liquid hydrogen under exhaustion	0.705	18.90	0.298	0.226	0.071	..
Resistance coefficients	0.003745	0.003607	0.003903	0.003917	0.004257	0.005515
Vanishing temperatures (Centigrade)	−244.50° −244.15°	−543.39° −530.32°	−257.90° −257.8°	−252.26° −252.25°	−225.62° −226.04°	−258.40°C. −246.80°D.

Magnetic Phenomena.—Low temperatures have very marked effects upon the magnetic properties of various substances. Oxygen, long known to be slightly magnetic in the gaseous

state, is powerfully attracted in the liquid condition by a magnet, and the same is true, though to a less extent, of liquid air, owing to the proportion of liquid oxygen it contains. A magnet of ordinary carbon steel has its magnetic moment temporarily increased by cooling, that is, after it has been brought to a permanent magnetic condition ("aged"). The effect of the first immersion of such a magnet in liquid air is a large diminution in its magnetic moment, which decreases still further when it is allowed to warm up to ordinary temperatures. A second cooling, however, increases the magnetic moment, which is again decreased by warming, and after a few repetitions of this cycle of cooling and heating the steel is brought into a condition such that its magnetic moment at the temperature of liquid air is greater by a constant percentage than it is at the ordinary temperature of the air. The increase of magnetic moment seems then to have reached a limit, because on further cooling to the temperature of liquid hydrogen hardly any further increase is observed. The percentage differs with the composition of the steel and with its physical condition. It is greater, for example, with a specimen tempered very soft than it is with another specimen of the same steel tempered glass hard. Aluminium steels show the same kind of phenomena as carbon ones, and the same may be said of chrome steels in the permanent condition, though the effect of the first cooling with them is a slight increase of magnetic moment. Nickel steels present some curious phenomena. When containing small percentages of nickel (*e.g.* 0.84 or 3.82), they behave under changes of temperature much like carbon steel. With a sample containing 7.65%, the phenomena after the permanent state had been reached were similar, but the first cooling produced a slight increase in magnetic moment. But steels containing 18.64 and 29% of nickel behaved very differently. The result of the first cooling was a reduction of the magnetic moment, to the extent of nearly 50% in the case of the former. Warming again brought about an increase, and the final condition was that at the temperature of liquid air the magnetic moment was always less than at ordinary temperatures. This anomaly is all the more remarkable in that the behaviour of pure nickel is normal, as also appears to be generally the case with soft and hard iron. Silicon, tungsten and manganese steels are also substantially normal in their behaviour, although there are considerable differences in the magnitudes of the variations they display (*Proc. Roy. Soc.* lx. 57 et seq.; also "The Effect of Liquid Air Temperatures on the Mechanical and other Properties of Iron and its Alloys," by Sir James Dewar and Sir Robert Hadfield, *Id.* lxxiv. 326-336).

Low temperatures also affect the permeability of iron, *i.e.* the degree of magnetization it is capable of acquiring under the influence of a certain magnetic force. With fine Swedish iron, carefully annealed, the permeability is slightly reduced by cooling to −185° C. Hard iron, however, in the same circumstances suffers a large increase of permeability. Unhardened steel pianoforte wire, again, behaves like soft annealed iron. As to hysteresis, low temperatures appear to produce no appreciable effect in soft iron; for hard iron the observations are undecisive.

Biological Research.—The effect of cold upon the life of living organisms is a matter of great intrinsic interest as well as of wide theoretical importance. Experiment indicates that moderately

high temperatures are much more fatal, at least to the lower forms of life, than are exceedingly low ones. Professor M'Kendrick froze for an hour at a temperature of −182° C. samples of meat, milk, &c., in sealed tubes; when these were opened, after being kept at blood-heat for a few days, their contents were found to be quite putrid. More recently some more elaborate tests were carried out at the Jenner (now Lister) Institute of Preventive Medicine on a series of typical bacteria. These were exposed to the temperature of liquid air for twenty hours, but their vitality was not affected, their functional activities remained unimpaired and the cultures which they yielded were normal in every respect. The same result was obtained when liquid hydrogen was substituted for air. A similar persistence of life has been demonstrated in seeds, even at the lowest temperatures; they were frozen for over 100 hours in liquid air at the instance of Messrs Brown and Escombe, with no other effect than to afflict their protoplasm with a certain inertness, from which it recovered with warmth. Subsequently commercial samples of barley, peas and vegetable-marrow and mustard seeds were literally steeped for six hours in liquid hydrogen at the Royal Institution, yet when they were sown by Sir W. T. Thiselton Dyer at Kew in the ordinary way, the proportion in which germination occurred was no smaller than with other batches of the same seeds which had suffered no abnormal treatment. Mr Harold Swithinbank has found that exposure to liquid air has little or no effect on the vitality of the tubercle bacillus, although by very prolonged exposures its virulence is modified to some extent; but alternate exposures to normal and very cold temperatures do have a decided effect both upon its vitality and its virulence. The suggestion once put forward by Lord Kelvin, that life may in the first instance have been conveyed to this planet on a meteorite, has been objected to on the ground that any living organism would have been killed before reaching the earth by its passage through the intense cold of interstellar space; the above experiments on the resistance to cold offered by seeds and bacteria show that this objection at least is not fatal to Lord Kelvin's idea.

At the Lister Institute of Preventive Medicine liquid air has been brought into use as an agent in biological research. An inquiry into the intracellular constituents of the typhoid bacillus, initiated under the direction of Dr Allan Macfadyen, necessitated the separation of the cell-plasma of the organism. The method at first adopted for the disintegration of the bacteria was to mix them with silver-sand and churn the whole up in a closed vessel in which a series of horizontal vanes revolved at a high speed. But certain disadvantages attached to this procedure, and accordingly some means was sought to do away with the sand and triturate the bacilli *per se*. This was found in liquid air, which, as had long before been shown at the Royal Institution, has the power of reducing materials like grass or the leaves of plants to such a state of brittleness that they can easily be powdered in a mortar. By its aid a complete trituration of the typhoid bacilli has been accomplished at the Jenner Institute, and the same process, already applied with success also to yeast cells and animal cells, is being extended in other directions.

Industrial Applications.—While liquid air and liquid hydrogen are being used in scientific research to an extent which increases every day, their applications to industrial purposes are not

so numerous. The temperatures they give used as simple refrigerants are much lower than are generally required industrially, and such cooling as is needed can be obtained quite satisfactorily, and far more cheaply, by refrigerating machinery employing more easily condensable gases. Their use as a source of motive power, again, is impracticable for any ordinary purposes, on the score of inconvenience and expense. Cases may be conceived of in which for special reasons it might prove advantageous to use liquid air, vaporized by heat derived from the surrounding atmosphere, to drive compressed-air engines, but any advantage so gained would certainly not be one of cheapness. No doubt the power of a waterfall running to waste might be temporarily conserved in the shape of liquid air, and thereby turned to useful effect. But the reduction of air to the liquid state is a process which involves the expenditure of a very large amount of energy, and it is not possible even to recover all that expended energy during the transition of the material back to the gaseous state. Hence to suggest that by using liquid air in a motor more power can be developed than was expended in producing the liquid air by which the motor is worked, is to propound a fallacy worse than perpetual motion, since such a process would have an efficiency of more than 100%. Still, in conditions where economy is of no account, liquid air might perhaps, with effectively isolated storage, be utilized as a motive power, *e.g.* to drive the engines of submarine boats and at the same time provide a supply of oxygen for the crew; even without being used in the engines, liquid air or oxygen might be found a convenient form in which to store the air necessary for respiration in such vessels. But a use to which liquid air machines have already been put to a large extent is for obtaining oxygen from the atmosphere. Although when air is liquefied the oxygen and nitrogen are condensed simultaneously, yet owing to its greater volatility the latter boils off the more quickly of the two, so that the remaining liquid becomes gradually richer and richer in oxygen. The fractional distillation of liquid air is the method now universally adopted for the preparation of oxygen on a commercial scale, while the nitrogen simultaneously obtained is used for the production of cyanamide, by its action on carbide of calcium. An interesting though minor application of liquid oxygen, or liquid air from which most of the nitrogen has evaporated, depends on the fact that if it be mixed with powdered charcoal, or finely divided organic bodies, it can be made by the aid of a detonator to explode with a violence comparable to that of dynamite. This explosive, which might properly be called an emergency one, has the disadvantage that it must be prepared on the spot where it is to be used and must be fired without delay, since the liquid evaporates in a short time and the explosive power is lost; but, on the other hand, if a charge fails to go off it has only to be left a few minutes, when it can be withdrawn without any danger of accidental explosion.

For further information the reader may consult W. L. Hardin, *Rise and Development of the Liquefaction of Gases* (New York, 1899), and Lefèvre, *La Liquéfaction des gaz et ses applications*; also the article CONDENSATION OF GASES. But the literature of liquid gases is mostly contained in scientific periodicals and the proceedings of learned societies. Papers by Wroblewski and Olszewski on the liquefaction of oxygen and nitrogen may be found in the *Comptes rendus*, vols, xcvi.-cii., and there are important memoirs by the former on the relations between the gaseous and liquid states and on the compressibility of hydrogen in *Wien. Akad. Sitzber.* vols. xciv. and xcvii.; his pamphlet *Comme l'air a été liquéfié* (Paris, 1885) should also be referred to. For Dewar's work, see *Proc. Roy. Inst.* from 1878 onwards, including "Solid Hydrogen" (1900); "Liquid Hydrogen Calorimetry" (1904); "New Low Temperature Phenomena" (1905); "Liquid Air and Charcoal at Low Temperatures" (1906); "Studies in High Vacua and Helium at Low Temperatures" (1907); also "The Nadir of Temperature and Allied Problems" (Bakerian Lecture), *Proc. Roy. Soc.* (1901), and the Presidential Address to the British Association (1902). The researches of Fleming and Dewar on the electrical and magnetic properties of substances at low temperatures are described in *Proc. Roy. Soc.* vol. lx., and *Proc. Roy. Inst.* (1896); see also "Electrical Resistance of Pure Metals, Alloys and Non-Metals at the Boiling-point of Oxygen," *Phil. Mag.* vol. xxxiv. (1892); "Electrical Resistance of Metals and Alloys at Temperatures approaching the Absolute Zero," *ibid.* vol. xxxvi. (1893); "Thermoelectric Powers of Metals and Alloys between the Temperatures of the Boiling-point of Water and the Boiling-point of Liquid Air," *ibid.* vol. xl. (1895); and papers on the dielectric constants of various substances at low temperatures in *Proc. Roy. Soc.* vols. lxi. and lxii. Optical and spectroscopic work by Liveing and Dewar on liquid gases is described in *Phil. Mag.* vols. xxxiv. (1892), xxxvi. (1893), xxxviii. (1894) and xl. (1895); for papers by the same authors on the separation and spectroscopic examination of the most volatile and least

volatile constituents of atmospheric air, see *Proc. Roy. Soc.* vols. lxiv., lxvii. and lxviii. An account of the influence of very low temperatures on the germinative power of seeds is given by H. T. Brown and F. Escombe in *Proc. Roy. Soc.* vol. lxii., and by Sir W. Thiselton Dyer, *ibid.* vol. lxv., and their effect on bacteria is discussed by A. Macfadyen, *ibid.* vols. lxvi. and lxxi.

(J. Dr.)

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1 Figs. 1, 5, 6, 7, 10, 11, 12, 13 in this article are from *Proc. Roy. Inst.*, by permission.

2 It may be noted that now that the commercial production of oxygen is effected by the liquefaction of air, with separation of its constituents in what is essentially a Coffey still, the chemist has at his command large quantities not only of the less volatile constituents, krypton and xenon, but also of the more volatile ones, neon and helium. Roughly a million volumes of air contain 20 volumes of neon and helium, about 15 of the former to 5 of the latter, approximately 1 volume of hydrogen being associated with them, so that in view of the enormous amounts of oxygen that are produced, helium can be obtained in practically any quantity directly from the atmosphere.

LIQUORICE. The hard and semi-vitreous sticks of paste, black in colour and possessed of a sweet somewhat astringent taste, known as liquorice paste or black sugar, are the inspissated juice of the roots of a leguminous plant, *Glycyrrhiza glabra*, the *radix glycyrrhizae* of the pharmacopoeia. The plant is cultivated throughout the warmer parts of Europe, especially on the Mediterranean shores, and to some extent in Louisiana and California. The roots for use are obtained in lengths of 3 or 4 ft., varying in diameter from 1/4 to 1 in.; they are soft, flexible and fibrous, and internally of a bright yellow colour, with a characteristic, sweet pleasant

taste. To this sweet taste of its root the plant owes its generic name *Glycyrrhiza* (γλυκύῤῥιζα, the sweet-root), of which the word liquorice is a corruption. The roots contain grape-sugar, starch, resin, asparagine, malic acid and the glucoside glycyrrhizin, $C_{24}H_{36}O_9$, a yellow amorphous powder with an acid reaction and a distinctive bitter-sweet taste. On hydrolysis, glycyrrhizin yields glucose and glycyrrhetin.

Stick liquorice is made by crushing and grinding the roots to a pulp, which is boiled in water over an open fire, and the decoction separated from the solid residue of the root is evaporated till a sufficient degree of concentration is attained, after which, on cooling, it is rolled into the form of sticks or other shapes for the market. The preparation of the juice is a widely extended industry along the Mediterranean coasts; but the quality best appreciated in the United Kingdom is made in Calabria, and sold under the names of Solazzi and Corigliano juice. Liquorice enters into the composition of many cough lozenges and other demulcent preparations; and in the form of aromatic syrups and elixirs it has a remarkable effect in masking the taste of nauseous medicines.

LIQUOR LAWS. In most Western countries the sale of alcoholic liquor is regulated by law. The original and principal object is to check the evils arising from the immoderate use of such liquor, in the interest of public order, morality and health; a secondary object is to raise revenue from the traffic. The form and the stringency of the laws passed for these

purposes vary very widely in different countries according to the habits of the people and the state of public opinion. The evils which it is desired to check are much greater in some countries than in others. Generally speaking they are greater in northern countries and cold and damp climates than in southern and more sunny ones. Climate has a marked influence on diet for physiological reasons over which we have no control. The fact is attested by universal experience and is perfectly natural and inevitable, though usually ignored in those international comparisons of economic conditions and popular customs which have become so common. It holds good both of food and drink. The inhabitants of south Europe are much less given to alcoholic excess than those of central Europe, who again are more temperate than those of the north. There is even a difference between localities so near together as the east and west of Scotland. The chairman of the Prison Commissioners pointed out before a British royal commission in the year 1897 the greater prevalence of drunkenness in the western half, and attributed it in part to the dampness of the climate on the western coast. But race also has an influence. The British carry the habit of drinking wherever they go, and their colonial descendants retain it even in hot and dry climates. The Slav peoples and the Magyars in central Europe are much more intemperate than the Teutonic and Latin peoples living under similar climatic conditions. These natural differences lead, in accordance with the principle discerned and enunciated by Montesquieu, to the adoption of different laws, which vary with the local conditions. But social laws of this character also vary with the state of public opinion, not only in different countries but in the same country at different times. The result is that the subject is in a state of incessant flux. There are not only many varieties of liquor laws, but also frequent changes in them, and new experiments are constantly being tried. The general tendency is towards increased stringency, not so much because the evils increase, though that happens in particular places at particular times, as because public opinion moves

broadly towards increasing condemnation of excess and increasing reliance on legislative interference. The first is due partly to a general process of refining manners, partly to medical influence and the growing attention paid to health; the second to a universal tendency which seems inherent in democracy.

Liquor laws may be classified in several ways, but the most useful way for the present purpose will be to take the principal methods of conducting the traffic as they exist, under four main headings, and after a brief explanation give some account of the laws in the principal countries which have adopted them. The four methods are: (1) licensing or commercial sale for private profit under a legal permit; (2) sale by authorized bodies not for private profit, commonly known as the Scandinavian or company system; (3) state monopoly; (4) prohibition. It is not a scientific classification, because the company system is a form of licensing and prohibition is no sale at all; but it follows the lines of popular discussion and is more intelligible than one of a more technical character would be. All forms of liquor legislation deal mainly with retail sale, and particularly with the sale for immediate consumption on the spot.

1. *Licensing.*—This is by far the oldest and the most widely adopted method; it is the one which first suggests itself in the natural course of things. Men begin by making and selling a thing without let or hindrance to please themselves. Then objections are raised, and when they are strong or general enough the law interferes in the public interest, at first mildly; it says in effect—This must not go on in this way or to this extent; there must be some control, and permission will only be given to duly authorized persons. Such persons are licensed or permitted to carry on the traffic under conditions, and there is obviously room for infinite gradations of strictness in granting permission and infinite variety in the conditions imposed. The procedure may vary from mere notification of the intention to open an

establishment up to a rigid and minutely detailed system of annual licensing laid down by the law. But in all cases, even when mere notification is required, the governing authority has the right to refuse permission or to withdraw it for reasons given, and so it retains the power of control. At the same time holders of the permission may be compelled to pay for the privilege and so contribute to the public revenue. The great merit of the licensing system is its perfect elasticity, which permits adjustment to all sorts of conditions and to the varying demands of public opinion. It is in force in the United Kingdom, which first adopted it, in most European countries, in the greater part of North America, including both the United States and Canada, in the other British dominions and elsewhere.

2. *The Scandinavian or Company System.*—The principle of this method is the elimination of private profit on the ground that it removes an incentive to the encouragement of excessive drinking. A monopoly of the sale of liquor is entrusted to a body of citizens who have, or are supposed to have, no personal interest in it, and the profits are applied to public purposes. The system, which is also called "disinterested management," is adopted in Sweden and Norway; and the principle has been applied in a modified form in England and Finland by the operation of philanthropic societies which, however, have no monopoly but are on the same legal footing as ordinary traders.

3. *State Monopoly*.—As the name implies, this system consists in retaining the liquor trade in the hands of the state, which thus secures all the profit and is at the same time able to exercise complete control. It is adopted in Russia, in certain parts of the United States and, in regard to the wholesale trade, in Switzerland.

4. *Prohibition.*—This may be general or local; in the latter case it is called "local option" or "local veto." The sale of liquor is made illegal in the hope of preventing drinking altogether or of diminishing it by making it

more difficult. General prohibition has been tried in some American states, and is still in force in a few; it is also applied to native races, under civilized rule, both in Africa and North America. Local prohibition is widely in force in the United States, Canada and Australasia, Sweden and Norway. In certain areas in other countries, including the United Kingdom, the sale of liquor is in a sense prohibited, not by the law, but by the owners of the property who refuse to allow any public-houses. Such cases have nothing to do with the law, but they are mentioned here because reference is often made to them by advocates of legal prohibition.

THE UNITED KINGDOM

England has had a very much longer experience of liquor legislation than any other country, and the story forms an introduction necessary to the intelligent comprehension of liquor legislation in general. England adopted a licensing system in 1551, and has retained it, with innumerable modifications, ever since. The English were notorious for hard drinking for centuries before licensing was adopted, and from time to time sundry efforts had been made to check it, but what eventually compelled the interference of the law was the growth of crime and disorder associated with the public-houses towards the end of the 15th century. Numbers of men who had previously been engaged in the civil wars or on the establishment of feudal houses were thrown on the world and betook themselves to the towns, particularly London, where they frequented the ale-houses, “dicing and drinking,” and lived largely on violence and crime. An act was passed in 1495 against vagabonds and unlawful games, whereby justices of the peace were empowered to “put away common ale-selling in towns and places where they should think convenient and to take sureties of keepers of ale-houses in their good behaviour.” That was the beginning of statutory control of the trade. The act clearly recognized a connexion between public

disorder and public-houses. The latter were ale-houses, for at that time ale was the drink of the people; spirits had not yet come into common use, and wine, the consumption of which on the premises was prohibited in 1552, was only drunk by the wealthier classes.

Early History of Licensing.—The act of 1551-1552, which introduced licensing, was on the same lines but went further. It confirmed the power of suppressing common ale-selling, and enacted that no one should be allowed to keep a common ale-house or "tippling" house without obtaining the permission of the justices in open session or of two of their number. It further "directed that the justices should take from the persons whom they licensed such bond and surety by recognisance as they should think convenient, and empowered them in quarter session to inquire into and try breaches by licensed persons of the conditions of their recognisances and cases of persons keeping ale-houses without licences and to punish the offenders" (Bonham Carter, Royal Commission on Liquor Licensing Laws, vol. iii.). This act embodied the whole principle of licensing, and the object was clearly stated in the preamble: "For as much as intolerable hurts and troubles to the commonwealth of this realm doth daily grow and increase through such abuses and disorders as are had and used in common ale-houses and other places called tippling houses." The evil was not due merely to the use of alcoholic liquor but to the fact that these houses, being public-houses, were the resort of idle and disorderly characters. The distinction should be borne in mind.

The act seems to have been of some effect, for no further legislation was attempted for half a century, though there is abundant evidence of the intemperate habits of all classes. Mr Bonham Carter (*loc. cit.*) observes:—

"The recognisances referred to in the act were valuable instruments for controlling the conduct of ale-house keepers. The justices, in exercise of their discretion, required the recognisances to contain such conditions for

the management and good order of the business as they thought suitable. In this way a set of regulations came into existence, many of which were subsequently embodied in acts of Parliament. In some counties general rules were drawn up, which every ale-house keeper was bound to observe."

It is interesting to note that among the conditions laid down about this time were the following: Closing at 9 P.M. and during divine service on Sunday; in some cases complete closing on Sunday except to travellers; the licence-holder to notify to the constable all strangers staying for more than a night and not to permit persons to continue drinking or tippling; prohibition of unlawful games, receiving stolen goods and harbouring bad characters; the use of standard measures and prices fixed by law. There was, however, no uniformity of practice in these respects until the 17th century, when an attempt was made to establish stricter and more uniform control by a whole series of acts passed between 1603 and 1627. The evils which it was sought to remedy by these measures were the existence of unlicensed houses, the use of ale-houses for mere drinking and the prevalence of disorder. It was declared that the ancient and proper use of inns and ale-houses was the refreshment and lodging of travellers, and that they were not meant for "entertainment and harbouring of lewd and idle people to spend and consume their money and their time in lewd and drunken manner." Regulations were strengthened for the suppression of unlicensed houses, licences were made annual, and the justices were directed to hold a special licensing meeting once a year (1618). Penalties were imposed on innkeepers for permitting tippling, and also on tipplers and drunkards (1625). In 1634 licensing was first applied to Ireland. Later in the century heavy penalties were imposed for adulteration.

The next chapter in the history of licensing has to do with spirits, and is very instructive. Spirits were not a native product like beer; brandy was introduced from France, gin from the Netherlands and whisky from Ireland;

but down to the year 1690 the consumption was small. The home manufacture was strictly limited, and high duties on imported spirits rendered them too dear for the general public unless smuggled. Consequently the people had not acquired the taste for them. But in 1690 distilling was thrown open to any one on the payment of very trifling duties, spirits became extremely cheap and the consumption increased with great rapidity. Regulation of the retail traffic was soon found to be necessary, and by an act passed in 1700-1701, the licensing requirements already existing for ale-house keepers were extended to persons selling distilled liquors for consumption on the premises. A new class of public-houses in the shape of spirit bars grew up. In the year 1732 a complete and detailed survey of all the streets and houses in London was carried out by William Maitland, F.R.S. Out of a total of 95,968 houses he found the following: brew-houses 171, inns 207, taverns 447, ale-houses 5975, brandy-shops 8659; total number of licensed houses for the retail sale of liquor 15,288, of which considerably more than one-half were spirit bars. The population was about three-quarters of a million. About one house in every six was licensed at this time, and that in spite of attempts made to check the traffic by restrictive acts passed in 1728-1729. The physical and moral evils caused by the excessive consumption of spirits were fully recognized; an additional duty of 5s. a gallon was placed on the distiller, and retailers were compelled to take out an excise licence of £20 per annum. The object was to make spirits dearer and therefore less accessible. At the same time, with a view to lessening the number of houses, the licensing procedure of the justices was amended by the provision that licences should only be granted at a general meeting of the justices acting in the division where the applicant resided, thus abolishing the power conferred by the original licensing act, of any two justices to grant a licence. This change, effected in 1729, was a permanent improvement, though it did not prevent the existence of the prodigious numbers of houses recorded by Maitland in 1732. The attempt to make

spirits dearer by high excise duties, on the other hand, was adjudged a failure because it led to illicit trade, and the act of 1728 was repealed in 1732. But the evil was so glaring that another and more drastic attempt in the same direction was made in 1736, when the famous Gin Act was passed in response to a petition presented to parliament by the Middlesex magistrates, declaring "that the drinking of geneva and other distilled waters had for some years past greatly increased; that the constant and excessive use thereof had destroyed thousands of His Majesty's subjects; that great numbers of others were by its use rendered unfit for useful labour, debauched in morals and drawn into all manner of vice and wickedness...." The retailing of spirits in quantities of less than 2 gallons was made subject to a licence costing £50 and the retailer had also to pay a duty of 20s. on every gallon sold. This experiment in "high licensing" was a disastrous failure, though energetic attempts were made to enforce it by wholesale prosecutions and by strengthening the regulations against evasion. Public opinion was inflamed against it, and the only results were corruptions of the executive and an enormous increase of consumption through illicit channels. The consumption of spirits in England and Wales nearly doubled between 1733 and 1742, and the state of things was so intolerable that after much controversy the high duties were repealed in 1742 with the object of bringing the trade back into authorized channels; the cost of a licence was reduced from £50 to £1 and the retail duty from 20s. to 1d. a gallon.

This period witnessed the high-water mark of intemperance in England. From various contemporary descriptions it is abundantly clear that the state of things was incomparably worse than anything in modern times, and that women, whose participation in the practice of drinking and frequenting public-houses is recorded by writers in the previous century, were affected as well as men. The experience is particularly instructive because it includes examples of excess and deficiency of opportunities and the ill effects of both on a people naturally inclined to indulgence in drink. It was followed

by more judicious action, which showed the adaptability of the licensing system and the advantages of a mean between laxity and severity. Between 1743 and 1753 acts were passed which increased control in a moderate way and proved much more successful than the previous measures. The retail licence duty was moderately raised and the regulations were amended and made stricter. The class of houses eligible for licensing was for the first time taken into account, and the retailing of spirits was only permitted on premises assessed for rates and, in London, of the annual value of £10; justices having an interest in the trade were excluded from licensing functions. Another measure which had an excellent effect made "tippling" debts—that is, small public-houses debts incurred for spirits—irrecoverable at law. The result of these measures was that consumption diminished and the class of houses improved. At the same time (1753) the general licensing provisions were strengthened and extended. The distinction between new licences and the renewal of old ones was for the first time recognized; applicants for new licences in country districts were required to produce a certificate of character from the clergy, overseers and church-wardens or from three or four householders. The annual licensing sessions were made statutory, and the consent of a justice was required for the transfer of a licence from one person to another during the term for which it was granted. Penalties for infringing the law were increased, and the licensing system was extended to Scotland (1755-1756). With regard to wine, it has already been stated that consumption on the premises was forbidden in 1552, and at the same time the retail sale was restricted to towns of some importance and the number of retailers, who had to obtain an appointment from the corporation or the justices, was strictly limited. In 1660 consumption on the premises was permitted under a Crown (excise) licence, good for a variable term of years; in 1756 this was changed to an annual excise licence of fixed amount, and in 1792 wine was brought under the same jurisdiction of the justices as other liquors.

It is clear from the foregoing that a great deal of legislation occurred during the 18th century, and that by successive enactments, particularly about the middle of the century, the licensing system gradually became adjusted to the requirements of the time and took a settled shape. The acts then passed still form the basis of the law. In the early part of the 19th century another period of legislative activity set in. A parliamentary inquiry into illicit trade in spirits took place in 1821, and in 1828 important acts were passed amending and consolidating the laws for England and for Scotland; in 1833 a general Licensing Act was passed for Ireland. These are still the principal acts, though they have undergone innumerable amendments and additions. The English act of 1828 introduced certain important changes. A licence from the justices was no longer required for the sale of liquor for consumption off the premises, and the power of the justices to suppress public-houses at their discretion (apart from the annual licensing), which they had possessed since 1495, was taken away. The removal of this power, which had long been obsolete, was the natural corollary of the development of the licensing system, its greater stringency and efficiency and the increase of duties imposed on the trade. Men on whom these obligations were laid, and who were freshly authorized to carry on the business every year, could not remain liable to summary deprivation of the privileges thus granted and paid for. The justices had absolute discretion to withhold licences from an applicant whether new or old; but an appeal was allowed to quarter sessions against refusal and also against conviction for offences under the act. The main points in the law at this time were the following. The sale of alcoholic liquors for consumption on the premises was forbidden under penalties except to persons authorized according to law by the justices. Licences were granted for one year and had to be renewed annually. The justices held a general meeting each year at a specified time for the purpose of granting licences; those peculiarly interested in the liquor trade were disqualified. The licence contained

various provisions for regulating the conduct of the house and maintaining order, but closing was only required during the hours of divine service on Sunday. Applicants for new licences and for the transfer of old ones (granted at a special sessions of the justices) were required to give notice to the local authorities and to post up notices at the parish church and on the house concerned.

Excise Licences.—It will be convenient at this point to explain the relation between that part of the licensing system which is concerned with the conduct of the traffic and lies in the jurisdiction of the justices and that part which has to do with taxation or revenue. The former is the earlier and more important branch of legislative interference; we have traced its history from 1495 down to 1828. Its object from the beginning was the maintenance of public order and good conduct, which were impaired by the misuse of public-houses; and all the successive enactments were directed to that end. They were attempts to suppress or moderate the evils arising from the traffic by regulating it. The excise licensing system has nothing to do with public order or the conduct of the traffic; its object is simply to obtain revenue, and for a long time the two systems were quite independent. But time and change gradually brought them into contact and eventually they came to form two aspects of one unified system. Licensing for revenue was first introduced in 1660 at the same time as duties on the manufacture of beer and spirits: but it was of an irregular character and was only applied to wine, which was not then under the jurisdiction of the justices at all (see above). In 1710 a small annual tax was imposed on the retailers of beer and ale and collected by means of a stamp on the justices' licence. In 1728 an annual excise licence of £20 was imposed on retailers of spirits, and in 1736 this was raised to £50 (see above). The object of these particular imposts, however, was rather to check the sale, as previously explained, than to secure revenue. In 1756 the previous tax on the retail sale of wine for consumption on the premises was changed to an annual excise licence,

which was in the next year extended to “made wines” and “sweets” (British wines). Similar licences, in place of the previous stamps, were temporarily required for beer and ale between 1725 and 1742 and permanently imposed in 1808. Thus the system of annual excise licences became gradually applied to all kinds of liquor. In 1825 the laws relating to them were consolidated and brought into direct relation with the other licensing laws. It was enacted that excise licences for the retail of liquor should only be granted to persons holding a justices’ licence or—to use the more correct term—certificate. The actual permission to sell was obtained on payment of the proper dues from the excise authorities, but they had no power to withhold it from persons authorized by the justices. And that was still the system in 1910.

Licensing since 1828.—There was no change in the form of the British licensing system between the consolidation of the law in 1825-1828 and the time (1910) at which we write; but there were a great many changes in administrative detail and some changes in principle. Only the most important can be mentioned. In 1830 a bold experiment was tried in exempting the sale of beer from the requirement of a justice’s licence. Any householder rated to the parish was entitled, under a bond with sureties, to take out an excise licence for the sale of beer for consumption on or off the premises. This measure, which applied to England and was commonly known as the Duke of Wellington’s Act, had two objects; one was to encourage the consumption of beer in the hope of weaning the people from spirits; the other was to counteract the practice of “tieing” public-houses to breweries by creating free ones. With regard to the first, it was believed that spirit-drinking was increasing again at the time and was doing a great deal of harm. The reason appears to have been a great rise in the returns of consumption, which followed a lowering of the duty on spirits from 11s. 8¼d. to 7s. a gallon in 1825. The latter step was taken because of the prevalence of illicit distillation. In 1823 the duty had been lowered for the

same reason in Scotland from 6s. 2d. and in Ireland from 5s. 7d. to a uniform rate of 2s. 4¾d. a gallon, with so much success in turning the trade from illegal to legal channels that a similar change was thought advisable in England, as stated. The legal or apparent consumption rose at once from 7 to nearly 13 million gallons; but it is doubtful if there was much or any real increase. According to an official statement, more than half the spirits consumed in 1820 were illicit. The facts are of much interest in showing what had already been shown in the 18th century, that the liquor trade will not bear unlimited taxation; the traffic is driven underground. It is highly probable that this accounts for part of the great fall in consumption which followed the raising of the spirit duty from 11s. to 14s. 9d. under Mr Lloyd George's Budget in 1909. With regard to "tied" houses, this is the original form of public-house. When beer was first brewed for sale a "tap" for retail purposes was attached to the brewery, and public-houses may still be found bearing the name "The Brewery Tap." At the beginning of the 19th century complaints were made of the increasing number of houses owned or controlled by breweries and of the dependence of the licence-holders, and in 1817 a Select Committee inquired into the subject. The Beerhouse Act does not appear to have checked the practice or to have diminished the consumption of spirits; but it led to a great increase in the number of beer-houses. It was modified in 1834 and 1840, but not repealed until 1869, when beer-houses were again brought under the justices.

Most of the other very numerous changes in the law were concerned with conditions imposed on licence-holders. The hours of closing are the most important of these. Apart from the ancient regulations of closing during divine service on Sunday, there were no restrictions in 1828; but after that at least a dozen successive acts dealt with the point. The first important measure was applied in London under a Police Act in 1839; it ordered licensed houses to be closed from midnight on Saturday to mid-day on Sunday, and produced a wonderful effect on public order. In 1853 a very

important act (Forbes Mackenzie) was passed for Scotland, by which sale on Sunday was wholly forbidden, except to travellers and lodgers, and was restricted on week days to the hours between 8 A.M. and 11 P.M. This act also introduced a distinction between hotels, public-houses and grocers licensed to sell liquor, and forbade the sale to children under 14 years, except as messengers, and to intoxicated persons. In England, after a series of enactments in the direction of progressive restriction, uniform regulations as to the hours of opening and closing for licensed premises were applied in 1874, and are still in force (see below). In 1878 complete Sunday closing, as in Scotland, was applied in Ireland, with the exemption of the five largest towns, Dublin, Belfast, Cork, Limerick and Waterford; and in 1881 the same provision was extended to Wales.

Other changes worthy of note are the following. In 1860 the free sale of wine for consumption off the premises was introduced by the Wine and Refreshment Houses Act, which authorized any shopkeeper to take out an excise licence for this purpose; the licences so created were subsequently known as grocers' licences. By the same act refreshment houses were placed under certain restrictions, but were permitted to sell wine for consumption on the premises under an excise licence. In 1861 spirit dealers were similarly authorized to sell spirits by the bottle. The effect of these measures was to exempt a good deal of the wine and spirit trade from the control of the justices, and the idea was to wean people from public-house drinking by encouraging them to take what they wanted at home and in eating-houses.

In 1869 this policy of directing the habits of the people into channels thought to be preferable, which had been inaugurated in 1830, was abandoned for one of greater stringency all round, which has since been maintained. All the beer and wine retail licences were brought under the discretion of the justices, but they might only refuse "off" licences and the

renewal of previously existing beer-house “on” licences upon specified grounds, namely (1) unsatisfactory character, (2) disorder, (3) previous misconduct, (4) insufficient qualification of applicant or premises. In 1872 an important act further extended the policy of restriction; new licences had to be confirmed, and the right of appeal in case of refusal was taken away; penalties for offences were increased and extended, particularly for public drunkenness, and for permitting drunkenness; the sale of spirits to persons under 16 was prohibited. In 1876 many of these provisions were extended to Scotland. In 1886 the sale of liquor for consumption on the premises was forbidden to persons under 13 years. In 1901 the sale for “off” consumption was prohibited to persons under 14, except in sealed vessels; this is known as the Child Messenger Act. These measures for the protection of children were extended in 1908 by an act which came into operation in April 1909, excluding children under 14 from the public-house bars altogether. The progressive protection of children by the law well illustrates the influence of changing public opinion. The successive measures enumerated were not due to increasing contamination of children caused by their frequenting the public-house, but to recognition of the harm they sustain thereby. The practice of taking and sending children to the public-house, and of serving them with drink, is an old one in England. A great deal of evidence on the subject was given before a Select Committee of the House of Commons in 1834; but it is only in recent years, when the general concern for children has undergone a remarkable development in all directions, that attempts have been made to stop it. In 1902 clubs, which had been increasing, and habitual drunkards, were brought under the law.

In 1904 a new principle was introduced into the licensing system in England, and this, too, was due to change in public opinion. Between 1830 and 1869, under the influence of the legislation described above, a continuous increase in the number of public-houses took place in England; but after 1869 they began to diminish through stricter control, and this

process has gone on continuously ever since. Reduction of numbers became a prime object with many licensing benches; they were reluctant to grant new licences, and made a point of extinguishing old ones year by year. At first this was easily effected under the new and stringent provisions of the legislation of 1869-1872, but it gradually became more difficult as the worst houses disappeared and the remaining ones were better conducted, and gave less and less excuse for interference. But the desire for reduction still gained ground, and a new principle was adopted. Houses against which no ill-conduct was alleged were said to be "superfluous," and on that ground licences were taken away. But this, again, offended the general sense of justice; it was felt that to take away a man's living or a valuable property for no fault of his own was to inflict a great hardship. To meet the difficulty the principle of compensation was introduced by the act of 1904. It provides that compensation shall be paid to a licence-holder (also to the owner of the premises) whose licence is withdrawn on grounds other than misconduct of the house or unsuitability of premises or of character. The compensation is paid out of a fund raised by an annual charge on the remaining licensed houses. This act has been followed by a large reduction of licences.

State of the Law in 1910.—In consequence of the long history and evolution of legislation in the United Kingdom and of the innumerable minor changes introduced, only a few of which have been mentioned above, the law has become excessively complicated. The differences between the English, Scottish and Irish codes, the distinction between the several kinds of liquor, between consumption on and off the premises, between new licences and the renewal of old ones, between premises licensed before 1869 and those licensed since, between excise and justices' licences—all these and many other points make the subject exceedingly intricate; and it is further complicated by the uncertainty of the courts and a vast body of case-made law. Only a summary of the chief provisions can be given here.

1. The open sale of intoxicating liquor (spirits, wine, sweets, beer, cider) by retail is confined to persons holding an excise licence, with a few unimportant exceptions, including medicine.

2. A condition precedent to obtaining such a licence is permission granted by the justices who are the licensing authority and called a justices' licence or certificate. Theatres, passenger boats and canteens are exempted from this condition; also certain dealers in spirits and wine.

3. Justices' licences are granted at special annual meetings of the local justices, called Brewster Sessions. Justices having a pecuniary interest in the liquor trade of the district, except as railway shareholders, are disqualified from acting; "bias" due to other interests may also be a disqualification.

4. Justices' licences are only granted for one year and must be renewed annually, with the exception of a particular class, created by the act of 1904 and valid for a term of years. Distinctions are made between granting a new licence and renewing an old one. The proceedings are stricter and more summary in the case of a new licence; notice of application must be given to the local authorities; the premises must be of a certain annual value; a plan of the premises must be deposited beforehand in the case of an "on" licence; the justices may impose conditions and have full discretion to refuse without any right of appeal; the licence, if granted, must be confirmed by a higher authority. In the case of old licences on the other hand, no notice is required; they are renewed to the former holders on application, as a matter of right; unless there is opposition or objection, which may come from the police or from outside parties or from the justices themselves. If there is objection the renewal may be refused, but only on specified grounds—namely misconduct, unfitness of premises or character, disqualification; otherwise compensation is payable on the plan explained above. There is a right of appeal to a higher court against refusal. In all

cases, whether the justices have full discretion or not, they must exercise their discretion in a judicial manner and not arbitrarily.

5. Licences may be transferred from one person to another in case of death, sickness, bankruptcy, change of tenancy, wilful omission to apply for renewal, forfeiture or disqualification. Licences may also be transferred from one house to another in certain circumstances.

6. A licence may be forfeited through the conviction of the holder of certain specified serious offences.

7. Persons may similarly be disqualified from holding a licence.

8. Liquor may only be sold on the premises specified in the licence and during the following hours:—week-days; London, 5 A.M. to 12.30 P.M. (Saturday, midnight); large towns 6 A.M. to 11 P.M.; other places 6 A.M. to 10 P.M.—Sundays; London, 1 P.M. to 3 P.M., 6 P.M. to 11 P.M.; other places 12.30 P.M. (or 1 P.M.) to 2.30 P.M. (or 3 P.M.), 6 P.M. to 10 P.M.; Christmas Day and Good Friday are counted as Sunday. In Scotland, Wales and Ireland (except the five chief towns) no sale is permitted on Sunday. Licence holders may sell during prohibited hours to lodgers staying in the house and to *bona-fide* travellers, who must be not less than 3 m. from the place they slept in on the previous night. Extension of hours of sale may be granted for special occasions and for special localities (*e.g.* early markets).

9. The following proceedings are prohibited in licensed premises: permitting children under 14 to be in a bar, selling any liquor to children under 14 for consumption on the premises, selling liquor to children under 14 as messengers except in corked and sealed vessels, selling spirits for consumption on the premises to persons under 16; selling to drunken persons and to habitual drunkards; permitting drunkenness, permitting disorder, harbouring prostitutes, harbouring constables, supplying liquor to constables on duty, bribing constables, permitting betting (persistent) or

gaming, permitting premises to be used as a brothel, harbouring thieves, permitting seditious meetings; permitting the payment of wagers on premises; permitting premises to be used for election committee rooms. In and within 20 m. of London music and dancing are prohibited on licensed premises except under special licences.

10. The police have the right of entry to licensed premises at any time for the purpose of preventing or detecting offences.

11. The injurious adulteration of any liquor is prohibited; also the dilution of beer; but dilution of spirits is not unlawful if the customer's attention is drawn to the fact.

12. All clubs in which intoxicating liquor is sold must be registered. If the liquor is the collective property of the members no licence is required for retail sale, but no liquor can be sold for consumption off the premises. Clubs run for profit, known as proprietory clubs, are on the same legal footing as public-houses.

13. Penalties incurred by licence-holders for offences under the foregoing provisions. For selling any other kind of liquor than that authorized—first offence, fine not exceeding £50 or one month's imprisonment; second offence, fine not exceeding £100 or 3 months' imprisonment with forfeiture of licence and, if ordered, confiscation of liquor and disqualification for five years; third offence, fine not exceeding £100 or six months' imprisonment with forfeiture of licence and, if ordered, confiscation of liquor and unlimited disqualification. Under the Excise Acts the penalty for selling without a licence is—for spirits, a fine of £100, confiscation of liquor, forfeiture of licence and perpetual disqualification; for wine, a fine of £20; for beer or cider "on" consumption £20, "off" consumption £10. For sale to children; first offence, fine up to £2, second offence, fine up to £5. Permitting premises to be used as a brothel, fine of £20, forfeiture of licence

and perpetual disqualification. Other offences, fine up to £10 for first conviction, up to £20 for second.

14. The following are offences on the part of the public. Being found drunk on any highway or other public place or on licensed premises; penalty, fine up to 10s. for first conviction, up to 20s. for second, and up to 40s. for third. Riotous or disorderly conduct while drunk; fine up to 40s. Falsely pretending to be a traveller or lodger; fine up to £5. Causing children to be in a bar or sending them for liquor contrary to the law; fine up to £2 for first and up to £5 for second offence. Attempt to obtain liquor by a person notified to the police as an habitual drunkard; fine up to 20s. for first offence, up to 40s. for subsequent ones. Giving drunken persons liquor or helping them to get it on licensed premises; fine up to 40s. or imprisonment for a month. Causing children under 11 to sing or otherwise perform on licensed premises, and causing boys under 14 or girls under 16 to do so between 9 P.M. and 6 A.M.; fine up to £25 or three months' imprisonment.

The foregoing statement of the law does not in all respects apply to Scotland and Ireland, where the administration differs somewhat from that of England. In Scotland the provost and bailies are the licensing authority in royal and parliamentary burghs, and elsewhere the justices. They hold two sessions annually for granting licences and have considerably more power in some respects than in England. The hours of opening are from 8 A.M. to 11 P.M. (week days only), but there is a discretionary power to close at 10 P.M. In Ireland the licensing authority is divided between quarter sessions and petty sessions. Public-house licences are granted and transferred at quarter sessions; renewals and other licences are dealt with at petty sessions. In Dublin, Belfast, Cork, Londonderry and Galway the licensing jurisdiction of quarter sessions is exercised by the recorder, elsewhere by the justices assembled and presided over by the county court judge. The

licensing jurisdiction of petty sessions is exercised by two or more justices, but in Dublin by one divisional justice.

Licence.	Old Duty.	New Duty 1909-1910.
Manufacturers' Licences—		
Distiller (spirits)	£10, 10s.	£10 for first 50,000 gallons, £10 for every additional 25,000 gallons.
Rectifier (spirits)	£10, 10s.	£15, 15s.
Brewer	£1	£1 for first 100 barrels, 12s. for every additional 50 barrels.
Sweets (British wines)	£1	£5, 5s.
Wholesale Dealers' Licences—		
Spirits	£10, 10s.	£15, 15s.
Beer	£3, 6s. 1d.	£10, 10s.
Wine	£10, 10s.	No change.
Sweets	£5, 5s.	No change.
Retail Licences On—		
Full or Publican's (spirits, beer, wine and cider)	£4, 10s. to £60 according to annual value of premises.	Half the annual value of premises, with a fixed minimum ranging from £5 in places with less than 2000 inhabitants to £35 in towns having over 100,000 inhabitants.
Beer-house	£3, 10s.	One-third of annual value of premises, with a minimum as above ranging from £3, 10s. to £23, 10s.
Wine (confectioners')	£3, 10s.	From £4, 10s. to £12 according to annual value.
Cider	£1, 5s.	From £2, 5s. to £6.
Sweets	£1, 5s.	From £2, 5s. to £6.
Retail Licences Off—		
Spirits	£3, 3s.	From £10 to £50 according to annual value.
Spirits (grocers', Scotland)	£4, 4s. to £13, 13s. 6d.	
Spirits (grocers', Ireland)	£9, 18s. 5d. to £14, 6s. 7d.	
Beer (England)	£1, 5s.	£1, 10s. to £10.
Beer (grocers', Scotland)	£2, 10s. and £4, 4s.	£1, 10s. to £10.
Wine (grocers')	£2, 10s. 0d.	£2, 10s. to £10.

Excise Licences and Taxation.—The excise licences may be divided into four classes, (1) manufacturers', (2) wholesale dealers', (3) retail dealers' for "on" consumption, (4) retail dealers' for "off" consumption. Only the two last classes come under the jurisdiction of the justices, as explained above. The total number of different excise licences is between 30 and 40, but several of them are subvarieties and unimportant or are peculiar to Scotland or Ireland. The duties charged on them were greatly changed and increased by the Finance Act of 1909-1910, and it seems desirable to state the changes thus introduced. The table on the previous page gives the principal kinds of licence with the old and the new duties.

There are in addition "occasional" licences valid for one or more days, which come under the jurisdiction of the justices; the duty is 2s. 6d. a day for the full licence (raised to 10s.) and 1s. for beer or wine only (raised to 5s.).

The total amount raised by the excise licences in the United Kingdom for the financial year ending 31st March 1909 was £2,209,928. Of this amount £1,712,160, or nearly four-fifths, was derived from the full or publicans' licence, £126,053 from the wholesale spirit licence and £88,167 from the beer-house licence; the rest are comparatively unimportant. But the licences only represent a small part of the revenue derived from liquor. The great bulk of it is collected by means of duties on manufacture and importation. The total amount for the year ending March 1909 was £37,428,189, or nearly 30% of the total taxation revenue of the country. The excise duties on the manufacture of spirits yielded £17,456,366 and those on beer £12,691,332; customs duties on importation yielded £5,046,949. The excise duty on spirits was at the rate of 11s. a gallon, raised at the end of April 1909 to 14s. 9d.; the corresponding duty on beer is 7s. 9d. a barrel (36 gallons). The relative taxation of the liquor trade in the United States, which has become important as a political argument, is discussed below.

Effects of Legislation.—The only effects which can be stated with precision and ascribed with certainty to legislation are the increase or diminution of the number of licences or licensed premises; secondary effects, such as increase or diminution of consumption and of drunkenness, are affected by so many causes that only by a very careful, well-informed and dispassionate examination of the facts can positive conclusions be drawn with regard to the influence of legislation (see TEMPERANCE). There is no more prolific ground for fallacious statements and arguments, whether unconscious or deliberate. The course of legislation traced above, however, does permit the broad conclusion that great laxity and the multiplication of facilities tend to increase drinking and disorder in a country like the United Kingdom, and that extreme severity produces the same or worse effects by driving the trade into illicit channels, which escape control, and thus really increasing facilities while apparently diminishing them. The most successful course has always been a mean between these extremes in the form of restraint judiciously applied and adjusted to circumstances. The most salient feature of the situation as influenced by the law in recent years is the progressive reduction in the number of licensed houses since 1869. Previously they had been increasing in England.

The number of public-houses, including beer-houses for "on" consumption, in 1831 was 82,466; in 1869 it had risen to 118,602; in 1909 it had fallen again to 94,794. But if the proportion of public-houses to population be taken there has been a continuous fall since 1831, as the following table shows:—

England and Wales.

Year.	No. of "on" Licences.	Proportion per 10,000 of Population.

1831	82,466	59
1871	112,886	49
1901	101,940	31
1909	94,794	26

The change may be put in another way. In 1831 there was one public-house to 168 persons; in 1909 the proportion was 1 to 375. The proportional reduction goes back to the 18th century. In 1732 there was in London one public-house to every 50 persons (see above).

In Scotland the number of public-houses has been diminishing since 1829, when there were 17,713; in 1909 there were only 7065, while the population had more than doubled. The number in proportion to population has therefore fallen far more rapidly than in England, thus—1831, 1 to 134 persons; 1909, 1 to 690 persons. In Ireland the story is different. There has been a fall in the number of public-houses since 1829, when there were 20,548; but it has not been large or continuous and the population has been steadily diminishing during the time, so that the proportion to population has actually increased, thus—1831, 1 to 395 persons; 1909, 1 to 249 persons. As a whole, however, the United Kingdom shows a large and progressive diminution of public-houses to population; nor is this counterbalanced by an increase of "off" licences. If we take the whole number of licences we get the following movement in recent years:—

No. of Retail Licences (*"on" and "off"*) *per 10,000 of Population.*

	1893.	1903.	1909.
England and Wales	46	42	37
Scotland	37	33	30
Ireland	41	46	45
United Kingdom	45	42	37

The diminution in the number of public-houses in England was markedly accelerated by the act of 1904, which introduced the principle of compensation. The average annual rate of reduction in the ten years 1894-1904 before the act was 359; in the four years 1905-1908; after the act it rose to 1388. The average annual number of licences suppressed with compensation was 1137, and the average annual amount of compensation paid was £1,096,946, contributed by the trade as explained above.

The reduction of public-houses has been accompanied in recent years by a constant increase in the number of clubs. By the act of 1902, which imposed registration, they were brought under some control and the number of legal clubs was accurately ascertained. Previously the number was only estimated from certain *data* with approximate accuracy. The following table gives the official figures:—

Clubs: England and Wales.

	1887.	1896.	1904.	1905.	1906.	1907.	1908.	1909.
Number	1982	3655	6371	6589	6721	6907	7133	7353
Proportion per 10,000	0.7	1.1	1.89	1.93	1.95	1.98	2.02	2.08

Clubs represent alternative channels to the licensed trade and they are under much less stringent control; they have no prohibited hours and the police have not the same right of entry. In so far, therefore, as clubs replace public-houses the reduction of the latter does not mean diminished facilities for drinking, but the contrary. In the years 1903-1908 the average number of clubs proceeded against for offences was 74 and the average number struck off the register was 52. The increase of clubs and the large proportion struck off the register suggest the need of caution in dealing with the licensed trade; over-stringent measures defeat their own end.

Persistent attempts have for many years been made to effect radical changes in the British system of licensing by the introduction of some of the methods adopted in other countries, and particularly those in the United States. But it is difficult to engraft new and alien methods, involving violent change, upon an ancient system consolidated by successive statutory enactments and confirmed by time and usage. The course of the law and administration since 1869 has made it particularly difficult. The stringent conditions imposed on licence-holders have given those who fulfil them a claim to consideration, and the reduction of licences, by limiting the market, has enhanced their value. An expectation of renewal, in the absence of misconduct, has grown up by usage and been confirmed by the law, which recognizes the distinction between granting a new licence and renewing an old one, by the treasury which levies death duties on the assumption that a licence is an enduring property, by local authorities which assess upon the same assumption, and by the High Courts of Justice, whose decisions have repeatedly turned on this point. The consequence of all this is that very large sums have been invested in licensed property, which has become part of the settled order of society; and to destroy it by some sudden innovation would cause a great shock. The position is entirely different in other countries where no such control has ever been exercised. It is possible to impose a new system where previously there was none, but not to replace suddenly an old and settled one for something entirely different. Only the most convincing proof of the need and the advantages of the change would justify it; and such proof has not been forthcoming. The British system has the great merit of combining adaptability to different circumstances and to changing customs with continuity and steadiness of administration. The advantages of abandoning it for some other are more than doubtful, the difficulties are real and serious. Over a very long period it has been repeatedly readjusted in conformity with the movement of public opinion and of national habits; while under it the executive have gradually

got the traffic well in hand, and a great and progressive improvement in order and conduct has taken place. The process is gradual but sure, and the record will compare favourably with that of any other comparable country. Further readjustment will follow and is desirable. The great defect of the law is its extreme complexity; it needs recasting and simplification. There are too many kinds of licence, and the classification does not correspond with the actual conditions of the traffic. Some licences are obsolete and superfluous; others make no distinction between branches of the trade which fulfil entirely different functions and require different treatment. The full or publican's licence, which is incomparably the most important, places on the same legal footing hotels, restaurants, village inns and mere drinking bars, and the lack of distinction is a great stumbling-block. In the attempt made in 1908 to introduce new legislation it was found necessary to incorporate distinctions between different classes of establishment, although that was not contemplated in the original bill. It will always be found necessary whenever the subject is seriously approached, because the law has to deal with things as they actually are. It does not fall within the scope of this article to discuss the numerous controversial questions which arise in connexion with various legislative proposals for dealing with the liquor traffic; but an account of the methods which it has been proposed to adopt from other countries will be found below.

The United States

The liquor legislation of the United States presents a great contrast to that of the United Kingdom, but it is not less interesting in an entirely different way. In place of a single homogeneous system gradually evolved in the course of centuries it embraces a whole series of different ones based on the most diverse principles and subject to sudden changes and frequent experiments. It is not sufficiently understood in Europe that the legislatures

of the several states are sovereign in regard to internal affairs and make what laws they please subject to the proviso that they cannot over-ride the Federal law. There is therefore no uniformity in regard to such matters as liquor legislation, and it is a mistake to speak of any particular system as representing the whole country. The United States government only interferes with the traffic to tax it for revenue, and to regulate the sale of liquor to Indians, to soldiers, etc. The liquor traffic is subject—whether in the form of manufacture, wholesale or retail trade—to a uniform tax of 25 dollars (£5) per annum imposed on every one engaged in it. Congress, under the constitution, controls interstate commerce, and the Supreme Court has decided that without its consent no state can prevent a railway or other carrying agency from bringing liquor to any point within its borders from outside. Thus no state can keep out liquor or prevent its consumption, but any state legislature may make what internal regulations it pleases and may prohibit the manufacture and sale altogether within its own borders. It may go further. In 1887 a judgment was delivered by the Supreme Court of the United States that it is within the discretionary power of a state to protect public health, safety and morals even by the destruction of property without compensation, and that the constitution of the United States is not thereby violated. Use has been made of this power in Kansas, and it appears therefore that persons who engage in the liquor trade do so at their own risk. There is in fact no stability at all except in a few states which have incorporated some principle in their constitutions, and even that does not ensure continuity of practice, as means are easily found for evading the law or substituting some other system which amounts to the same thing. As a whole the control of the liquor traffic oscillates violently between attempted suppression and great freedom combined with heavy taxation of licensed houses.

In the great majority of the states some form of licensing exists; it is the prevailing system and was adopted, no doubt from England, at an early

period. It is exercised in various ways. The licensing authority may be the municipality or a specially constituted body or the police or a judicial body. The last, which is the method in Pennsylvania, seems to be exceptional. According to Mr Fanshawe there is a general tendency, due to the prevailing corruption, to withdraw from municipal authorities power over the licensing, and to place this function in the hands of commissioners, who may be elected or nominated. In New York state the licensing commissioners used to be nominated in cities by the mayors and elected elsewhere; but by the Raines law of 1896 the whole administration was placed under a state commissioner appointed by the governor with the consent of the Senate. A similar plan is in force in some important cities in other states. In Boston the licensing is in the hands of a police board appointed by the governor; in Baltimore and St Louis the authority is vested in commissioners similarly appointed; and in Washington the licensing commissioners are appointed by the president. In Pennsylvania, where the court of quarter sessions is the authority, the vesting of licensing in a judicial body dates back to 1676 and bears the stamp of English influence. It is noteworthy that in Philadelphia and Pittsburg (Allegheny county) the judicial court was for a time given up in favour of commissioners, but the change was a great failure and abandoned in 1888. The powers of the licensing authority vary widely; in some cases the only grounds of refusal are conduct and character, and licences are virtually granted to every applicant; in others the discretion to refuse is absolute. In Massachusetts the number of licences allowed bears a fixed ratio to the population, namely 1 to 1000, except in Boston, where it is 1 to 500, but as a rule where licences are given they are given freely. They are valid for a year and granted on conditions. The first and most general condition is the payment of a fee or tax, which varies in amount in different states. Under the “high licence” system (see below) it generally varies according to the size of the locality and the class of licence where different classes are recognized. In

Massachusetts there are six licences; three for consumption on the premises —namely (1) full licence for all liquors, (2) beer, cider, and light wine, (3) beer and cider; two for consumption off the premises—namely (1) spirits, (2) other liquors; the sixth is for druggists. In New York state also there are six classes of licence, though they are not quite the same; but in many states there appears to be only one licence, and no distinction between on and off sale, wholesale or retail. Another condition generally imposed in addition to the tax is a heavy bond with sureties; it varies in amount but is usually not less than 2000 dollars (£400) and may be as high as 6000 dollars (£1200). A condition precedent to the granting of a licence imposed in some states is the deposit of a petition or application some time beforehand, which may have to be backed by a certain number of local residents or tax-payers. In Pennsylvania the required number is 12, and this is the common practice elsewhere; in Missouri a majority of tax-payers is required, and the licence may even then be refused, but if the petition is signed by two-thirds of the tax-payers the licensing authority is bound to grant it. This seems to be a sort of genuine local option. Provision is also generally made for hearing objectors. Another condition sometimes required (Massachusetts and Iowa) is the consent of owners of adjoining property. In some states no licences are permitted within a stated distance of certain institutions; *e.g.* public parks (Missouri) and schools (Massachusetts). Regulations imposed on the licensed trade nearly always include prohibition of sale to minors under 18 and to drunkards, on Sundays, public holidays and election days, and prohibition of the employment of barmaids. Sunday closing, which is universal, dates at least from 1816 (Indiana) and is probably much older. The hours of closing on week days vary considerably but are usually 10 P.M. or 11 P.M. Other things are often prohibited including indecent pictures, games and music.

State Prohibition.—In a few states no licences are allowed. State prohibition was first introduced in 1846 under the influence of a strong

agitation in Maine, and within a few years the example was followed by the other New England states; by Vermont in 1852, Connecticut in 1854, New Hampshire in 1855 and later by Massachusetts and Rhode Island. They have all now after a more or less prolonged trial given it up except Maine. Other states which have tried and abandoned it are Illinois (1851-1853), Indiana (1855-1858), Michigan, Iowa, Nebraska, South Dakota. The great Middle states have either never tried it, as in the case of New York (where it was enacted in 1855 but declared unconstitutional), Pennsylvania and New Jersey, or only gave it a nominal trial, as with Illinois and Indiana. A curious position came about in Ohio,[1] one of the great industrial states. It did not adopt prohibition, which forbids the manufacture and sale of liquor; but in 1851 it abandoned licensing, which had been in force since 1792, and incorporated a provision in the constitution declaring that no licence should thereafter be granted in the state. The position then was that retail sale without a licence was illegal and that no licence could be granted. This singular state of things was changed in 1886 by the "Dow law," which authorized a tax on the trade and rendered it legal without expressly sanctioning or licensing it. There were therefore no licences and no licensing machinery, but the traffic was taxed and conditions imposed. In effect the Dow law amounted to repeal of prohibition and its replacement by the freest possible form of licensing. In Iowa, which early adopted a prohibitory law, still nominally in force, a law, known as the "mulct law," was passed in 1894 for taxing the trade and practically legalizing it under conditions. The story of the forty years' struggle in this state between the prohibition agitation and the natural appetites of mankind is exceedingly instructive; it is an extraordinary revelation of political intrigue and tortuous proceedings, and an impressive warning against the folly of trying to coerce the personal habits of a large section of the population against their will. It ended in a sort of compromise, in which the coercive principle is preserved in one law and personal liberty vindicated by another contradictory one.

The result may be satisfactory, but it might be attained in a less expensive manner. What suffers is the principle of law itself, which is brought into disrepute.

State prohibition, abandoned by the populous New England and central states, has in recent years found a home in more remote regions. In 1907 it was in force in five states—Maine, Kansas, North Dakota, Georgia and Oklahoma; in January, 1909, it came into operation in Alabama, Mississippi, and North Carolina; and in July 1909 in Tennessee.

Local Prohibition.—The limited form of prohibition known as local veto is much more extensively applied. It is an older plan than state prohibition, having been adopted by the legislature of Indiana in 1832. Georgia followed in the next year, and then other states took it up for several years until the rise of state prohibition in the middle of the century caused it to fall into neglect for a time. But the states which adopted and then abandoned general prohibition fell back on the local form, and a great many others have also adopted it. In 1907 it was in force in over 30 states, including all the most populous and important, with one or two exceptions. But the extent to which it is applied varies very widely and is constantly changing, as different places take it up and drop it again. Some alternate in an almost regular manner every two or three years, or even every year; and periodical oscillations of a general character occur in favour of the plan or against it as the result of organized agitation followed by reaction. The wide discrepancies between the practice of different states are shown by some statistics collected in 1907, when the movement was running favourably to the adoption of no licence. In Tennessee the whole state was under prohibition with the exception of 5 municipalities; Arkansas, 56 out of 75 counties; Florida, 35 out of 46 counties; Mississippi, 56 out of 77 counties; North Carolina, 70 out of 97 counties; Vermont, 3 out of 6 cities and 208 out of 241 towns. These appear to be the most prohibitive states, and they

are all of a rural character. At the other end of the scale were Pennsylvania with 1 county and a few towns ("town" in America is generally equivalent to "village" in England); Michigan, 1 county and a few towns; California, parts of 8 or 10 counties. New York had 308 out of 933 towns, Ohio, 480 out of 768 towns, Massachusetts, 19 out of 33 cities and 249 out of 321 towns. At the end of 1909 a strong reaction against the prohibition policy set in, notably in Massachusetts.

There is no more uniformity in the mode of procedure than in the extent of application. At least five methods are distinguished. In the most complete and regular form a vote is taken every year in all localities whether there shall be licences or not in the ensuing year and is decided by a bare majority. A second method of applying the general vote is to take it at any time, but not oftener than once in four years, on the demand of one-tenth of the electorate. A third plan is to apply this principle locally and put the question to the vote, when demanded, in any locality. A fourth and entirely different system is to invest the local authority with powers to decide whether there shall be licences or not; and a fifth is to give residents power to prevent licences by means of protest or petition. The first two methods are those most widely in force; but the third plan of taking a local vote by itself is adopted in some important states, including New York, Ohio and Illinois. Opinions differ widely with regard to the success of local veto, but all independent observers agree that it is more successful than state prohibition, and the preference accorded to it by so many states after prolonged experience proves that public opinion broadly endorses that view. Its advantage lies in its adaptability to local circumstances and local opinion. It prevails mainly in rural districts and small towns; in the larger towns it is best tolerated where they are in close proximity to "safety valves" or licensed areas in which liquor can be obtained; the large cities do not adopt it. On the other hand, it has some serious disadvantages. The perpetually renewed struggle between the advocates and opponents of

prohibition is a constant cause of social and political strife; and the alternate shutting up and opening of public houses in many places makes continuity of administration impossible, prevents the executive from getting the traffic properly in hand, upsets the habits of the people, demoralizes the trade and stands in the way of steady improvement.

Public Dispensaries.—This entirely different system of controlling the traffic has been in general operation in one state only, South Carolina; but it was also applied to certain areas in the neighbouring states of North Carolina, Georgia and Alabama. The coloured element is very strong in these states, especially in South Carolina, where the coloured far exceeds the white population. The dispensary system was inaugurated there in 1893. It had been preceded by a licensing system with local veto (adopted in 1882), but a strong agitation for state prohibition brought matters to a crisis in 1891. The usual violent political struggle, which is the only constant feature of liquor legislation in the United States, took place, partly on temperance and partly on economic grounds; and a way out was found by adopting an idea from the town of Athens in Georgia, where the liquor trade was run by the municipality through a public dispensary. A law was passed in 1892 embodying this principle but applying it to the whole state. The measure was fiercely contested in the courts and the legislature for years and it underwent numerous amendments, but it survived. Under it the state became the sole purveyor of liquor, buying wholesale from the manufacturers and selling retail through dispensaries under public management and only for consumption off the premises. Many changes were introduced from time to time without abandoning the principle, but in 1907 the system of state control was replaced by one of county administration. Local veto is also in force, and thus the localities have the choice of a dispensary or no sale at all. The regulations are very strict. The dispensaries are few and only open on week-days and during the day-time; they close at sunset. Liquor is only sold in bottles and in not less quantities

than half a pint of spirits and a pint of beer, and it must be taken away; bars are abolished. There is a general consensus of testimony to the effect of the system in improving public order especially among the coloured population, who are very susceptible to drink. The law seems to be well carried out in general, but Charleston and Columbia, the only two considerable towns, are honeycombed with illicit drink-shops, as the writer has proved by personal experience. Columbia is the capital and the seat of cotton manufactures, as are all the larger towns, with the exception of Charleston, which is the port and business centre. The population of the state is predominantly rural, and local prohibition obtains in 18 out of 41 counties.

The following statistical comparison, extracted from the United States Census of 1900 and the Inland Revenue Returns by Mr W. O. Tatum (*New Encyclopedia of Social Reform*) and here presented in tabular form, is highly instructive. It shows the population and number of liquor dealers paying the United States tax in two prohibition states, one state under what is considered the best licensing system, and South Carolina.

State.	Population.	Wholesale Liquor Dealers.	Retail Liquor Dealers.
Maine (Prohibition)	694,466	51	1366
Kansas (Prohibition)	1,470,495	129	3125
Massachusetts (Licence)	2,805,346	617	5092
S. Carolina (Dispensary)	1,340,316	13	534

This table may be said to epitomize the results of the United States restrictive liquor laws. It presents examples of three different systems; the proportion of retail liquor sellers to population is—under complete prohibition, 1 to 508 and 1 to 475; under licence and local prohibition, 1 to

530; under dispensary and local prohibition, 1 to 2509. But the remarkable thing is the enormous amount of illicit traffic existing under all three systems. It is incomparably greatest under complete prohibition because the whole of the traffic in these states is illicit. In South Carolina one of the wholesale dealers and 388 of the 534 retailers were illicit. In Massachusetts the number cannot be stated, but it is very large. If the whole state were under licence the total legal number of licences, which is limited in proportion to population (see above), would be 3400; and in that case there would be some 1700 illicit retailers. But a large part of the state, probably more than half, is under local prohibition, so that the majority of the 5000 retail dealers must be illicit. These facts, which are typical and not exceptional, reveal the failure of the laws to control the traffic; only partial or spasmodic attempts are made to enforce them and to a great extent they are ignored by common consent. The illegal trade is carried on so openly that the United States revenue officers have no difficulty in collecting the federal tax. It is not a satisfactory state of things, or one which countries where law is respected would care to imitate. The example is a good lesson in what to avoid.

Taxation.—Mention has been made above of the federal and state taxation imposed on the liquor trade. The former is uniform; the latter varies greatly, even in those states which have adopted the “high licence.” This system is intended to fulfil two purposes; to act as an automatic check on the number of licences and to produce revenue. It was introduced in Nebraska in 1881, when a tax of 1000 dollars (£200) was placed on saloons (public houses) in large towns, and half that amount in smaller ones. The practice gradually spread and has now been adopted by a large number of states, noticeably the populous and industrial north-eastern and central states. In Massachusetts, where the high licence was adopted in 1874 when the state returned to licensing after a trial of prohibition, the fees are exceptionally high, the minimum for a fully licensed on and off house being

1300 dollars (£260); in Boston the average tax is £310. In New York state it ranges from 150 dollars (£30) in sparsely populated districts to 1200 dollars (£240), and in Pennsylvania it is much the same. In New Jersey, on the other hand, it ranges from £20 to £60; in Connecticut from £50 to £90; in Rhode Island from £40 to £80. In Missouri, which has a special system of its own and a sort of sliding scale, great variations occur and in some cases the tax exceeds £500. In Michigan it is uniform at £100. The mean for the large cities is £133. The revenue derived from this source is distributed in many ways, but is generally divided in varying proportions between the state, the county and the municipality; sometimes a proportion goes to the relief of the poor, to road-making or some other public purpose. The amount levied in the great cities is very large. It will be seen from the foregoing that the taxation of licences is much heavier in the United States than in the United Kingdom. The total yield was ascertained by a special inquiry in 1896 and found to be rather less than 12 millions sterling; in the same year the yield from the same source in the United Kingdom was just under 2 millions. Allowing for difference of population the American rate of taxation was 3¼ times as great as the British. It has been inferred that the liquor trade is much more highly taxed in the United States and that it would bear largely increased taxation in the United Kingdom; that argument was brought forward in support of Mr Lloyd George's budget of 1909. But it only takes account of the tax on licences and leaves out of account the tax on liquor which is the great source of revenue in the United Kingdom, as has been shown above. The scales are much lower in the United States, especially on spirits, which are only taxed at the average rate of 5s. 8d. a gallon against 11s. (raised to 14s. 9d. in 1909) in the United Kingdom. Mr Frederic Thompson has calculated out the effect of the two sets of rates and shown that if British rates were applied to the United States the average yield in the three years ending 1908 would be raised from 44 millions to 76 millions; and conversely if American rates were applied to the United

Kingdom the average yield would be lowered from 36 millions to 23 millions. Taking licences and liquor taxation together he finds that the application of the British standards for both would still raise the total yield in the United States by 39%; and that even the exceptionally high rates prevailing in Massachusetts would, if applied to the United Kingdom, produce some 4 millions less revenue than the existing taxation. Other calculations based on the consumption and taxation per head lead to the same conclusion that the trade is actually taxed at a considerably higher rate in the United Kingdom. In the three years ending 1908 the average amount paid per head in taxation was 13s. 8¾d. in the United States and 17s. 6¾d. in the United Kingdom. It may be added that the method of taxing licences heavily has certain disadvantages; it stimulates that illicit trade which is the most outstanding feature of the traffic in the United States, and combined with the extreme insecurity of tenure involved in local option it gives licence-holders additional inducements to make as much money as possible by any means available, while they have the opportunity, for no compensation is ever paid for sudden dispossession. The notion that the trade will stand an indefinite amount of taxation is a dangerous and oft-proved fallacy.

European Countries.

With the exception of Sweden, Norway and Russia, which have special systems of their own, the continental countries of Europe have as yet paid comparatively little legislative attention to the subject of the liquor traffic, which is recognized by the law but for the most part freely permitted with a minimum of interference. Differences exist, but, generally speaking, establishments may be opened under a very simple procedure, which amounts to an elementary form of licensing, and the permission is only withdrawn for some definite and serious offence. Regulations and

conditions are for the most part left to the discretion of the local authority and the police and are not burdensome. The reason for such freedom as compared with the elaborate and stringent codes of the United Kingdom and the United States is not less concern for public welfare but the simple fact that the traffic gives less trouble and causes less harm through the abuse of drink; the habits of the people are different in regard to the character of the drinks consumed, the mode of consumption and the type of establishment. Cafés, restaurants and beer-gardens are much more common, and mere pot-houses less so than in the English-speaking countries. Where trouble arises and engages the attention of the authorities and the legislature, it is almost invariably found to be associated with the consumption of spirits. In several of the wine-producing countries, which are generally marked by the temperate habits of the people, the widespread havoc among the vines caused some years ago by the phylloxera led to an increased consumption of spirits which had a bad effect and aroused considerable anxiety. This was notably the case in France, where an anti-alcohol congress, held in 1903, marked the rise of public and scientific opinion on the subject. Temperance societies have become active, and in some countries there is a movement towards stricter regulations or at least a demand for it; but in others the present law is a relaxation of earlier ones.

France.—The present law governing the licensing of establishments where liquor is sold for consumption on the premises was passed in 1880; it abrogated the previous decree of 1851, by which full discretion was vested in the local authorities, and freed the traffic from arbitrary restrictions. It provides that any person desiring to open a café, cabaret or other place for retailing liquor must give notice to the authorities, with details concerning himself, the establishment and the proprietor, at least 15 days beforehand; the authority in Paris is the préfecture of police and elsewhere the mairie. Transfers of proprietorship or management must be notified within 15 days, and intended transference of location 8 days beforehand. The penalty for

infraction is a fine of 16 francs to 100 francs. Legal minors and persons convicted of certain crimes and offences—theft, receiving stolen goods, various forms of swindling, offences against morality, the sale of adulterated articles—are prohibited; in the case of crimes, forever; in the case of offences, for five years. Otherwise permission cannot be refused, subject to conditions which the local authority has power to lay down regulating the distance of such establishments from churches, cemeteries, hospitals, schools and colleges. But persons engaged in the trade, who are convicted of the offences mentioned above and of infraction of the law for the suppression of public drunkenness, are disabled, as above. The law practically amounts to free trade and the number of houses has increased under it; in 1900 there was one to every 81 persons. This proportion is only exceeded by Belgium. Under the Local Government Act of 1884 municipal authorities are empowered, for the maintenance of public order, to fix hours of closing, regulate dancing, forbid the employment of girls and the harbouring of prostitutes and make other regulations. The hours of closing differ considerably but usually they are 11 P.M., midnight or 1 A.M. The trade is lightly taxed; retailers pay from 15 to 50 francs a year; wholesale dealers, 125 francs; breweries the same in most departments, distilleries 25 francs. The excise revenue from liquor amounted to £20,000,000 in 1900.

Germany.—The German law and practice are broadly similar to the French, but the several states vary somewhat in detail. Under the imperial law of 1879 inns or hotels and retail trade in spirits for on or off consumption may not be carried on without a permit or licence from the local authority which, however, can only be refused on the ground of character or of unsuitability of premises. This is the general law of the empire; but the state governments are empowered to make the granting of a licence for retailing spirits dependent on proof that it is locally required, and also to impose the same condition on inn-keeping and the retailing of other drinks in places with less than 15,000 inhabitants and in larger ones which

obtain a local statute to that effect. Before a licence is granted the opinion of the police and other executive officers is to be taken. The licensing authority is the mayor in towns and the chairman of the district council in rural areas. The provisions with regard to the dependence of a licence on local requirements have been adopted by Prussia and other states, but apparently little or no use is made of them. Permits are very freely granted, and the number of licensed houses, though not so great as in France, is very high in proportion to population. Three classes of establishment are recognized—(1) *Gast-wirthschaft*, (2) *Schank-wirthschaft*, (3) *Klein-handel*. *Gast-wirthschaft* is inn-keeping, or the lodging of strangers in an open house for profit, and includes "pensions" of a public character; the imperial law provides that a licence may be limited to this function and need not include the retailing of liquor. *Schank-wirthschaft* is the retailing for profit of all sorts of drinks, including coffee and mineral waters; it corresponds to café in France and refreshment house in England; but the mere serving of food does not come under the law with which we are here concerned. *Klein-handel* is retail sale either for on or off consumption, and the liquor for which a licence is required in this connexion is described as *branntwein* or *spiritus*, and is defined as distilled alcoholic liquor, whether by itself or in combination. A licence for *Schank-wirthschaft* includes *Klein-handel*, but not vice-versa; none is required for the retail sale of wine which is the seller's own produce. Licences may be withdrawn for offences against the law. Licensed houses are under the supervision of the police, who fix the hours of closing; it is usually 10 P.M., but is commonly extended to 11 P.M. or midnight in the larger towns and still later in the case of particular establishments. Some cafés in Berlin do not close till 3 A.M. and some never close at all. Persons remaining on the premises in forbidden hours after being ordered to leave by the landlord are liable to punishment. Serving drunkards and persons of school age is forbidden. Drunkards, in addition to fines or imprisonment for disorderly conduct, are liable to be

deprived of control of their affairs and placed under guardianship. For music and dancing special permits are required. With regard to taxation, in Prussia all business establishments beyond a certain value pay an annual tax and licensed houses are on the same footing as the rest. Businesses producing less than £75 a year or of less than £150 capital value are free; the rest are arranged in four classes on a rising scale. In the three lower classes the tax ranges from a minimum of 4s. to a maximum of £24; in the highest class, which represents businesses producing £2500 and upwards (or a capital value of £50,000 and upwards) the tax is 1% of the profits. There is also a stamp duty on the licence ranging from 1s. 6d. to £5. The latter goes to the local revenue, the business tax to the government. Beer and spirits are also subject to an excise tax, from which the imperial revenue derived £7,700,000 in 1901; but the total taxation of the liquor trade could only be calculated from the returns of all the federated states.

The laws of France and Germany are fairly representative of the European states, with some minor variations. In *Holland* the number of licensed spirit retailers is limited in proportion to population (1 to 500), and the taxation, which is both national and local, ranges from 10 to 25% of the annual value.

In *Austria-Hungary* and *Rumania* the licence duty is graduated according to the population of the place, as used to be the case in Prussia. In 1877 a severe police law was applied to Galicia in order to check the excesses of spirit-drinking. The Poles, it may be observed, are spirit-drinkers, and the exceptional treatment of this part of the Austrian empire is one more illustration of the trouble arising from that habit, which forces special attempts to restrain it. The law, just mentioned, in Holland is another instance; and the particular cases of Russia and Scandinavia, described below, enforce the same lesson. Where the drink of the people is confined to wine and beer there is comparatively little trouble. In *Switzerland* the

manufacture and wholesale sale of spirits has been a federal monopoly since 1887, but the retailing is a licensed trade, as elsewhere, and is less restricted than formerly. Before federation in 1874 the cantons used to direct local authorities to restrict the number of licences in proportion to population; but under the new constitution the general principle of free trade was laid down, and the Federal Council intimated to the cantonal authorities that it was no longer lawful to refuse a licence on the ground that it was not needed.

Russia.—In 1895 Russia entered upon an experiment in regard to the spirit traffic and began to convert the previously existing licence system into a state monopoly. The experiment was held to be successful and was gradually extended to the whole country. Under this system, which to some extent resembles that of South Carolina but is much less rigid, the distilleries remain in private hands but their output is under government control. The retail sale is confined to government shops, which sell only in sealed bottles for consumption off the premises, and to commercial establishments which sell on commission for the government. Spirit bars are abolished and only in a few high class restaurants are spirits sold by the glass; in ordinary eating-houses and at railway refreshment rooms they are sold in sealed government bottles but may be consumed on the premises. The primary object was to check the excesses of spirit-drinking which were very great in Russia among the mass of the people. The effect has been a very large reduction in the number of liquor shops, which has extended also to the licensed beer-houses though they are not directly affected as such. Presumably when they could no longer sell spirits it did not pay them to take out a licence for beer.

Sweden and Norway.—In these countries the celebrated “Gothenburg” or company system is in force together with licensing and local veto. Like the Russian state monopoly the company system applies only to spirits, and for

the same reason; spirits are or were the common drink of the people and excessive facilities in the early part of the 19th century produced the usual result. The story is very similar to that of England in the 18th century, given above. From 1774 to 1788 distilling in Sweden was a crown monopoly, but popular opposition and illicit trade compelled the abandonment of this plan in favour of general permission granted to farmers, innkeepers and landowners. At the beginning of the 19th century the right to distil belonged to every owner and cultivator of land on payment of a trifling licence duty, and it was further extended to occupiers. In 1829 the number of stills paying licence duty was 173,124 or 1 to every 16 persons; the practice was in fact universal and the whole population was debauched with spirits. The physical and moral results were the same as those recorded in England a hundred years before. The supply was somewhat restricted by royal ordinance in 1835, but the traffic was not effectively dealt with until 1855 when a law was passed which practically abolished domestic distilling by fixing a minimum daily output of 200 gallons, with a tax of about 10d. a gallon. This turned the business into a manufacture and speedily reduced the number of stills. At the same time the retail sale was subjected to drastic regulations. A licensing system was introduced which gave the local authority power to fix the number of licences and put them up to auction or to hand over the retail traffic altogether to a company formed for the purpose of carrying it on. The latter idea, which is the Gothenburg system, was taken from the example of Falun and Jönköping which had a few years ago voluntarily adopted the plan. The law of 1855 further gave rural districts the power of local veto. Four-fifths of the population live in rural districts, and the great majority of them immediately took advantage of the provision. The company system, on the other hand, was not applied by the towns until 1865, when Gothenburg adopted it.

In Norway the course of events was very similar. There, too, distilling and spirit-drinking were practically universal in the early part of the century

under the laws of 1816, but were checked by legislation a few years sooner than in Sweden. In 1845 a special licensing system was introduced, giving the local authority power to fix the number of licences, and in 1848 the small and domestic stills were stopped. The Gothenburg system was not adopted in Norway until 1871 and then with some modification. The essence of this method of conducting the retail traffic is that the element of private gain is eliminated. A monopoly is granted to a company consisting of a number of disinterested citizens of standing with a capital, and they manage the sale both for "on" and "off" consumption in the public interest. The profits, after payment of 5% on the capital, originally went in Sweden mainly to the municipality in relief of rates, in Norway to objects of public utility. The latter was considered preferable because it offers less temptation to make the profits as high as possible. Fault has, however, been found with both methods, and payment of profits to the state is now preferred. In 1894 a law was passed in Norway providing for the following distribution: 65% to the state, 20% to the company, and 15% to the municipality. In 1907 Sweden adopted a law in the same direction. The intention is to eliminate more completely the motive of gain from the traffic. In 1898 the net profits of the companies exceeded half a million sterling in Sweden and reached £117,500 in Norway.

The company system had in 1910 had more than half a century's trial; it had gone through some vicissitudes and been subjected to much criticism, which was balanced by at least as much eulogy. It had held its own in Sweden, where 101 towns had adopted it in 1906. In Norway at the same date it was in force in 32 towns while 29 had adopted local veto, which was extended from the country districts, where it had previously been optional, to the towns by the law of 1894.

As we have already said, it only applies to spirits. In both countries the sale of beer and wine for "on" consumption is carried on in the ordinary

way under a licensing system; the sale of beer in bottles for consumption off the premises is practically free. The beer traffic is regarded by some as a "safety valve" and by others as a defect in the system. The consumption has greatly increased in Sweden; in Norway it increased up to 1900 and has since declined. But other more deleterious substitutes for spirits have come into use in the shape of concocted "wines" and methylated spirits. The company management has had the following effects: it has greatly reduced the number of spirit bars, improved their character and conduct, added eating-rooms, where good and cheap meals are served, stopped drinking on credit and by persons under 18 years of age, shortened the hours of sale, raised the price and lowered the strength of spirits. But the restrictions placed on the sale for consumption on the premises has stimulated the retail bottle trade and home drinking.

British Dominions.

Canada.—Liquor legislation in Canada has been much influenced by the proximity and example of the United States. Licensing, modified by local veto, prevails throughout the Dominion except in the Indian settlements; but the several provinces have their own laws, which vary in stringency. As a whole the licensing system rather resembles the American than the British type. The licensing authority is either a board of commissioners or the municipality, and there has been the same tendency as in the United States to substitute the former for the latter. In British Columbia no new hotel licence is granted in cities except on the request of two-thirds of the owners and occupiers of the adjoining property, but their consent is not necessary for renewal. In other provinces the municipal authority has power to limit as well as regulate the licensed trade. Sunday closing is the rule; on week-days the usual closing hour in the large towns is 11 P.M. The power of locally prohibiting licensed houses by vote was introduced by the Canada

Temperance Act, a federal law passed in 1875 and commonly known as the Scott Act. Extensive use has been made of it, especially in the maritime provinces, where the temperance sentiment is very strong, but in recent years it has rather lost ground. In 1908 it was in force in 22 counties or cities, of which ten were in Nova Scotia, ten in New Brunswick and two in Manitoba; it was nowhere in force in the remaining provinces. Three elections were held under the act in 1907-1908, two in Nova Scotia and one in New Brunswick, and in the first two prohibition was defeated. In 1910 Nova Scotia, apparently dissatisfied with the progress of local prohibition under the Scott Act, passed a prohibitory law for the whole province, exempting Halifax, the capital and only considerable town, but making provision for its subsequent inclusion by a referendum to the ratepayers. There is in Canada the same oscillation of public opinion as in the United States, and the same toleration of evasion of the law. The writer has stayed in hotels in several prohibition towns, where there was not only a regular bar but a printed wine list from which anything could be ordered at meals without any concealment at all. The chief difference between the conduct of hotels under prohibition and under licensing is that under licensing the bar is closed at the legal hour, which is usually 11 o'clock, and under prohibition it remains open as long as there are any customers to serve. The law is nominally respected by imposing a periodical fine. In small towns and rural districts local prohibition is much more effective. In short the experience of Canada confirms that of the United States. In addition to the federal law, the local authorities have power, in Quebec, to prohibit as well as to regulate the trade. The high licence system has not been adopted in Canada. The total revenue derived by the Dominion government in 1908 from taxation of the liquor trade, including duties and licence fees, was £1,800,000.

Australia.—The licensing laws of Australia are less repressive and the practice more resembles the British model. Queensland has adopted local

prohibition, but it is not applied. New South Wales has a limited form of veto applying only to new licences; South Australia has the same together with a provision for the optional reduction of licences; Victoria, on the other hand, allows an option both ways, for reducing or increasing the licences; West Australia and Tasmania merely give the local ratepayers the right of protest; in West Australia it holds good against new licences only and if a majority object the licence is refused; in Tasmania protest may be made against renewals and transfers also, but the decision lies with the licensing authority. There is practically no prohibition in the Commonwealth.

New Zealand.—This state has a licensing system with local option provisions of its own. The licensing authority is a local committee, and there are seven kinds of licence, of which two are for consumption on the premises. The fees range from £1 for a wine licence to £40 for a full publican's licence in towns, or £45 for one permitting an additional hour's sale at night; the fees go to the revenue of the local authority. In 1907 the total number of licences granted was 2179 and the fees paid amounted to £45,865. Of the whole number, 1367, or 1 to every 666 persons, were houses licensed for on consumption. The closing hour is 10 P.M. except for houses specially licensed to be open till 11 P.M. In 1893 local option was introduced by the Alcoholic Liquors Sale Control Act, which provided for the taking of a poll on the question of licences. The electoral districts for the purpose are the same as for the House of Representatives, except that the cities of Auckland, Wellington, Christchurch and Dunedin each form a single district for the licensing poll. It is taken at the same time as the election of members of the House of Representatives, and three questions are propounded—(1) continuance of existing licences, (2) reduction, (3) no licences. A voter may vote for two proposals but not more. An absolute majority of all the votes recorded carries (1); an absolute majority of all the votes recorded carries (2), whereupon the licensing committee reduces the licences by any number from 5 to 25% of the total. But if three-fifths of all

the votes cast are in favour of no licence then that supersedes (1) and (2). The poll taken in December 1905 gave the following results: of the 68 districts 40 carried no proposal (which is equivalent to continuance of existing licences), 18 carried continuance, 4 reduction, 6 no licence, including 3 which had previously adopted no licence. Women, it must be remembered, vote as well as men. The aggregate vote in favour of no licence shows a large proportional increase since the first poll in the present system in 1896.

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1 In 1908 local option was adopted in Ohio.

LIRA, the Italian name (Lat. *libra*, pound) for a silver coin, the Italian unit of value in the Latin Monetary Union, corresponding to the French, Swiss and Belgian franc (*q.v.*), and the drachma of Greece, &c. The name is sometimes used of the Turkish pound, *medjidie*.

LIRI, or GARIGLIANO (anc. *Liris*), a river of central Italy, which rises at Cappadocia, 7 m. W. of Avezzano, and traverses a beautiful valley between lofty mountains, running S.S.E. as far as Arce. This valley is followed by the railway from Avezzano to Roccasecca. At Isola del Liri are two fine waterfalls. Below Ceprano, the ancient Fregellae, after it has issued from the mountains, the Liri is joined by the Sacco (anc. *Trerus*) formed by the union of several torrents between Palestrina and Segni, and the Melfa from the mountains N.E. of Atina, and runs E. through a broader valley. It then turns S. again through the mountains S.W. of the Via Latina (the line of which is followed by the modern railway to Naples), keeping W. of Rocca Monfina, and falls into the sea just below Minturnae, after a course of 104 m. It is not navigable at any point.

LIROCONITE, a rare mineral consisting of hydrous basic copper and aluminium arsenate, with the probable formula $Cu_9Al_4(OH)_{15}(AsO_4)_5 \cdot 20H_2O$. It crystallizes in the monoclinic system, forming flattened octahedra almost lenticular in shape (hence the German name *Linsenkupfer*). Characteristic is the bright sky-blue colour, though sometimes, possibly owing to differences in chemical composition, it is verdigris-green. The colour of the streak or powder is rather paler; hence the name liroconite, from the Gr. λειρός, pale, and κονία, powder. The hardness is 2½, and the specific gravity 2.95. The mineral was found at the beginning of the 19th century in the copper mines near Gwennap in Cornwall, where it was associated with other copper arsenates in the upper, oxidized portions of the lodes.

(L. J. S.)

LISBON (*Lisboa*), the capital of the kingdom of Portugal and of the department of Lisbon; on the right bank of the river Tagus, near its entrance into the Atlantic Ocean, in 38° 42′ 24″ N. and 9° 11′ 10″ W. Pop. (1900) 356,009. Lisbon, the westernmost of European capitals, is built in a

succession of terraces up the sides of a range of low hills, backed by the granite mountains of Cintra. It fronts the Tagus, and the view from the river of its white houses, and its numerous parks and gardens, is comparable in beauty with the approach to Naples or Constantinople by sea. The lower reaches of the estuary form a channel (Entrada do Tejo) about 2 m. wide and 8 m. long, which is partially closed at its mouth by a bar of silt. Owing to the reclamation of the foreshore on the right, and the consequent narrowing of the waterway, the current flows very swiftly down this channel, which is the sole outlet for the immense volume of water accumulated in the Rada de Lisboa—a tidal lake formed by the broadening of the estuary in its upper part to fill a basin 11 m. long with an average breadth of nearly 7 m. The southern or left shore of the channel rises sharply from the water's edge in a line of almost unbroken though not lofty cliffs; the margin of the lake is flat, marshy and irregular. Lisbon extends for more than 5 m. along the shores of both channel and lake, and for more than 3 m. inland. Its suburbs, which generally terminate in a belt of vineyards, parks or gardens, interspersed with villas and farms, stretch in some cases beyond the Estrada Militar, or Estrada da Nova Circumvallação, an inner line of defence 25 m. long, supplementary to the forts and other military works at the mouth of the Tagus, on the heights of Cintra and Alverca, and at Caxias, Sacavem, Monsanto and Ameixoeira. The climate of Lisbon is mild and equable, though somewhat oppressive in summer. Extreme cold is so rare that in the twenty years 1856-1876 snow fell only thrice; and in the 18th and early 19th centuries Lisbon was justly esteemed as a winter health-resort. The mean annual temperature is 60.1° F., the mean for winter 50.9°, the average rainfall 29.45 in. As in 1906, when no rain fell between April and September, long periods of drought are not uncommon, although the proximity of the Atlantic and the frequency of sea-fogs keep the atmosphere humid; the mean atmospheric moisture is nearly 71 (100 = saturation). There is a good water supply, conveyed to the city by two vast

aqueducts. The older of these is the Aqueducto das Aguas Livres, which was built in the first half of the 18th century and starts from a point near Bellas, 15 m. W.N.W. Its conduits, which are partly underground, are conveyed across the Alcantara valley through a magnificent viaduct of thirty-five arches, exceeding 200 ft. in height. At the Lisbon end of the aqueduct is the Mae d'Agua (*i.e.* "Mother of Water"), containing a huge stone hall in the midst of which is the reservoir. The Alviella aqueduct, opened in 1880, brings water from Alviella near Pernes, 70 m. N.N.E. Numerous fountains are among the means of distribution. Sewage is discharged into the Tagus, and the sanitation of the city is good, except in the older quarters.

Divisions of the City.—The four municipal districts (*bairros*) into which Lisbon is divided are the *Alfama*, or old town, in the east; the *Cidade Baixa*, or lower town, which extends inland from the naval arsenal and custom house; the *Bairro Alto*, comprising all the high ground west of the Cidade Baixa; and the *Alcantara*, or westernmost district, named after the small river Alcantara, which flows down into the Tagus. Other names commonly used, though unofficial, are "Lisboa Oriental" as an alternative for Alfama; "Lisboa Occidental" for the slopes which lead from the Cidade Baixa to the Bairro Alto; "Buenos Ayres" (originally so named from the number of its South American residents) for the Bairro Alto S.W. of the Estrella Gardens and E. of the Necessidades Park; "Campo de Ourique" and "Rato" for the suburbs respectively N.W. and N.E. of Buenos Ayres.

The Alfama.—The Alfama, which represents Roman and Moorish Lisbon, is less rich in archaeological interest than its great antiquity might suggest, although parts of a Roman temple, baths, &c., have been disinterred. But as the earthquake of 1755 did comparatively little damage to this quarter, many of its narrow, steep and winding alleys retain the medieval aspect which all other parts of the city have lost; and almost rival

the slums of Oporto in picturesque squalor. The most conspicuous feature of the Alfama is the rocky hill surmounted by the Castello de São Jorge, a Moorish citadel which has been converted into a fort and barracks. The Sé Patriarchal, a cathedral founded in 1150 by Alphonso I., is said by tradition to have been a Moorish mosque. It was wrecked by an earthquake in 1344 and rebuilt in 1380, but the earthquake of 1755 shattered the dome, the roof and belfry were subsequently burned, and after the work of restoration was completed the choir and façade were the only parts of the 14th-century Gothic church unspoiled. In one of the side chapels is the tomb of St Vincent (d. 304), patron saint of Lisbon; a pair of ravens kept within the cathedral precincts are popularly believed to be the same birds which, according to the legend, miraculously guided the saint's vessel to the city. The armorial bearings of Lisbon, representing a ship and two ravens, commemorate the legend. Other noteworthy buildings in the Alfama are the 12th-century church of São Vicente de Fóra, originally, as its name implies, "outside" the city; the 13th-century chapel of Nossa Senhora do Monte; the 16th-century church of Nossa Senhora da Graça, which contains a reputed wonder-working statue of Christ and the tomb of Alphonso d'Albuquerque (1453-1515); and a secularized Augustinian monastery, used as the archbishop's palace.

Modern Lisbon.—West of the Alfama the city dates chiefly from the period after the great earthquake. Its lofty houses, arranged in long straight streets, its gardens and open spaces, a few of its public buildings, and almost all its numerous statues and fountains, will bear comparison with those of any European capital. The centre of social and commercial activity is the district which comprises the Praça do Commercio, Rua Augusta, Rocío, and Avenida da Liberdade, streets and squares occupying the valley of a vanished tributary of the Tagus. The Praça do Commercio is a spacious square, one side of which faces the river, while the other three sides are occupied by the arcaded buildings of the custom house, post office and

other government property. In the midst is a bronze equestrian statue of Joseph I., by J. M. de Castro, which was erected in 1775 and gives point to the name of "Black Horse Square" commonly applied to the Praça by the British. A triumphal arch on the north side leads to Rua Augusta, originally intended to be the cloth-merchants' street; for the plan upon which Lisbon was rebuilt after 1755 involved the restriction of each industry to a specified area. This plan succeeded in the neighbouring Rua Aurea and Rua da Prata, still, as their names indicate, famous for goldsmiths' and silversmiths' shops. Rua Augusta terminates on the north in the Rocío or Praça de Dom Pedro Quarto, a square paved with mosaic of a curious undulatory pattern and containing two bronze fountains, a lofty pillar surmounted by a statue of Pedro IV., and the royal national theatre (Teatro de Dona Maria Segunda), erected on the site which the Inquisition buildings occupied from 1520 to 1836. The narrow Rua do Principe, leading past the central railway station, a handsome Mauresque building, connects the Rocío with the Avenida da Liberdade, one of the finest avenues in Europe. The central part of the Avenida, a favourite open-air resort of Lisbon society, is used for riding and driving; on each side of it are paved double avenues of trees, with flower-beds, statues, ponds, fountains, &c., and between these and the broad pavements are two roadways for trams and heavy traffic. Thus the Avenida has the appearance of three parallel streets, separated by avenues of trees instead of houses. Its width exceeds 300 ft. It owes its name to an obelisk 98 ft. high, erected in 1882 at its southern end, to commemorate the liberation of Portugal from Spanish rule (December, 1640). North and north-east of the Avenida are the Avenida Park, the Edward VII. Park (so named in memory of a visit paid to Lisbon by the king of England in 1903), Campo Grande, with its finely wooded walks, and Campo Pequeno, with the bull-ring. Other noteworthy public gardens are the Passeio da Estrella, commanding magnificent views of the city and river, the Largo do Principe Real, planted with bananas and other tropical

trees, the Tapada das Necessidades, originally the park of one of the royal residences, and the Botanical Gardens of the polytechnic school, with a fine avenue of palms and collections of tropical and subtropical flora hardly surpassed in Europe. There are large Portuguese cemeteries east and west of Lisbon, a German cemetery, and an English cemetery, known also as *Os Cyprestes* from the number of its cypresses. This was laid out in 1717 at the cost of the British and Dutch residents and contains the graves of Henry Fielding (1707-1754), the novelist, and Dr Philip Doddridge (1702-1751), the Nonconformist divine.

Lisbon is the seat of an archbishop who since 1716 has borne *ex officio* the honorary title of patriarch; he presides over the House of Peers and is usually appointed a cardinal. The churches of modern Lisbon are generally built in the Italian style of the 18th century; the interiors are overlaid with heavy ornament. Perhaps the finest is the Estrella church, with its white marble dome and twin towers visible for many miles above the city. The late Renaissance church of São Roque contains two beautiful chapels dating from the 18th century, one of which is inlaid with painted tiles, while the other was constructed in Rome of coloured marbles, and consecrated by the pope before being shipped to Lisbon. Its mosaics and lapis lazuli pillars are exceptionally fine. The 14th-century Gothic Igreja do Carmo was shattered by the great earthquake. Only the apse, pillared aisles and outer walls remain standing, and the interior has been converted into an archaeological museum. The church of Nossa Senhora da Conceição has a magnificent Manoeline façade.

The Palacio das Cortes, in which both Houses of Parliament sit, is a 16th-century Benedictine convent, used for its present purpose since 1834. It contains the national archives, better known as the Torre do Tombo collection, because in 1375 the archives were first stored in a tower of that name. The royal palace, or Paço das Necessidades, west of Buenos Ayres, is

a vast 18th-century mansion occupying the site of a chapel dedicated to Nossa Senhora das Necessidades (*i.e.* "Our Lady who helps at need").

The Suburbs of Ajuda and Belem.—In the extreme west of Lisbon, beyond the Alcantara valley, are Belem (*i.e.* "Bethlehem"), beside the Tagus, and Ajuda, on the heights above. The Paço de Belem, built in 1700 for the counts of Aveiro, became the chief royal palace under John V. (1706-1750). The Torre de Belem, on the foreshore, is a small tower of beautiful design, built in 1520 for the protection of shipping. The finest ecclesiastical building in Portugal except the monasteries of Alcobaça and Batalha also fronts the river. It is the Convento dos Jeronymos, a Hieronymite convent and church, founded in 1499 to commemorate the discovery of the sea-route to India by Vasco da Gama. It was built of white limestone by João de Castilho (d. 1581), perhaps the greatest of Manoeline architects. Its cloisters form a square with blunted corners, surrounded by a two-storeyed arcade, every available portion of which is covered with exquisite sculptures. Parts of the building have been restored, but the cloisters and the beautiful central gateway remain unspoiled. The interior contains many royal tombs, including that of Catherine of Braganza (d. 1705), the wife of Charles II. of England. The supposed remains of Camoens and Vasco da Gama were interred here in 1880. In 1834, when the convent was secularized, its buildings were assigned to the Casa Pia, an orphanage founded by Maria I. Since 1903 they have contained the archaeological collections of the Portuguese Ethnological Museum. The royal Ajuda palace, begun (1816-1826) by John VI. but left unfinished, derives its name from the chapel of N. S. de Ajuda ("Our Lady of Aid"). It contains some fine pictures and historical trophies. In the coach-house there is an unsurpassed collection of state coaches, the cars upon which figures of saints are borne in procession, sedan chairs, old cabriolets and other curious vehicles.

The Environs of Lisbon.—The administrative district of Lisbon has an area of 3065 sq. m., with a population of 709,509 in 1900. It comprises the lower parts of the Tagus and Sado; the sea-coast from 5 m. S. of Cape Carvoeiro to within 3 m. of the bluff called the Escarpa do Rojo; and a strip of territory extending inland for a mean distance of 30 m. This region corresponds with the southern part of Estremadura (*q.v.*). Its more important towns, Setubal, Cintra, Torres Vedras and Mafra, are described in separate articles. Sines, a small seaport on Cape Sines, was the birthplace of Vasco da Gama. On the left bank of the Tagus, opposite Lisbon, are the small towns of Almada, Barreiro, Aldeia Gallega and Seixal, and the hamlet of Trafaria, inhabited by fishermen. The beautiful strip of coast west of Oeiras and south of Cape Roca is often called the "Portuguese Riviera." Its fine climate, mineral springs and sea-bathing attract visitors at all seasons to the picturesque fortified bay of Cascaes, or to Estoril, Mont' Estoril and São João do Estoril, modern towns consisting chiefly of villas, hotels and gardens. The Boca do Inferno ("Mouth of Hell") is a cavity in the rocks at Cascaes resembling the Bufador at Peñiscola (*q.v.*). The villages of Carcavellos, Bucellas, Lumiar and Collares produce excellent wines; at Carcavellos is the receiving station for cables, with a large British staff, and a club and grounds where social and athletic meetings are held by the British colony. Alhandra, on the right bank of the Tagus, above Lisbon, was the birthplace of Albuquerque; fighting bulls for the Lisbon arena are bred in the adjacent pastures.

Railways, Shipping and Commerce.—Lisbon has five railway stations—the central (Lisboa-Rocío), for the lines to Cintra, northern and central Portugal, and Madrid via Valencia de Alcántara; the Santa Apolonia or Caes dos Soldados, at the eastern extremity of the quays, for the same lines (excluding Cintra) and for southern Portugal and Andalusia; the Caes do Sodré and Santos, farther west along the quays, for Cascaes; and the Barreiro, on the left bank of the Tagus, for southern Portugal. In 1902 the

railways north and south of the Tagus were connected near Lisbon by a bridge. In the previous year an extensive system of electric tramways replaced the old-fashioned cable cars and mule trams. Electric and hydraulic lifts are used where the streets are too steep for trams. Lisbon is lighted by both electricity and gas; it has an admirable telephone service, and is connected by the Carcavellos cable-station with Cornwall (England), Vigo in Galicia, Gibraltar, the Azores and Madeira.

Ships of the largest size can enter the Tagus, and the Barreiro inlet is navigable at low water by vessels drawing 16 ft. There are extensive quays along the right bank, with hydraulic cranes, two graving docks, a slipway, warehouses and lines of railway. The government and private docks are on the left bank. Loading and discharging are principally effected by means of lighters. The exports are wines, oil, fruit, tinned fish, salt, colonial produce, cork, pitwood, leather and wool. The imports include cotton and woollen goods, linen, ale and porter, butter, tea, hardware, tin plates, coal, iron, machinery, chemical manure, &c., from Great Britain; grain and petroleum from the United States; dried codfish from Norway and Newfoundland; silks, perfumery and fancy goods from France; hemp, flax, grain, petroleum and cloth from Russia; linen, machinery, hardware, sugar, &c., from Germany and Holland, iron, steel, timber, pitch and salt fish from the Baltic; cocoa, coffee, wax and rubber from the Portuguese colonies. Towards the close of the 19th century the tourist traffic from Great Britain and Germany attained considerable importance, and Lisbon has long been one of the principal ports of debarcation for passengers from Brazil and of embarcation for emigrants to South America. Shipbuilding, including the construction of vessels for the national navy, is a growing industry. The fisheries have always been important, and in no European fishmarket is the produce more varied. Sardines and tunny are cured and tinned for export. In addition to a fleet of about 600 sailing boats, the Tagus is the headquarters of a small fleet of steam trawlers. The industries of Lisbon include dyeing,

distillation of spirits and manufactures of woollen, cotton, silk and linen fabrics, of pottery, soap, paper, chemicals, cement, corks, tobacco, preserved foods and biscuits.

Education and Charity.—Although the seat of the only university in Portugal was fixed at Coimbra in 1527, Lisbon is the educational centre of the Portuguese world, including Brazil. Its chief learned societies are the Society of Medical Sciences, the Geographical Society, the Royal Academy of Sciences, the Academy of Fine Arts, the Royal Conservatory of Music and the Propaganda de Portugal. The museum of the Academy of Fine Arts contains the largest collection of pictures and statues by native and foreign artists in Portugal. The Geographical Society has gained an international reputation; it possesses a valuable library and museum. The National Library, founded in 1796, contains over 400,000 printed books, and upwards of 9000 MSS. There are also colonial, naval, artillery, natural history and commercial museums, meteorological and astronomical observatories, zoological gardens and an aquarium. Purely educational institutions include the medical, polytechnic, military and naval schools, commercial, agricultural and industrial institutes, a school of art, a central lyceum, a school for teachers, &c. The English college for British Roman Catholics dates from 1628. The Irish Dominicans have a seminary, and Portuguese ecclesiastical schools are numerous. There are hospitals for women, and for contagious diseases, almshouses, orphanages, a foundling hospital and a very large quarantine station on the south bank of the Tagus, founded in 1857 after an outbreak of yellow fever had devastated the city. Foremost among the theatres, circuses and other places of amusement is the royal opera-house of São Carlos, built in 1792-1793 on the model of the Scala at Milan.

Population.—The population of Lisbon, 187,404[1] in 1878, rose to 301,206 in 1890 and 356,009 in 1900. It includes a large foreign colony,

composed chiefly of Spaniards, British, Germans, French, Brazilians and immigrants from the Portuguese colonies, among whom are many half-castes. The majority of the Spaniards are domestic servants and labourers from Galicia, whose industry and easily gained knowledge of the kindred Portuguese language enables them to earn a better livelihood here than in their own homes. The British, German and French communities control a large share of the foreign trade. The Brazilians and colonial immigrants are often merchants and landowners who come to the mother-country to spend their fortunes in a congenial social environment.

The street life of the city is full of interest. The bare-footed, ungainly fishwives, dressed in black and bearing flat trays of fish on their heads; the Galician water-carriers, with their casks; the bakers, bending beneath a hundredweight of bread slung in a huge basket from their shoulders; the countrymen, with their sombreros, sashes and hardwood quarter-staves, give colour and animation to their surroundings; while the bag-pipes played by peasants from the north, the whistles of the knife-grinders, and the distinctive calls of the vendors of fruit, lottery tickets, or oil and vinegar, contribute a babel of sound. For church festivals and holidays the country-folk come to town, the women riding on pillions behind the men, adorned in shawls, aprons and handkerchiefs of scarlet or other vivid hues, and wearing the strings of coins and ornaments of exquisite gold and silver filigree which represent their savings or dowries. The costumes and manners of all classes may be seen at their best in the great bull-ring of Campo Pequeno, a Mauresque building which holds many thousands of spectators. A Lisbon bullfight is a really brilliant exhibition of athletic skill and horsemanship, in which amateurs often take part, and neither horses nor bulls are killed. There is a Tauromachic Club solely for amateurs.

History.—The name Lisbon is a modification of the ancient name *Olisipo*, also written *Ulyssippo* under the influence of a mythical story of a

city founded by Odysseus (Ulysses) in Iberia, which, however, according to Strabo, was placed by ancient tradition rather in the mountains of Turdetania (the extreme south of Spain). Under the Romans Olisipo became a *municipium* with the epithet of *Felicitas Julia*, but was inferior in importance to the less ancient *Emerita Augusta* (Mérida). From 407 to 585 it was occupied by Alaric, and thenceforward by the Visigoths until 711, when it was taken by the Moors. Under the Moors the town bore in Arabic the name of *Al Oshbūna* or *Lashbūna*. It was the first point of Moslem Spain attacked by the Normans in 844. When Alphonso I. of Portugal took advantage of the decline and fall of the Almoravid dynasty to incorporate the provinces of Estremadura and Alemtejo in his new kingdom, Lisbon was the last city of Portugal to fall into his hands, and yielded only after a siege of several months (21st October 1147), in which he was aided by English and Flemish crusaders on their way to Syria. In 1184 the city was again attacked by the Moslems under the powerful caliph Abu Yakub, but the enterprise failed. In the reign of Ferdinand I., the greater part of the town was burned by the Castilian army under Henry II. (1373), and in 1384 the Castilians again besieged Lisbon, but without success. Lisbon became the seat of an archbishop in 1390, the seat of government in 1422. During the 16th century it gained much in wealth and splendour from the establishment of a Portuguese empire in India and Africa. From 1580 to 1640 Lisbon was a provincial town under Spanish rule, and it was from this port that the Spanish Armada sailed in 1588. In 1640 the town was captured by the duke of Braganza, and the independence of the kingdom restored.

For many centuries the city had suffered from earthquakes, and on the 1st of November 1755 the greater part of it was reduced almost in an instant to a heap of ruins. A tidal wave at the same time broke over the quays and wrecked the shipping in the Tagus; fire broke out to complete the work of destruction; between 30,000 and 40,000 persons lost their lives; and the value of the property destroyed was about £20,000,000. The shock was felt

from Scotland to Asia Minor. Careful investigation by Daniel Sharpe, an English geologist, has delimited the area in and near Lisbon to which its full force was confined. Lisbon is built in a geological basin of Tertiary formation, the upper portion of which is loose sand and gravel destitute of organic remains, while below these are the so-called Almada beds of yellow sand, calcareous sandstone and blue clay rich in organic remains. The Tertiary deposits, which altogether cover an area of more than 2000 sq. m., are separated near Lisbon from rocks of the Secondary epoch by a great sheet of basalt. The uppermost of these Secondary rocks is the hippurite limestone. It was found that no building on the blue clay escaped destruction, none on any of the Tertiary deposits escaped serious injury, and all on the hippurite limestone and basalt were undamaged. The line at which the earthquake ceased to be destructive thus corresponded exactly with the boundary of the Tertiary deposits.

At the beginning of the 19th century the French invasion, followed by the removal of the court to Rio de Janeiro, the Peninsular War, the loss of Brazil and a period of revolution and dynastic trouble, resulted in the utter decadence of Lisbon, from which the city only recovered after 1850 (see PORTUGAL: *History*).

BIBLIOGRAPHY.—Every book which deals with the topography, trade or history of Portugal as a whole necessarily devotes a portion of its space to the capital; see PORTUGAL: *Bibliography*. The following treat more exclusively of Lisbon: A. Dayot, *Lisbonne* (No. ix. of the "*Capitales du monde*" series) (Paris, 1892); Freire de Oliveira, *Elementos para a historia do municipio de Lisboa* (9 vols., Lisbon, 1885-1898); J. de Castilho, *Lisboa antiga* (7 vols., Lisbon, 1890), and (by the same author) *A Ribeira de Lisboa* (Lisbon, 1893).

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1 This figure represents the population of a smaller area than that of modern Lisbon, for the civic boundaries were extended by a decree dated the 23rd of December 1886.

LISBURN, a market town, and cathedral city of Co. Antrim, Ireland, situated in a beautiful and fertile district on the Lagan, and on the Great Northern railway, 8 m. S.S.W. of Belfast. Pop. (1901) 11,461. Christ Church (1622) which possesses a fine octagonal spire, is the cathedral church of the united Protestant dioceses of Down, Connor and Dromore, and contains a monument to Jeremy Taylor, who was bishop of the see. The public park was presented to the town by Sir Richard Wallace (d. 1890), and after his death the castle gardens were also given to the town. The staple manufacture is linen, especially damasks and muslins, originally introduced by Huguenots. There are also bleaching and dyeing works, and a considerable agricultural trade. The town is governed by an urban district council. The ruins of Castle Robin, 2 m. N. of the town, stand on a summit of the White Mountains, and the building dates from the time of Queen Elizabeth. At Drumbo, 3½ m. E. of Lisburn, is one of the finest examples of early fortification in Ireland, known as the Giant's Ring, with a cromlech in the centre. Here are also a round tower and the remains of a church ascribed to St Patrick.

In the reign of James I., Lisburn, which was then known as Lisnegarvy (Gambler's Fort), was an inconsiderable village, but in 1627 it was granted by Charles I. to Viscount Conway, who erected the castle for his residence, and laid the foundation of the prosperity of the town by the introduction of English and Welsh settlers. In November 1641 the town was taken by the insurgents, who on the approach of superior numbers set fire to it. The

troops of Cromwell gained a victory near the town in 1648, and the castle surrendered to them in 1650. The church was constituted a cathedral in 1662 by Charles II., from whom the town received the privilege of returning two members to parliament, but after the Union it returned only one and in 1885 ceased to be a parliamentary borough. Lisburn gives the titles of earl and viscount to the family of Vaughan.

LISIEUX, a town of north-western France, capital of an arrondissement in the department of Calvados, 30 m. E. of Caen by rail. Pop. (1906) 15,194. Lisieux is prettily situated in the valley of the Touques at its confluence with the Orbiquet. Towers of the 16th century, relics of the old fortifications, remain, and some of the streets, bordered throughout by houses of the 14th, 15th and 16th centuries, retain their medieval aspect. The church of St Peter, formerly a cathedral, is reputed to be the first Gothic church built in Normandy. Begun in the latter half of the 12th century it was completed in the 13th and 16th centuries. There is a lantern-tower over the crossing and two towers surmount the west façade, one only of which has a spire, added towards the end of the 16th century. In the interior there is a Lady-Chapel, restored in the 15th century by Bishop Pierre Cauchon, one of the judges of Joan of Arc. The church of St Jacques (late 15th century) contains beautiful glass of the Renaissance, some remarkable stalls and old frescoes, and a curious picture on wood, restored in 1681. The church of St Désir (18th century) once belonged to a Benedictine abbey. The old episcopal palace near the cathedral is now used as a court-house, museum, library and prison, and contains a beautiful hall called the salle dorée. Lisieux is the seat of a sub-prefect, and has tribunals of first instance and of commerce, a chamber of arts and manufactures, a board of trade arbitrators and a communal college. Its manufactures of woollens are important, and bleaching, wool and flax-spinning, tanning, brewing, timber-sawing, metal-

founding, and the manufacture of machinery, hosiery and boots and shoes are carried on; there is trade in grain, cattle and cheese.

In the time of Caesar, Lisieux, under the name of *Noviomagus*, was the capital of the Lexovii. Though destroyed by the barbarians, by the 6th century it had become one of the most important towns of Neustria. Its bishopric, suppressed in 1802, dates from that period. In 877 it was pillaged by the Normans; and in 911 was included in the duchy of Normandy by the treaty of St Clair-sur-Epte. Civil authority was exercised by the bishop as count of the town. In 1136 Geoffrey Plantagenet laid siege to Lisieux, which had taken the side of Stephen of Blois. The town was not reduced till 1141, by which time both it and the neighbourhood had been brought to the direst extremities of famine. In 1152 the marriage of Henry II. of England to Eleanor of Guienne, which added so largely to his dominions, was celebrated in the cathedral. Thomas à Becket took refuge here, and some vestments used by him are shown in the hospital chapel. Taken by Philip Augustus and reunited to France in 1203, the town was a frequent subject of dispute between the contending parties during the Hundred Years' War, the religious wars, and those of the League.

LISKEARD, a market town and municipal borough in the Bodmin parliamentary division of Cornwall, England, 15 m. W.N.W. of Plymouth, on the Great Western and the Liskeard and Looe railways. Pop. (1901) 4010. It lies high, above two small valleys opening to that of the Looe river,

in a hilly, picturesque district. The Perpendicular church of St Martin, with a tower of earlier date, having a Norman arch, is one of the largest ecclesiastical buildings in the county. The site of a castle built by Richard, brother of Henry III. and earl of Cornwall, is occupied by public gardens. At the grammar school, which formerly occupied a building in those gardens, Dr John Wolcot, otherwise known as Peter Pindar, was educated. Liskeard was formerly an important mining centre. Its manufactures include leather and woollen goods, and there are iron foundries. The borough is under a mayor, 4 aldermen and 12 councillors. Area, 2704 acres.

Liskeard (Liscarret) was at the time of the Domesday Survey an important manor with a mill rendering 12d. yearly and a market rendering 4s. By the Conqueror it had been given to the count of Mortain by whom it was held in demesne. Ever since that time it has passed with the earldom or duchy of Cornwall. The fertility of its soil and the river Looe probably led to early settlement at Liskeard. Richard, king of the Romans, recognized its natural advantages and built the manor house or castle and resided there occasionally. In 1240 he constituted Liskeard a free borough and its burgesses freemen with all the liberties enjoyed by the burgesses of Launceston and Helston. In 1266 he granted fairs at the Feasts of the Assumption and St Matthew. His son Edmund earl of Cornwall in 1275 granted to the burgesses for a yearly rent of £18 (sold by William III. to Lord Somers) the borough in fee farm with its mills, tolls, fines and pleas, pleas of the crown excepted. Liskeard was made a coinage town for tin in 1304. Edward the Black Prince secured to the burgesses in 1355 immunity from pleas outside their franchise for trespass done within the borough. Queen Elizabeth granted a charter of incorporation in 1580 under which there were to be a mayor, recorder and eight councillors. This charter was surrendered to Charles II. in 1680 and a new one granted by his brother under which the corporation became a self-elected body. From 1295 to 1832 Liskeard sent two members to the House of Commons. The

parliamentary franchise, at first exercised by the burgesses, was vested by James' charter in the corporation and freemen. By determining to admit no new freemen the voters became reduced to between 30 and 60. Sir Edward Coke was returned for this borough in 1620, and Edward Gibbon the historian in 1774. In 1832 Liskeard was deprived of one of its members and in 1885 it became merged in the county.

Besides the fairs already mentioned a third was added by Elizabeth's charter to be held on Ascension Day. These are still among the most considerable cattle fairs in the county. The same charter ratified a market on Mondays and provided for another on Saturdays. The latter is now held weekly, the former twice a month. The flour mill at Lamellion mentioned in the charter of 1275, and probably identical with the mill of the Domesday Survey, is still driven by water.

LISLE, ALICE (*c.* 1614-1685), commonly known as Lady Alice Lisle, was born about 1614. Her father, Sir White Beckenshaw, was descended from an old Hampshire family; her husband, John Lisle (d. 1664), had been one of the judges at the trial of Charles I., and was subsequently a member of Cromwell's House of Lords—hence his wife's courtesy title. Lady Lisle seems to have leaned to Royalism, but with this attitude she combined a decided sympathy with religious dissent. On the 20th of July 1685, a fortnight after the battle of Sedgemoor, the old lady consented to shelter John Hickes, a well-known Nonconformist minister, at

her residence, Moyles Court, near Ringwood. Hickes, who was a fugitive from Monmouth's army, brought with him Richard Nelthorpe, also a partizan of Monmouth, and under sentence of outlawry. The two men passed the night at Moyles Court, and on the following morning were arrested, and their hostess, who had denied their presence in the house, was charged with harbouring traitors. Her case was tried by Judge Jeffreys at the opening of the "Bloody Assizes" at Winchester. She pleaded that she had no knowledge that Hickes's offence was anything more serious than illegal preaching, that she had known nothing previously of Nelthorpe (whose name was not included in the indictment, but was, nevertheless, mentioned to strengthen the case for the Crown), and that she had no sympathy with the rebellion. The jury reluctantly found her guilty, and, the law recognizing no distinction between principals and accessories in treason, she was sentenced to be burned. Jeffreys ordered that the sentence should be carried out that same afternoon, but a few days' respite was subsequently granted, and James II. allowed beheading to be substituted for burning. Lady Lisle was executed in Winchester market-place on the 2nd of September 1685. By many writers her death has been termed a judicial murder, and one of the first acts of parliament of William and Mary reversed the attainder on the ground that the prosecution was irregular and the verdict injuriously extorted by "the menaces and violences and other illegal practices" of Jeffreys. It is, however, extremely doubtful whether Jeffreys, for all his gross brutality, exceeded the strict letter of the existing law.

See Howell, *State Trials*; H. B. Irving, *Life of Judge Jeffreys*; Stephen, *History of the Criminal Law of England*.

LISMORE, an island in the entrance to Loch Linnhe, Argyllshire, Scotland, 5 m. N.W. of Oban. Pop. (1901) 500. It lies S.W. and N.E., is 9½ m. long and 1¾ m. broad, and has an area of 9600 acres. It divides the lower end of the loch into two channels, the Lynn of Morvern on the W. and the Lynn of Lome on the E. The name is derived from the Gaelic *lios mòr*, "great garden." Several ruined castles stand on the coast, and the highest point of the island is 500 ft. above the sea. The inhabitants raise potatoes, oats, cattle and horses, and these, with dairy produce, form the bulk of the trade. Steamers call at Auchnacrosan. A Columban monastery was founded in Lismore by St Moluag about 592. About 1200 the see of Argyll was separated from Dunkeld by Bishop John, "the Englishman," and Lismore soon afterwards became the seat of the bishop of Argyll, sometimes called "Episcopus Lismoriensis," quite distinct from the bishop of the Isles (Sudreys and Isle of Man), called "Episcopus Sodoriensis" or "Insularum," whose see was divided in the 14th century into the English bishopric of Sodor and Man and the Scottish bishopric of the Isles. The Rev. John Macaulay (d. 1789), grandfather of Lord Macaulay, the historian, and the Rev. Donald M'Nicol (1735-1802), who took up the defence of the Highlands against Dr Johnson, were ministers of Lismore.

For the *Book of the Dean of Lismore* see CELT: *Scottish Gaelic Literature*.

LISMORE, a town of Rous county, New South Wales, Australia, 320 m. direct N. by E. of Sydney. Pop. (1901) 4378. It is the principal town of the north coast district, and the seat of a Roman Catholic bishop. The surrounding country is partly pastoral, and partly agricultural, the soil being very fertile. The town has a cathedral, school of art, and other public buildings, while its industrial establishments include saw-mills, sugar-mills, butter factories and an iron foundry. Standing at the head of navigation of the Richmond river, Lismore has a large export trade in dairy produce, poultry, pigs, and pine and cedar timber.

LISMORE, a market town and seat of a diocese in Co. Waterford, Ireland, 43 m. W.S.W. of Waterford by the Waterford and Mallow branch of the Great Southern & Western Railway. Pop. (1901) 1583. It is beautifully situated on a steep eminence rising abruptly from the Blackwater. At the verge of the rock on the western side is the old baronial castle, erected by King John in 1185, which was the residence of the bishops till the 14th century. It was besieged in 1641 and 1643, and in 1645 it was partly

destroyed by fire. The present fabric is largely modern; while the portico was designed by Inigo Jones. To the east, on the summit of the height, is the cathedral of St Carthagh, of various dates. There are portions probably of the 12th and 13th centuries, but the bulk of the building is of the 17th century, and considerable additions, including the tower and spire, were made in the 19th. There are a grammar school, a free school and a number of charities. Some trade is carried on by means of the river, and the town is the centre of a salmon fishery district.

The original name of Lismore was Maghsciath. A monastery founded here by St Carthagh in 633 became so celebrated as a seat of learning that it is said no fewer than twenty churches were erected in its vicinity. The bishopric, which is said to have originated with this foundation, was united to that of Waterford in 1363. In the 9th and beginning of the 10th centuries the town was repeatedly plundered by the Danes, and in 978 the town and abbey were burned by the men of Ossory. Henry II., after landing at Waterford, received in Lismore castle the allegiance of the archbishops and bishops of Ireland. In 1518 the manor was granted to Sir Walter Raleigh, from whom it passed to Sir Richard Boyle, afterwards earl of Cork. From the earls of Cork it descended by marriage to the dukes of Devonshire. It was incorporated as a municipal borough in the time of Charles I., when it also received the privilege of returning members to parliament, but at the Union in 1800 it was disfranchised and also ceased to exercise its municipal functions.

LISSA (Serbo-Croation *Vis*; Lat. *Issa*), an island in the Adriatic sea, forming part of Dalmatia, Austria. Lissa lies 31 m. S. by W. of Spalato, and is the outermost island of the Dalmatian Archipelago. Its greatest length is 10½ m.; its greatest breadth 4½ m. In shape it is a long, roughly drawn parallelogram, surrounded by a wall of rock, which incloses the fertile central plain, and is broken, on the north, west and east by natural harbours. Its culminating point is Mount Hum (1942 ft.), on the south-west. The island, which belongs to the administrative district of Lesina, is divided between two communes, named after the chief towns, Lissa (*Vis*), on the north, and Comisa (*Komia*), on the west. Lissa, the capital, has a strongly fortified harbour. It contains the palace of the old Venetian counts Gariboldi, the former residence of the English governor, the monastery of the Minorites and at a little distance to the west the ruins of the ancient city of Issa. The islanders gain their livelihood by viticulture, for which Issa was once famous, by sardine fishing and by the distillation of rosemary oil. Pop. (1900) 9918, of whom 5261 belonged to the town and commune of Lissa, and 4657 to Comisa.

Issa is said to have been settled by people from Lesbos, the Issa of the Aegean. The Parians, assisted by Dionysius the Elder of Syracuse, introduced a colony in the 4th century B.C. During the First Punic War (265-241 B.C.) the Issaeans with their beaked ships helped the Roman Duilius; and the great republic, having defended their island against the attacks of Agron of Illyria and his queen Teuta, again found them serviceable allies in the war with Philip of Macedon (*c.* 215-211). As early as 996 the Venetians ruled the island, and, though they retired for a time before the Ragusans, their power was effectually established in 1278. Velo Selo, then the chief settlement, was destroyed by Ferdinand of Naples in 1483 and by the Turks in 1571. The present city arose shortly afterwards. During the Napoleonic wars, the French held Lissa until 1811, and during this period the island prospered greatly, its population increasing from 4000 to 12,000 between

1808 and 1811. In the latter year the French squadron was defeated by the British (see below); though in the same year a French fleet, flying British colours, entered Lissa, and only retired after burning 64 merchantmen. Thenceforward the island gained a valuable trade in British goods, which, being excluded from every port under French control, were smuggled into Dalmatia. In 1812 the British established an administrative system, under native officials, in Lissa and the adjoining islands of Curzola and Lagosta. All three were ceded to Austria in 1815.

Battles of Lissa.—Two naval actions have been fought in modern times near this island. The first took place on the 13th of March 1811, and was fought between a Franco-Venetian squadron, under the command of an officer named Dubourdieu (of whom little or nothing else is known), and Captain (afterwards Sir) William Hoste with a small British force. The Franco-Venetian squadron (Venice was then part of the dominions of the emperor Napoleon) consisted of six frigates, of which four were of forty guns, and of five corvettes or small craft. The British squadron was composed of three frigates, the "Amphion," 32 (Captain William Hoste), the "Cerberus" (Captain Henry Whitby) and the "Active," 38 (Captain James A. Gordon). With them was the "Volage," 22 (Captain Phipps Hornby). The action has a peculiar interest because the French captain imitated the method of attack employed by Nelson at Trafalgar. He came down from windward in two lines parallel to one another, and at an angle to the British squadron. Captain Hoste was not compelled to lie still as the allies did at Trafalgar. He stood on, and as the two French lines had to overtake him as he slipped away at an angle to their course, one of them got in the way of the other. Captain Hoste materially forwarded the success of his manœuvre by leading the foremost French ship, the "Favorite," 40, on to a reef, which was known to himself, but not to the enemy. Both squadrons then turned, and the Franco-Venetians falling into great confusion were

defeated in spite of the gallant fighting of the individual ships. Two prizes were taken and Dubourdieu was killed.

The second naval battle of Lissa was fought between the Austrian and Italian navies on the 20th of July 1866. The island, then in possession of the Austrians, was attacked by an Italian squadron from Ancona of 12 ironclads and 22 wooden vessels. One of the ironclads was damaged in a bombardment of the forts, and two were detached on other service, when an Austrian squadron of 7 ironclads, one unarmoured warship the “Kaiser” and a number of small craft which had left Fasano under the command of Admiral Tegethoff came to interrupt their operations. The Italian admiral Persano arranged his ships in a single long line ahead, which allowing for the necessary space between them meant that the Italian formation stretched for more than 2 m. Just before the action began Admiral Persano shifted his flag from the “Ré d’Italia,” the fourth ship in order from the van, to the ram “Affondatore,” the fifth. This made it necessary for the “Affondatore” and the ships astern to shorten speed, and, as the leading vessels stood on, a gap was created in the Italian line. Admiral Tegethoff, who was on the port bow of the Italians, attacked with his squadron in three divisions formed in obtuse angles. The Italians opened a very rapid and ill-directed fire at a distance of 1000 yds. The Austrians did not reply till they were at a distance of 300 yds. Under Tegethoff’s vigorous leadership, and aided by the disorder in the Italian line, the Austrians brought on a brief, but to the Italians destructive, mêlée. They broke through an interval between the third and fourth Italian ships. The unarmed Austrian ships headed to attack the unarmed Italians in the rear. At this point an incident occurred to which an exaggerated importance was given. The Italian ironclad “Ré di Portogallo” of 5600 tons, in the rear of the line, stood out to cover the unarmoured squadron by ramming the Austrians. She was herself rammed by the wooden “Kaiser” (5000 tons), but received little injury, while the Austrian was much injured. The “Kaiser” and the wooden vessels then

made for the protection of fort San Giorgio on Lissa unpursued. In the centre, where the action was hottest, the Austrian flagship "Ferdinand Max" of 5200 tons rammed and sank the "Ré d'Italia." The Italian "Palestro" of 2000 tons was fired by a shell and blew up. By midday the Italians were in retreat, and Tegethoff anchored at San Giorgio. His squadron had suffered very little from the wild fire of the Italians. The battle of the 20th July was the first fought at sea by modern ironclad steam fleets, and therefore attracted a great deal of attention. The sinking of the "Ré d'Italia" and the ramming of the "Portogallo" by the "Kaiser" gave an immense impulse to the then popular theory that the ram would be a leading, if not the principal, weapon in modern sea warfare. This calculation has not been borne out by more recent experience, and indeed was not justified by the battle itself, in which the attempts to ram were many and the successes very few. The "Ré d'Italia" was struck only because she was suddenly and most injudiciously backed, so that she had no way on when charged by the "Ferdinand Max."

For the first battle of Lissa see James's *Naval History*, vol. v. (1837). A clear account of the second battle will be found in Sir S. Eardley-Wilmot's *Development of Navies* (London, 1892); see also H. W. Wilson's *Ironclads in Action* (London, 1896).

(D. H.)

LISSA (Polish *Lézno*), a town in the Prussian province of Posen, 25 m. N.E. from Glogau by rail and at the junction of lines to Breslau, Posen and Landsberg. Pop. (1905) 16,021. The chief buildings are the handsome

palace, the medieval town-hall, the four churches and the synagogue. Its manufactures consist chiefly of shoes, machinery, liqueurs and tobacco; it also possesses a large steam flour-mill, and carries on a brisk trade in grain and cattle.

Lissa owes its rise to a number of Moravian Brothers who were banished from Bohemia by the emperor Ferdinand I. in the 16th century and found a refuge in a village on the estate of the Polish family of Leszczynski. Their settlement received municipal rights in 1561. During the Thirty Years' War the population was reinforced by other refugees, and Lissa became an important commercial town and the chief seat of the Moravian Brothers in Poland. Johann Amos Comenius was long rector of the celebrated Moravian school here. In 1656 and 1707 Lissa was burned down.

See Voigt, *Aus Lissas erster Blütezeit* (Lissa, 1905), and Sanden, *Geschichte der Lissaer Schule* (Lissa, 1905).

LIST, FRIEDRICH (1789-1846), German economist, was born at Reutlingen, Württemberg, on the 6th of August 1789. Unwilling to follow the occupation of his father, who was a prosperous tanner, he became a clerk in the public service, and by 1816 had risen to the post of ministerial under-secretary. In 1817 he was appointed professor of administration and politics at the university of Tübingen, but the fall of the ministry in 1819 compelled him to resign. As a deputy to the Württemberg chamber, he was active in advocating administrative reforms. He was eventually expelled

from the chamber and in April 1822 sentenced to ten months' imprisonment with hard labour in the fortress of Asperg. He escaped to Alsace, and after visiting France and England returned in 1824 to finish his sentence, and was released on undertaking to emigrate to America. There he resided from 1825 to 1832, first engaging in farming and afterwards in journalism. It was in America that he gathered from a study of Alexander Hamilton's work the inspiration which made him an economist of his pronounced "National" views. The discovery of coal on some land which he had acquired made him financially independent, and he became United States consul at Leipzig in 1832. He strongly advocated the extension of the railway system in Germany, and the establishment of the *Zollverein* was due largely to his enthusiasm and ardour. His latter days were darkened by many misfortunes; he lost much of his American property in a financial crisis, ill-health also overtook him, and he brought his life to an end by his own hand on the 30th of November 1846.

List holds historically one of the highest places in economic thought as applied to practical objects. His principal work is entitled *Das Nationale System der Politischen Ökonomie* (1841). Though his practical conclusions were different from those of Adam Müller (1779-1829), he was largely influenced not only by Hamilton but also by the general mode of thinking of that writer, and by his strictures on the doctrine of Adam Smith. It was particularly against the cosmopolitan principle in the modern economical system that he protested, and against the absolute doctrine of free trade, which was in harmony with that principle. He gave prominence to the national idea, and insisted on the special requirements of each nation according to its circumstances and especially to the degree of its development.

He refused to Smith's system the title of the industrial, which he thought more appropriate to the mercantile system, and designated the former as

“the exchange-value system.” He denied the parallelism asserted by Smith between the economic conduct proper to an individual and to a nation, and held that the immediate private interest of the separate members of the community would not lead to the highest good of the whole. That the nation was an existence, standing between the individual and humanity, and formed into a unity by its language, manners, historical development, culture and constitution. That this unity must be the first condition of the security, wellbeing, progress and civilization of the individual; and private economic interests, like all others, must be subordinated to the maintenance, completion and strengthening of the nationality. The nation having a continuous life, its true wealth must consist—and this is List’s fundamental doctrine—not in the quantity of exchange-values which it possesses, but in the full and many-sided development of its productive powers. Its economic education should be more important than the immediate production of values, and it might be right that one generation should sacrifice its gain and enjoyment to secure the strength and skill of the future. In the sound and normal condition of a nation which has attained economic maturity, the three productive powers of agriculture, manufactures and commerce should be alike developed. But the two latter factors are superior in importance, as exercising a more effective and fruitful influence on the whole culture of the nation, as well as on its independence. Navigation, railways, all higher technical arts, connect themselves specially with these factors; whilst in a purely agricultural state there is a tendency to stagnation. But for the growth of the higher forms of industry all countries are not adapted—only those of the temperate zones, whilst the torrid regions have a natural monopoly in the production of certain raw materials; and thus between these two groups of countries a division of labour and confederation of powers spontaneously takes place.

List then goes on to explain his theory of the stages of economic development through which the nations of the temperate zone, which are

furnished with all the necessary conditions, naturally pass, in advancing to their normal economic state. These are (1) pastoral life, (2) agriculture, (3) agriculture united with manufactures; whilst in the final stage agriculture, manufactures and commerce are combined. The economic task of the state is to bring into existence through legislative and administrative action the conditions required for the progress of the nation through these stages. Out of this view arises List's scheme of industrial politics. Every nation, according to him, should begin with free trade, stimulating and improving its agriculture by intercourse with richer and more cultivated nations, importing foreign manufactures and exporting raw products. When it is economically so far advanced that it can manufacture for itself, then a system of protection should be employed to allow the home industries to develop themselves fully, and save them from being overpowered in their earlier efforts by the competition of more matured foreign industries in the home market. When the national industries have grown strong enough no longer to dread this competition, then the highest stage of progress has been reached; free trade should again become the rule, and the nation be thus thoroughly incorporated with the universal industrial union. What a nation loses for a time in exchange values during the protective period she much more than gains in the long run in productive power—the temporary expenditure being strictly analogous, when we place ourselves at the point of view of the life of the nation, to the cost of the industrial education of the individual. The practical conclusion which List drew for Germany was that she needed for her economic progress an extended and conveniently bounded territory reaching to the sea-coast both on north and south, and a vigorous expansion of manufactures and commerce, and that the way to the latter lay through judicious protective legislation with a customs union comprising all German lands, and a German marine with a Navigation Act. The national German spirit, striving after independence and power through union, and the national industry, awaking from its lethargy and eager to

recover lost ground, were favourable to the success of List's book, and it produced a great sensation. He ably represented the tendencies and demands of his time in his own country; his work had the effect of fixing the attention, not merely of the speculative and official classes, but of practical men generally, on questions of political economy; and his ideas were undoubtedly the economic foundation of modern Germany, as applied by the practical genius of Bismarck.

See biographies of List by Goldschmidt (Berlin, 1878) and Jentsch (Berlin, 1901), also *Fr. List, ein Vorläufer und ein Opfer für das Vaterland* (Anon., 2 vols., Stuttgart, 1877); M. E. Hirst's *Life of Friedrich List* (London, 1909) contains a bibliography and a reprint of List's *Outlines of American Political Economy* (1827).

LIST (O.E. *liste*, a Teutonic word, cf. Dut. *lijst*, Ger. *Leiste*, adapted in Ital. *lista* and Fr. *liste*), properly a border or edging. The word was thus formerly used of a geographical boundary or frontier and of the lobe of the ear. In current usage "list" is the term applied to the "selvage" of a piece of cloth, the edging, *i.e.* of a web left in an unfinished state or of different material from the rest of the fabric, to be torn or cut off when it is made up, or used for forming a seam. A similar edging prevents unravelling. The material, cut off and collected, is known as "list," and is used as a soft cheap material for making slippers, padding cushions, &c. Until the employment of rubber, list was used to stuff the cushions of billiard tables. The same word probably appears, in a plural form "lists," applied to the

barriers or palisades enclosing a space of ground set apart for tilting (see TOURNAMENT). It is thus used of any place of contest, and the phrase "to enter the lists" is frequently used in the sense of "to challenge." The word in this application was taken directly from the O. Fr. *lisse*, modern *lice*, in Med. Lat. *liciae*. This word is usually taken to be a Romanic adaptation of the Teutonic word. In medieval fortifications the *lices* were the palisades forming an outwork in front of the main walls of a castle or other fortified place, and the word was also used of the space enclosed between the palisades and the enceinte; this was used for exercising troops, &c. From a transference of "list," meaning edge or border, to a "strip" of paper, parchment, &c., containing a "list" of names, numbers, &c., comes the use of the word for an enumeration of a series of names of persons or things arranged in order for some specific purpose. It is the most general word for such an enumeration, other words, such as "register," "schedule," "inventory," "catalogue," having usually some particular connotation. The chief early use of list in this meaning was of the roll containing the names of soldiers; hence to "list a soldier" meant to enter a recruit's name for service, in modern usage "to enlist" him. There are numerous particular applications of "list," as in "civil list" (*q.v.*), "active or retired list" in the navy or army. The term "free list" is used of an enumeration of such commodities as may at a particular time be exempt from the revenue laws imposing an import duty.

The verb "to list," most commonly found in the imperative, meaning "hark!" is another form of "listen," and is to be referred, as to its ultimate origin, to an Indo-European root *klu*-, seen in Gr. κλύειν, to hear, κλέος, glory, renown, and in the English "loud." The same root is seen in Welsh *clûst* and Irish *clûas*, ear. Another word "list," meaning pleasure, delight, or, as a verb, meaning "to please, choose," is chiefly found in such phrases as "the wind bloweth where it listeth." This is from the O.E. *lystan*, cf. Dut. *lusten*, Ger. *lüsten*, to take pleasure in, and is also found in the English

doublet “lust,” now always used in the sense of an evil or more particularly sexual desire. It is probably an application of this word, in the sense of “inclination,” that has given rise to the nautical term “list,” for the turning over of a ship on to its side.

LISTA Y ARAGON, ALBERTO (1775-1848), Spanish poet and educationalist, was born at Seville on the 15th of October 1775. He began teaching at the age of fifteen, and when little over twenty was made professor of elocution and poetry at Seville university. In 1813 he was exiled, on political grounds, but pardoned in 1817. He then returned to Spain and, after teaching for three years at Bilbao, started a critical review at Madrid. Shortly afterwards he founded the celebrated college of San Mateo in that city. The liberal character of the San Mateo educational system was not favoured by the government, and in 1823 the college was closed. Lista after some time spent in Bayonne, Paris and London was recalled to Spain in 1833 to edit the official *Madrid Gazette*. He was one of the founders of the Ateneo, the free university of Madrid, and up till 1840 was director of a college at Cadiz. All the leading spirits of the young generation of Spaniards, statesmen, writers, soldiers and diplomatists came under his influence. He died at Seville on the 5th of October 1848.

LISTER, JOSEPH LISTER, 1st BARON (1827-), English surgeon, was born at Upton, in Essex, on the 5th of April 1827. His father, Joseph Jackson Lister, F.R.S., was eminent in science, especially in optical science, his chief claim to remembrance being that by certain improvements in lenses he raised the compound microscope from the position of a scientific toy, "distorting as much as it magnified," to its present place as a powerful engine of research. Other members of Lord Lister's family were eminent in natural science. In his boyhood Joseph Lister was educated at Quaker schools; first at Hitchin in Hertfordshire, and afterwards at Tottenham, near London. In 1844 he entered University College, London, as a student in arts, and took his B.A. degree at the University of London in 1847. He continued at University College as a medical student, and became M.B. and F.R.C.S. in 1852. The keen young student was not long in bringing his faculties to bear upon pathology and the practice of medicine. While house-surgeon at University College Hospital, he had charge of certain cases during an outbreak of hospital gangrene, and carefully observed the phenomena of the disease and the effects of treatment upon it. He was thus early led to suspect the parasitic nature of the disorder, and searched with the microscope the material of the spreading sore, in the hope of discovering in it some invading fungus; he soon convinced himself of the cardinal truth that its causes were purely local. He also minutely investigated cases of pyaemia, another terrible scourge of hospitals at that

time, and made *camera lucida* sketches of the appearances revealed by the microscope.

To realize Lister's work it is necessary to remember the condition of surgical practice at that date. About the middle of the 19th century the introduction of anaesthetics had relieved the patient of much of the horror of the knife, and the surgeon of the duty of speed in his work. The agony of the sufferer had naturally and rightly compelled the public to demand rapid if not slap-dash surgery, and the surgeon to pride himself on it. Within decent limits of precision, the quickest craftsman was the best. With anaesthetics this state of things at any rate was changed. The pain of the operation itself no longer counted, and the surgeon was enabled not only to be as cautious and sedulous as dexterous, but also to venture upon long, profound and intricate operations which before had been out of the question. Yet unhappily this new enfranchisement seemed to be but an ironical liberty of Nature, who with the other hand took away what she had given. Direct healing of surgical wounds ("by first intention"), far from being the rule, was a piece of luck too rare to enter into the calculations of the operator; while of the graver surgical undertakings, however successful mechanically, the mortality by sepsis was ghastly. Suppuration, phagedaena and septic poisonings of the system carried away even the most promising patients and followed even trifling operations. Often, too, these diseases rose to the height of epidemic pestilences, so that patients, however extreme their need, dreaded the very name of hospital, and the most skilful surgeons distrusted their own craft. New hospitals or new wards were built, yet after a very short time the new became as pestiferous as the old; and even scrupulous care in ventilation and housemaids' cleanliness failed to prevent the devastation. Surgery had enlarged its freedom, but only to find the weight of its new responsibilities more than it could bear.

When Lister was appointed to the chair of surgery in Glasgow the infirmary of that city was a hotbed of septic disease; so much so that his hospital visits evidently distressed him greatly. Windows were widely opened, piles of clean towels were supplied, but still the pestilence stalked through the wards. The building stands to-day as it stood then, with no substantial alteration; but by the genius of Lister its surgical wards are now as free from septic accidents as the most modern hospital in the land. James Simpson, early in the ’sixties, pathetically denounced the awful mortality of operations in hospitals, and indeed uttered desperate protests against the hospital system itself; yet, not long afterwards, Lister came to prove that it was not in the hospital that the causes of that mortality lay hidden, but in the operator himself, his tools and his assistants. Happily this beneficent discovery was made in time to preserve the inestimable boon of the hospital system from the counsels of despair. When Lister took up the task speculation was on the wrong tack; the oxygen of the air was then supposed to be the chief cause of the dissolution of the tissues, and to prevent access of air was impossible. For instance, a simple fracture, as of a bone of the leg, would do perfectly well, while in the very next bed a compound fracture—one, that is, where the skin is lacerated, and access to the seat of injury opened out—would go disastrously wrong. If the limb were amputated, a large proportion of such cases of amputation succumbed to septic poisoning.

On graduation as bachelor of medicine, Lister went to Edinburgh, where he soon afterwards became house-surgeon to Mr Syme; and he was much impressed by the skill and judgment of this great surgeon, and also by the superiority of his method of dressing recent wounds with dry lint, as compared with the “water dressing” in use at University College. Yet under these more favourable conditions the amelioration was only one of degree; in most wounds indeed “union by first intention” was rendered impossible by the presence of the silk ligatures employed for arresting bleeding, for

these could come away only by a process of suppuration. On the expiry of his house-surgeoncy in Edinburgh, Lister started in that city an extra-academical course of lectures on surgery; and in preparation for these he entered on a series of investigations into inflammation and allied subjects. These researches, which were detailed fully in three papers in *Phil. Trans.* (1859), and in his Croonian lecture to the Royal Society in 1863, testified to an earnestness of purpose, a persevering accuracy of observation and experiment and an insight of scientific conception which show that if Lister had never developed the aseptic method of surgery, he would have taken a very high place in pathology. In his speech in Paris at the Thirteenth International Congress of Medicine in 1900, Lord Lister said that he had done no more than seize upon Pasteur's discoveries and apply them to surgery. But though Lister saw the vast importance of the discoveries of Pasteur, he saw it because he was watching on the heights; and he was watching there alone. From Pasteur Lister derived no doubt two fruitful ideas: first, that decomposition in organic substances is due to living "germs"; and, secondly, that these lowly and minute forms of vegetable life spring always, like higher organisms, from parents like themselves, and cannot arise *de novo* in the animal body. After his appointment to the Glasgow chair in 1860, Lister had continued his researches on inflammation; and he had long been led to suspect that decomposition of the blood in the wound was the main cause of suppuration. The two great theories established by Pasteur seemed to Lister to open out the possibility of what had before appeared hopeless—namely, the prevention of putrefaction in the wound, and consequently the forestalling of suppuration. To exclude the oxygen of the air from wounds was impossible, but it might be practicable to protect them from microbes.

The first attempt to realize this idea was made upon compound fractures; and the means first employed was carbolic acid, the remarkable efficacy of which in deodorizing sewage made Lister regard it as a very powerful

germicide. It was applied to the wound undiluted, so as to form with the blood a dense crust, the surface of which was painted daily with the acid till all danger had passed. The results, after a first failure, were in the highest degree satisfactory, so that, as Lister said in his presidential address to the British Association in Liverpool, he “had the joy of seeing these formidable injuries follow the same safe and tranquil course as simple fractures.” The caustic property of undiluted carbolic acid, though insignificant in comparison with the far greater evils to be avoided in compound fracture, made it unsuited for general surgery. To make it applicable to the treatment of abscesses and incised wounds, it was necessary to mitigate its action by blending it with some inert body; and the endeavour to find the best medium for this purpose, such as to combine perfect antiseptic efficiency with the least possible irritation of the tissues, formed the subject of experiments continued for many years in the laboratory and in the ward. At one stage in these inquiries an attempt was made to provide an atmosphere free from living organisms by means of a fine spray of a watery solution of carbolic acid; for it was then supposed by Lister to be necessary not only to purify the surgeon’s hands and instruments and the skin of the patient about the seat of operation, but also to wage war with the microbes which, as Pasteur had shown, people every cubic inch of the air of an inhabited room. Under the use of the spray better results were obtained than ever before, and this success encouraged its use. But researches carried on for several years into the relations of the blood to micro-organisms led Lister to doubt the harmfulness of the atmospheric dust. At the London Congress in 1881 he narrated experiments which proved that the serum of the blood is a very unfavourable soil for the development of the bacteria diffused through the air, and others which showed that the cells of an organizing blood-clot have a very remarkable power of disposing of microbes and of limiting their advance. Hence he considered it probable that in surgical operations the atmosphere might be disregarded altogether.[1] As long, however, as this was

only a matter of probability, he did not dare to discard the spray. But at length, at the Berlin Congress in 1890, he was able to announce that the certainty he had so long desired had been arrived at. A careful consideration of the physical constitution of the spray had shown him that the microbes of the dust involved in its vortex could not possibly have their vitality destroyed or even impaired by it. Such being the case, the uniform success obtained when he had trusted the spray implicitly as an aseptic atmosphere, abandoning completely certain other precautions which he had before deemed essential, proved conclusively to his mind that the air might safely be left entirely out of consideration in operating.[2] Thus he learnt that not the spray only, but all antiseptic irrigations or washings of the wound also, with their attendant irritation of the cut surfaces, might be dispensed with—a great simplification, indirectly due to experiments with the spray. The spray had also served a very useful purpose by maintaining a pure condition of the entourage of the operation; not indeed in the way for which it was devised, but as a very mild form of irrigation. And Lister took care to emphasize the necessity for redoubled vigilance on the part of the surgeon and his assistants when this "unconscious caretaker," as he called it, had been discarded.

The announcement that he had given up the spray was absurdly interpreted in some quarters to mean that he had virtually abandoned his theory and his antiseptic methods. The truth is that the spray was only one of many devices tried for a while in the course of the long-continued endeavour to apply the antiseptic principle to the best advantage, and abandoned in favour of something better. Two main objects were always kept steadily in view by him—during the operation to guard the wound against septic microbes by such means as existing knowledge indicated, and afterwards to protect it against their introduction, avoiding at the same time all needless irritation of the tissues by the antiseptic. Upon the technical methods of attaining these ends this is not the place to enlarge; suffice it to

say that the endowments and the industry of the discoverer, as seen in the rapidity and flexibility of mind with which he seized upon and selected the best means, were little less remarkable than the activity of the same faculties in his original ideas.

To illustrate this opinion, his work on the ligature may be taken. It had long been the universal practice of surgeons to employ threads of silk or flax for tying arteries, long ends being left to provide escape of the pus (invariably formed during the tedious process of the separation of the ligature) together with the portion of the arterial coats included in the knot. Lister hoped that if, by antiseptic means, the thread were deprived of living microbes, it would no longer cause suppuration, but might be left with short cut ends to become embedded permanently among the tissues of the wound, which thus would be allowed to heal by primary union throughout. A trial of this method upon the carotid artery of a horse having proved perfectly successful, he applied it in a case of aneurysm in the human subject; and here again the immediate results were all that could be desired. But a year later, the patient having died from other causes, the necropsy showed remnants of the silk thread incompletely absorbed, with appearances around them which seemed to indicate that they had been acting as causes of disturbance. Thus was suggested to him the idea of employing for the ligature some material susceptible of more speedy absorption; and the antiseptic treatment of contused wounds having shown that dead tissue, if protected from putrefaction, is removed by the surrounding structures without the intervention of suppuration, he resolved to try a thread of some such nature. Catgut, which is prepared from one of the constituents of the small intestine of the sheep, after steeping in a solution of carbolic acid, was used in a preliminary trial upon the carotid artery of a calf. The animal was killed a month later, when, on dissection, a very beautiful result was disclosed. The catgut, though removed, had not been simply absorbed; pari passu with its gradual removal, fibrous tissue of new formation had been

laid down, so that in place of the dead catgut was seen a living ligature embracing the artery and incorporated with it. The wound meanwhile had healed without a trace of suppuration. This success appeared to justify the use of the catgut ligature in the human subject, and for a while the results were entirely satisfactory. But though this was the case with the old samples of catgut first employed, which, as Lister was afterwards led to believe, had been "seasoned" by long keeping, it was found that when catgut was used fresh as it comes from the makers, it was unsuited in various ways for surgical purposes. The attempt by special preparation to obtain an article in all respects trustworthy engaged his attention from time to time for years afterwards. To quote the words of Sir Hector Cameron, who was for several years assistant to Lord Lister, it required "labour and toilsome investigation and experiment of which few can have any adequate idea."

In 1869 Lister succeeded his father-in-law, Syme, in the chair of clinical surgery of Edinburgh. In 1877 he accepted an invitation to the chair of surgery at King's College, London, in the anticipation that here he would be more centrally placed for communication with the surgical world at home and abroad, and might thus exercise his beneficent mission to more immediate advantage. In 1896 Lister retired from practice, but not from scientific study. From 1895 to 1900 he was President of the Royal Society. In 1883 he was created a baronet, and in 1897 he was raised to the peerage as Baron Lister of Lyme Regis. Among the Coronation honours in 1902, he was nominated an original member of the new Order of Merit.

In England Lister's teaching was slow in making its way. The leading surgeons of Germany were among the first to seize upon the new idea with avidity and practical success; so early as 1875, in the course of a tour he made on the Continent, great festivals were held in his honour in Munich and Leipzig. The countrymen of Pasteur did not lag far behind; and it is no

exaggeration to speak of Lister's appearances in foreign countries at this time as triumphal.

The relation of Semmelweiss to Lister is of historical importance. Lister's work on the antiseptic system began in 1864; his first publication on the subject was in March 1867. At this date, and for long afterwards, Semmelweiss was unknown, or ignored, not only by French and Germans, but also by his own Hungarian people; and this neglect broke his heart. The French Academy pronounced against his opinions, and so did the highest pathological authority in Germany. In England, till long after his death, probably his name was not so much as mentioned. In the early 'seventies Lister's method was in full operation in Hungary as elsewhere, yet none of the surgeons of Budapest ever mentioned Semmelweiss; not even when, in 1883, they gave a great banquet to Lister. It was after this occasion that Dr Duka, a Hungarian physician practising in London, wrote a biography of Semmelweiss, which he sent to Lister, and thus brought Semmelweiss before him for the first time. Thenceforth Lister generously regarded Semmelweiss as in some measure his forerunner; though Semmelweiss was not aware of the microbic origin of septic poisons, nor were his methods, magnificent as was their success in lying-in hospitals, suitable for surgical work.

In public Lord Lister's speeches were simple, clear and graceful, avoiding rhetorical display, earnest for the truth, jealous for his science and art, forgetful of himself. His writings, in like manner plain, lucid and forcible, scarcely betray the labour and thought of their production. With the courtesy and serenity of his carriage he combined a passionate humanity, so often characteristic of those who come of the Society of Friends, and a simple love of truth which showed itself in his generous encouragement of younger workers.

(T. C. A.)

1 See *Trans. of the International Medical Congress* (1881), vol. ii. p. 373.

2 See *Verhandlungen des X internationalen Congresses*, Bd. i. p. 33.

LISTER, MARTIN (*c.* 1638-1712), English naturalist and physician, was born at Radclive, near Buckingham. He was nephew of Sir Matthew Lister, physician to Anne, queen of James I., and to Charles I. He was educated at St John's College, Cambridge, 1655, graduated in 1658/9, and was elected a fellow in 1660. He became F.R.S. in 1671. He practised medicine at York until 1683, when he removed to London. In 1684 he received the degree of M.D. at Oxford, and in 1687 became F.R.C.P. He contributed numerous articles on natural history, medicine and antiquities to the *Philosophical Transactions*. His principal works were *Historiae animalium Angliae tres tractatus* (1678); *Historiae Conchyliorum* (1685-1692), and *Conchyliorum Bivalvium* (1696). As a conchologist he was held in high esteem, but while he recognized the similarity of fossil mollusca to living forms, he regarded them as inorganic imitations produced in the rocks. In 1683 he communicated to the Royal Society (*Phil. Trans.*, 1684), *An ingenious proposal for a new sort of maps of countries; together with tables of sands and clays, such as are chiefly found in the north parts of England*. In this essay he suggested the preparation of a soil or mineral map of the country, and thereby is justly credited with being the first to realize the importance of a geological survey. He died at Epsom on the 2nd of February 1712.

LISTON, JOHN (*c.* 1776-1846), English comedian, was born in London. He made his public *début* on the stage at Weymouth as Lord Duberley in *The Heir-at-law*. After several dismal failures in tragic parts, some of them in support of Mrs Siddons, he discovered accidentally that his *forte* was comedy, especially in the personation of old men and country boys, in which he displayed a fund of drollery and broad humour. An introduction to Charles Kemble led to his appearance at the Haymarket on the 10th of June 1805 as Sheepface in the *Village Lawyer*, and his association with this theatre continued with few interruptions until 1830. *Paul Pry*, the most famous of all his impersonations, was first presented on the 13th of September 1825, and soon became, thanks to his creative genius, a real personage. Liston remained on the stage till 1837; during his last years his mind failed, and he died on the 22nd of March 1846. He had married in 1807 Miss Tyrer (d. 1854), a singer and actress.

Several pictures of Liston in character are in the Garrick Club, London, and one as Paul Pry in the South Kensington Museum.

LISTON, ROBERT (1794-1847), Scottish surgeon, was born on the 28th of October 1794 at Ecclesmachan, Linlithgow, where his father was parish minister. He began the study of anatomy under Dr John Barclay (1758-1826) at Edinburgh in 1810, and soon became a skilful anatomist. After eight years' study, he became a lecturer on anatomy and surgery in the Edinburgh School or Medicine; and in 1827 he was elected one of the surgeons to the Royal Infirmary. In 1835 he was chosen professor of clinical surgery in University College, London, and this appointment he held until his death, which occurred in London on the 7th of December 1847. Liston was a teacher more by what he did than by what he said. He taught simplicity in all operative procedures; fertile in expedients, of great nerve and of powerful frame, he is remembered as an extraordinarily bold, skilful and rapid operator. He was the author of *The Elements of Surgery* (1831-1832) and *Practical Surgery* (1837), and made several improvements in methods of amputation, and in the dressing of wounds.

LISZT, FRANZ (1811-1886), Hungarian pianist and composer, was born on the 22nd of October 1811, at Raiding, in Hungary. His appeal to musicians was made in a threefold capacity, and we have, therefore, to deal with Liszt the unrivalled pianoforte virtuoso (1830-1848); Liszt the conductor of the "music of the future" at Weimar, the teacher of Tausig, Bülow and a host of lesser pianists, the eloquent writer on music and musicians, the champion of Berlioz and Wagner (1848-1861); and Liszt the prolific composer, who for some five-and-thirty years continued to put forth

pianoforte pieces, songs, symphonic orchestral pieces, cantatas, masses, psalms and oratorios (1847-1882). As virtuoso he held his own for the entire period during which he chose to appear in public; but the militant conductor and prophet of Wagner had a hard time of it, and the composer's place is still in dispute. Liszt's father, a clerk to the agent of the Esterhazy estates and an amateur musician of some attainment, was Hungarian by birth and ancestry, his mother an Austrian-German. The boy's gifts attracted the attention of certain Hungarian magnates, who furnished 600 gulden annually for some years to enable him to study music at Vienna and Paris. At Vienna he had lessons in pianoforte playing from Carl Czerny of "Velocity" fame, and from Salieri in harmony and analysis of scores. In his eleventh year he began to play in public there, and Beethoven came to his second concert in April 1823. During the three years following he played in Paris, the French provinces and Switzerland, and paid three visits to England. In Paris he had composition lessons from Paër, and a six months' course of lessons in counterpoint from Reicha. In the autumn of 1825 the handsome and fascinating *enfant gâté* of the salons and ateliers—"La Neuvième Merveille du monde"—had the luck to get an operetta (*Don Sancho*) performed three times at the Académie Royale. The score was accidentally destroyed by fire, but a set of studies à la Czerny and Cramer, belonging to 1826 and published at Marseilles as 12 Études, op. i., is extant, and shows remarkable precocity. After the death of his father in 1828 young Liszt led the life of a teacher of the pianoforte in Paris, got through a good deal of miscellaneous reading, and felt the influence of the religious, literary and political aspirations of the time. He attended the meetings of the Saint-Simonists, lent an ear to the romantic mysticism of Père Enfantin and later to the teaching of Abbé Lamennais. He also played Beethoven and Weber in public—a very courageous thing in those days. The appearance of the violinist Paganini in Paris, 1831, marks the starting-point of the supreme eminence Liszt ultimately attained as a virtuoso. Paganini's marvellous

technique inspired him to practise as no pianist had ever practised before. He tried to find equivalents for Paganini's effects, transcribed his violin caprices for the piano, and perfected his own technique to an extraordinary degree. After Paganini he received a fresh impulse from the playing and the compositions of Chopin, who arrived in 1831, and yet another impulse of equal force from a performance of Berlioz's "Symphonie Fantastique, épisode de la vie d'un artiste," in 1832. Liszt transcribed this work, and its influence ultimately led him to the composition of his "Poèmes symphoniques" and other examples of orchestral programme-music.

From 1833 to 1848—when he gave up playing in public—he was greeted with frantic applause as the prince of pianists. Five years (1835-1840) were spent in Switzerland and Italy, in semi-retirement in the company of Madame la comtesse d'Agoult (George Sand's friend and would-be rival, known in literary circles as "Daniel Stern," by whom Liszt had three children, one of them afterwards Frau Cosima Wagner): these years were devoted to further study in playing and composition, and were interrupted only by occasional appearances at Geneva, Milan, Florence and Rome, and by annual visits to Paris, when a famous contest with Thalberg took place in 1837. The enthusiasm aroused by Liszt's playing and his personality—the two are inseparable—reached a climax at Vienna and Budapest in 1839-1840, when he received a patent of nobility from the emperor of Austria, and a sword of honour from the magnates of Hungary in the name of the nation. During the eight years following he was heard at all the principalcentres—including London, Leipzig, Berlin, Copenhagen, St Petersburg, Moscow, Warsaw, Constantinople, Lisbon and Madrid. He gained much money, and gave large sums in charity. His munificence with regard to the Beethoven statue at Bonn made a great stir. The subscriptions having come in but sparsely, Liszt took the matter in hand, and the monument was completed at his expense, and unveiled at a musical festival conducted by Spohr and himself in 1845. In 1848 he settled at Weimar with

Princess Sayn-Wittgenstein (d. 1887), and remained there till 1861. During this period he acted as conductor at court concerts and on special occasions at the theatre, gave lessons to a number of pianists, wrote articles of permanent value on certain works of Berlioz and the early operas of Wagner, and produced those orchestral and choral pieces upon which his reputation as a composer mainly depends. His ambition to found a school of composers as well as a school of pianists met with complete success on the one hand and partial failure on the other. His efforts on behalf of Wagner, who was then an exile in Switzerland, culminated in the first performance of *Lohengrin* on the 28th of August 1850, before a special audience assembled from far and near. Among the works produced for the first time or rehearsed with a view to the furtherance of musical art were Wagner's *Tannhäuser*, *Der fliegende Holländer*, *Das Liebesmahl der Apostel*, and *Eine Faust Overtüre*, Berlioz's *Benvenuto Cellini*, the *Symphonie Fantastique*, *Harold en Italie*, *Roméo et Juliette*, *La Damnation de Faust*, and *L'Enfance du Christ*—the last two conducted by the composer—Schumann's *Genoveva*, *Paradise and the Peri*, the music to *Manfred* and to *Faust*, Weber's *Euryanthe*, Schubert's *Alfonso und Estrella*, Raff's *König Alfred*, Cornelius's *Der Barbier von Baghdad* and many more. It was Liszt's habit to recommend novelties to the public by explanatory articles or essays, which were written in French (some for the *Journal des débats* and the *Gazette musicale* of Paris) and translated for the journals of Weimar and Leipzig—thus his two masterpieces of sympathetic criticism, the essays *Lohengrin et Tannhäuser à Weimar* and *Harold en Italie*, found many readers and proved very effective. They are now included, together with articles on Schumann and Schubert, and the elaborate and rather high-flown essays on Chopin and *Des Bohémiens et de leur musique en Hongrie* (the latter certainly, and the former probably, written in collaboration with Madame de Wittgenstein), in his *Gesammelte Schriften* (6 vols., Leipzig). The compositions belonging to the period of his residence at Weimar

comprise two pianoforte concertos, in E flat and in A, the “Todtentanz,” the “Concerto pathétique” for two pianos, the solo sonata “An Robert Schumann,” sundry “Études,” fifteen “Rhapsodies Hongroises,” twelve orchestral “Poèmes symphoniques,” “Eine Faust Symphonie,” and “Eine Symphonie zu Dante’s ‘Divina Commedia,’” the “13th Psalm” for tenor solo, chorus and orchestra, the choruses to Herder’s dramatic scenes “Prometheus,” and the “Missa solennis” known as the “Graner Fest Messe.” Liszt retired to Rome in 1861, and joined the Franciscan order in 1865.[1] From 1869 onwards Abbé Liszt divided his time between Rome and Weimar, where during the summer months he received pupils—gratis as formerly—and, from 1876 up to his death at Bayreuth on the 31st of July 1886, he also taught for several months every year at the Hungarian Conservatoire of Budapest.

About Liszt’s pianoforte technique in general it may be said that it derives its efficiency from the teaching of Czerny, who brought up his pupil on Mozart, a little Bach and Beethoven, a good deal of Clementi and Hummel, and a good deal of his (Czerny’s) own work. Classicism in the shape of solid, respectable Hummel on the one hand, and Carl Czerny, a trifle flippant, perhaps, and inclined to appeal to the gallery, on the other, these gave the musical parentage of young Liszt. Then appears the Parisian Incroyable and grand seigneur—“Monsieur Lits,” as the Parisians called him. Later, we find him imitating Paganini and Chopin, and at the same time making a really passionate and deep study of Beethoven, Weber, Schubert, Berlioz. Thus gradually was formed the master of style—whose command of the instrument was supreme, and who played like an inspired poet. Liszt’s strange musical nature was long in maturing its fruits. At the pianoforte his achievements culminate in the two books of studies, twice rewritten, and finally published in 1852 as *Études d’exécution transcendante*, the *Études de concert* and the *Paganini Studies*; the two concertos and the *Todtentanz*, the *Sonata in B minor*, the *Hungarian*

Rhapsodies and the fine transcriptions of Beethoven's symphonies (the 9th for two pianofortes as well as solo), and of Berlioz's *Symphonie fantastique*, and the symphony, *Harold en Italie*. In his orchestral pieces of Liszt appears —next to Berlioz—as the most conspicuous and most thorough-going representative of programme music, *i.e.* instrumental music expressly contrived to illustrate in detail some poem or some succession of ideas or pictures. It was Liszt's aim to bring about a direct alliance or amalgamation of instrumental music with poetry. To effect this he made use of the means of musical expression for purposes of illustration, and relied on points of support outside the pale of music proper. There is always danger of failure when an attempt is thus made to connect instrumental music with conceptions not in themselves musical, for the order of the ideas that serve as a programme is apt to interfere with the order which the musical exposition naturally assumes—and the result in most cases is but an amalgam of irreconcilable materials. In pieces such as Liszt's "Poèmes symphoniques," *Ce qu'on entend sur la montagne* (1848-1856), after a poem by Victor Hugo, and *Die Ideale* (1853-1857), after a poem by Schiller, the hearer is bewildered by a series of startling orchestral effects which succeed one another apparently without rhyme or reason. The music does not conform to any sufficiently definite musical plan—it is hardly intelligible as music without reference to the programme. Liszt's masterpiece in orchestral music is the *Dante Symphony* (1847-1855), the subject of which was particularly well suited to his temperament, and offered good chances for the display of his peculiar powers as a master of instrumental effect. By the side of it ranks the *Faust Symphony* (1854-1857), in which the moods of Goethe's characters—Faust, Gretchen and Mephistopheles—are depicted in three instrumental movements, with a chorus of male voices, supplying a kind of comment, by way of close. The method of presentation in both symphonies is by means of representative themes (*Leitmotif*), and their combination and interaction. Incidents of the

poem or the play are illustrated or alluded to as may be convenient, and the exigencies of musical form are not unfrequently disregarded for the sake of special effects. Of the twelve Poèmes symphoniques, *Orphée* is the most consistent from a musical point of view, and is exquisitely scored. Melodious, effective, readily intelligible, with a dash of the commonplace, *Les Préludes*, *Tasso*, *Mazeppa* and *Fest-Klänge* bid for popularity. In these pieces, as in almost every production of his, in lieu of melody Liszt offers fragments of melody—touching and beautiful, it may be, or passionate, or tinged with triviality; in lieu of a rational distribution of centres of harmony in accordance with some definite plan, he presents clever combinations of chords and ingenious modulations from point to point; in lieu of musical logic and consistency of design, he is content with rhapsodical improvisation. The power of persistence seems wanting. The musical growth is spoilt, the development of the themes is stopped, or prevented, by some reference to extraneous ideas. Everywhere the programme stands in the way. In much of Liszt's vocal music, particularly in the songs and choral pieces written to German words, an annoying discrepancy is felt to exist between the true sound of the words and the musical accents. The music is generally emotional, the expression direct and passionate; there is no lack of melodic charm and originality, yet the total effect is frequently disappointing. In the choral numbers of the five masses, and in the oratorios *Die Heilige Elisabeth* and *Christus*, the rarity of fugal polyphony acts as a drawback. Its almost complete absence in some of these works makes for monotony and produces a sense of dullness, which may not be inherent in all the details of the music, but is none the less distinctly present.

Omitting trifles and all publications that have been cancelled, the following list of compositions may be taken as fairly comprehensive:—

Pianoforte Pieces.—Études d'exécution transcendante; Études de concert; Zwei Etuden, Waldesrauschen, Gnomentanz; Ab Irato; Paganini

Studies; Années de Pélerinage, 3 sets; Harmonies poétiques et religieuses, 1-10; Consolations, 1-6; Ave Maria in E; Sonata in B minor; Konzert-Solo in E minor; Scherzo und Marsch; Ballades, I. II.; Polonaises, I. II.; Apparitions, 1-3; Berceuse; Valse impromptu; Mazurka brillant; 3 Caprices Valses; Galop chromatique; Mephisto-Walzer, I., II., III. and Polka; Zwei Legenden, "Die Vogelpredigt," "Der heilige Franciscus auf den Wogen schreitend"; "Der Weihnachtsbaum," 1-12; Sarabande und Chaconne ("Almira"); Elegies, I., II. and III.; La lugubre Gondola; Dem Andenken Petöfi's; Mosonyi's Grabgeleit; Romance oubliée; Valses oubliées, 1-3; Liebesträume, 1-3 (originally songs); Hexameron; Rhapsodies Hongroises, 1-18.

Pieces for Two Pianos.—Concerto pathétique (identical with the Konzert-Solo in E minor); Dante symphony; Faust symphony; Poèmes symphoniques, 1-12; Beethoven's 9th symphony.

Pianoforte with Orchestra.—Concertos I. in E flat, II. in A; Todtentanz; Fantasie ueber Motif aus Beethoven's "Ruinen von Athen"; Fantasie ueber Ungarische National Melodien; Schubert's Fantasia in C; Weber's Polacca in E.

Fantaisies de Concert for Piano Solo.—Don Juan; Norma; Sonnambula; I Puritani; Lucia, I., II.; Lucrezia, I., II.; La Juive; Robert le Diable; Les Huguenots; Le Prophète, 1-4. *Paraphrases*, Auber, Tarantella di bravura (Masaniello); Verdi, Rigoletto, Ernani, Il Trovatore; Mendelssohn, "Hochzeitsmarsch und Elfenreigen"; Gounod, Valse de Faust, Les Adieux de Roméo et Juliette; Tschaikowsky, Polonaise; Dargomiyski, Tarantelle; Cui, Tarantella; Saint-Saëns, Danse macabre; Schubert, Soirées de Vienne, Valses caprices, 1-9.

Transcriptions.—Beethoven's Nine Symphonies; Berlioz's "Symphonie fantastique," "Harold en Italie"; Bénédiction et Serment (Benvenuto

Cellini); Danse des Sylphes (Damnation de Faust); Weber's overtures, Der Freischütz, Euryanthe, Oberon, Jubilee; Beethoven's and Hummel's Septets; Schubert's Divertissement à la Hongroise; Beethoven's Concertos in C minor, G and E flat (orchestra for a second piano); Wagner's Tannhäuser overture, march, romance, chorus of pilgrims; Lohengrin, Festzug und Brautlied, Elsa's Brautgang, Elsa's Traum, Lohengrin's Verweiss an Elsa; Fliegender Holländer, Spinnlied; Rienzi, Gebet; Rheingold, Walhall; Meistersinger, "Am stillen Herd"; Tristan, Isolde's Liebestod; Chopin's six Chants Polonais; Meyerbeer's Schillermarsch; Bach's six organ Preludes and Fugues; Prelude and Fugue in G minor; Beethoven, Adelaide; 6 miscellaneous and 6 Geistliche Lieder; Liederkreis; Rossini's Les Soirées musicales; Schubert, 59 songs; Schumann, 13 songs; Mendelssohn, 8 songs; Robert Franz, 13 songs.

Organ Pieces.—Missa pro organo; Fantasia and Fugue, "Ad nos, ad salutarem undam"; B-A-C-H Fugue; Variations on Bach's Basso continuo, "Weinen, Klagen"; Bach's Introduction and Fugue, "Ich hatte viel Bekümmerniss"; Bach's Choral Fugue, "Lob und Ehre"; Nicolai's Kirchliche Festouvertüre, "Ein feste Burg"; Allegri's Miserere; Mozart's Ave Verum; Arcadelt's Ave Maria; Lasso's Regina Coeli.

Orchestral Pieces.—Eine Symphonie zu Dante's "Divina Commedia"; Eine Faust Symphonie; Poèmes symphoniques: 1. "Ce qu'on entend sur la montagne"; 2. Tasso; 3. Les Préludes; 4. Orphée; 5. Prométhée; 6. Mazeppa; 7. Fest-Klänge; 8. Héroïde funèbre; 9. Hungaria; 10. Hamlet; 11. Hunnenschlacht; 12. Die Ideale; Zwei Episoden aus Lenau's Faust: I. Der nächtliche Zug, II. Der Tanz in der Dorfschenke; Marches, Rakoczy, Goethe, Huldigung, "Vom Fels zum Meer" (for a military band); Ungarischer, Heroischer and Sturmmarsch; Le Triomphe funèbre du Tasse; "Von der Wiege bis zum Grab"; six Hungarian rhapsodies; four marches; four songs, and Die Allmacht, by Schubert.

Vocal Music.—Oratorios: “Die Legende von der Heiligen Elisabeth,” “Christus,” “Stanislaus” (unfinished). Masses: Missa solennis for the inauguration of the cathedral at Gran; Ungarische Krönungs-messe; Missa choralis (with organ); Missa and Requiem for male voices (with organ); Psalms, 13, 137, 23 and 18; 12 Kirchen-Chor-Gesänge (with organ). Cantatas: Prometheus-chöre; “Beethoven Cantata”; “An die Künstler”; Die Glocken des Strassburger Münsters; 12 Chöre für Männergesang; Songs, 8 books; Scena, Jeanne d’Arc au bûcher.

Melodramatic Pieces for Declamation, with Pianoforte Accompaniment.—Leonore (Bürger); Der traurige Mönch (Lenau); Des todten Dichter’s Liebe (Jokai); Der blinde Sänger (Tolstoy).

Editions, Text and Variants.—Beethoven’s Sonatas; Weber’s Concertstück and Sonatas; Schubert Fantasia, 4 Sonatas, Impromptus, Valses and Moments musicaux.

See also L. Ramaun, *Fr. Liszt als Künstler und Mensch* (1880-1894); E. Dannreuther, *Oxford Hist. of Music*, vol. vi.(1905). (E. Da.)

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1 It is understood that, in point of fact, the Princess Wittgenstein was determined to marry Liszt; and as neither he nor her family wished their connexion to take this form, Cardinal Hohenlohe quietly had him ordained.—[Ed. *E.B.*].

LITANY. This word (λιτανεία), like λιτή (both from λίτομαι), is used by Eusebius and Chrysostom, commonly in the plural, in a general

sense, to denote a prayer or prayers of any sort, whether public or private; it is similarly employed in the law of Arcadius (*Cod. Theod.* xvi. tit. 5, leg. 30), which forbids heretics to hold assemblies in the city "ad litaniam faciendam." But some trace of a more technical meaning is found in the epistle (*Ep.* 63) of Basil to the church of Neocaesarea, in which he argues, against those who were objecting to certain innovations, that neither were "litanies" used in the time of Gregory Thaumaturgus. The nature of the recently introduced litanies, which must be assumed to have been practised at Neocaesarea in Basil's day, can only be conjectured; probably they had many points in common with the "rogationes," which, according to Sidonius Apollinaris, had been coming into occasional use in France about the beginning of the 5th century, especially when rain or fine weather was desired, and, so far as the three fast days before Ascension were concerned, were first fixed, for one particular district at least, by Mamertus or Mamercus of Vienne (A.D. *c.* 450). We gather that they were penitential and intercessory prayers offered by the community while going about in procession, fasting and clothed in sackcloth. In the following century the manner of making litanies was to some extent regulated for the entire Eastern empire by one of the *Novels* of Justinian, which forbade their celebration without the presence of the bishops and clergy, and ordered that the crosses which were carried in procession should not be deposited elsewhere than in churches, nor be carried by any but duly appointed persons. The first synod of Orleans (A.D. 511) enjoins for all Gaul that the "litanies" before Ascension be celebrated for three days; on these days all menials are to be exempt from work, so that every one may be free to attend divine service. The diet is to be the same as in Quadragesima; clerks not observing these rogations are to be punished by the bishop. In A.D. 517 the synod of Gerunda provided for two sets of "litanies"; the first were to be observed for three days (from Thursday to Saturday) in the week after Pentecost with fasting, the second for three days from November 1. The

second council of Vaison (529), consisting of twelve bishops, ordered the *Kyrie eleison*—now first introduced from the Eastern Church—to be sung at matins, mass and vespers.

A synod of Paris (573) ordered litanies to be held for three days at the beginning of Lent, and the fifth synod of Toledo (636) appointed litanies to be observed throughout the kingdom for three days from December 14. The first mention of the word litany in connexion with the Roman Church goes back to the pontificate of Pelagius I. (555), but implies that the thing was at that time already old. In 590 Gregory I., moved by the pestilence which had followed an inundation, ordered a "litania septiformis," sometimes called *litania major*, that is to say, a sevenfold procession of clergy, laity, monks, virgins, matrons, widows, poor and children. It must not be confused with the *litania septena* used in church on Easter Even. He is said also to have appointed the processions or litanies of April 25 (St Mark's day), which seem to have come in the place of the ceremonies of the old Robigalia. In 747 the synod of Cloveshoe ordered the litanies or rogations to be gone about on April 25 "after the manner of the Roman Church," and on the three days before Ascension "after the manner of our ancestors." The latter are still known in the English Church as Rogation Days. Games, horse racing, junkettings were forbidden; and in the litanies the name of Augustine was to be inserted after that of Gregory. The reforming synod of Mainz in 813 ordered the major litany to be observed by all for three days in sackcloth and ashes, and barefoot. The sick only were exempted.

As regards the form of words prescribed for use in these "litanies" or "supplications," documentary evidence is defective. Sometimes it would appear that the "procession" or "litany" did nothing else but chant *Kyrie eleison* without variation. There is no reason to doubt that from an early period the special written litanies of the various churches all showed the common features which are now regarded as essential to a litany, in as far

as they consisted of (1) invocations, (2) deprecations, (3) intercessions, (4) supplications. But in details they must have varied immensely. The offices of the Roman Catholic Church at present recognize two litanies, the "Litaniae majores" and the "Litaniae breves," which differ from one another chiefly in respect of the fulness with which details are entered upon under the heads mentioned above. It is said that in the time of Charlemagne the angels Orihel, Raguhel, Tobihel were invoked, but the names were removed by Pope Zacharias as really belonging to demons. In some medieval litanies there were special invocations of S. Fides, S. Spes, S. Charitas. The litanies, as given in the Breviary, are at present appointed to be recited on bended knee, along with the penitential psalms, in all the six week-days of Lent when ordinary service is held. Without the psalms they are said on the feast of Saint Mark and on the three rogation days. A litany is chanted in procession before mass on Holy Saturday. The "litany" or "general supplication" of the Church of England, which is appointed "to be sung or said after morning prayer upon Sundays, Wednesdays and Fridays, and at other times when it shall be commanded by the ordinary," closely follows the "Litaniae majores" of the Breviary, the invocations of saints being of course omitted. A similar German litany will be found in the works of Luther. In the Roman Church there are a number of special litanies peculiar to particular localities or orders, such as the "Litanies of Mary" or the "Litanies of the Sacred Name of Jesus."

There was originally a close connexion between the litany and the liturgy (*q.v.*). The ninefold *Kyrie eleison* at the beginning of the Roman Mass is a relic of a longer litany of which a specimen may still be seen in the Stowe missal. In the Ambrosian liturgy, the threefold *Kyrie eleison* or Lesser Litany occurs thrice, after the *Gloria in excelsis*, after the gospel and at the end of Mass; and on the first five Sundays in Lent a missal litany is placed before the *Oratio super populum*, and on the same five Sundays in the Mozarabic rite before the epistle. In Eastern liturgies litanies are a

prominent feature, as in the case of the deacon's litany at the beginning of the *Missa fidelium* in the Clementine liturgy, immediately before the *Anaphora* in the Greek liturgy of St James, &c.

(F. E. W.)

LITCHFIELD, a township and the county-seat of Litchfield county, Connecticut, U.S.A., about 28 m. W. of Hartford, and including the borough of the same name. Pop. of the township (1890) 3304; (1900) 3214; (1910) 3005; of the borough (1890) 1058; (1900) 1120; (1910) 903. Area of the township, 48.6 sq. m. The borough is served by the New York, New Haven & Hartford railroad. It is situated on elevated land, and is one of the most attractive of southern New England summer resorts. The principal elevation in the township is Mt. Prospect, at the base of which there is a vein of pyrrhotite, with small quantities of nickel and copper. On the southern border of the borough is Lake Bantam (about 900 acres, the largest lake in the state) whose falls, at its outlet, provide water power for factories of carriages and electrical appliances. Dairying is the most important industry, and in 1899 the county ranked first among the counties of the state in the value of its dairy products—$1,373,957, from 3465 farms, the value of the product for the entire state being $7,090,188.

The lands included in the township of Litchfield (originally called Bantam) were bought from the Indians in 1715-1716 for £15. the Indians reserving a certain part for hunting. The township was incorporated in 1719, was named Litchfield, after Lichfield in England, and was settled by

immigrants from Hartford, Windsor, Wethersfield, Farmington and Lebanon (all within the state) in 1720-1721. In 1751 it became the county-seat of Litchfield county, and at the same time the borough of Litchfield (incorporated in 1879) was laid out. From 1776 to 1780 two depôts for military stores and a workshop for the Continental army were maintained, and the leaden statue of George III., erected in Bowling Green, New York City, in 1770, and torn down by citizens on the 9th of July 1776, was cut up and taken to Litchfield, where, in the house (still standing) of Oliver Wolcott it was melted into bullets for the American army by Wolcott's daughter and sister. Aaron Burr, whose only sister married Tapping Reeve (1744-1823), lived in Litchfield with Reeve in 1774-1775. In 1784 Reeve established here the Litchfield Law School, the first institution of its kind in America. In 1798 he associated with himself James Gould (1770-1838), who, after Reeve's retirement in 1820, continued the work, with the assistance of Jabez W. Huntington (1788-1847), until 1833. The school was never incorporated, it had no buildings, and the lectures were delivered in the law offices of its instructors, but among its 1000 or more students were many who afterwards became famous, including John C. Calhoun; Levi Woodbury (1789-1851), United States senator from New Hampshire in 1825-1831 and in 1841-1845, secretary of the navy in 1831-1834 and of the treasury in 1834-1841, and a justice of the United States Supreme Court from 1845; John Y. Mason; John M. Clayton; and Henry Baldwin (1780-1844), a justice of the United States Supreme Court from 1830. In 1792 Mrs Sarah Pierce made one of the first efforts toward the higher education of women in the United States by opening in Litchfield her Female Seminary, which had an influential career of about forty years, and numbered among its alumnae Harriet Beecher Stowe, Mrs Marshall O. Roberts, Mrs Cyrus W. Field and Mrs Hugh McCulloch. Litchfield was the birthplace of Ethan Allen; of Henry Ward Beecher; of Harriet Beecher Stowe, whose novel, *Poganuc People*, presents a picture of social conditions in Litchfield during

her girlhood; of Oliver Wolcott, Jr. (1760-1833); of John Pierpont (1785-1866), the poet, preacher and lecturer; and of Charles Loring Brace, the philanthropist. It was also the home, during his last years, of Oliver Wolcott (1726-1797); of Colonel Benjamin Tallmadge (1774-1835), an officer on the American side in the War of Independence and later (from 1801 to 1817) a Federalist member of Congress; and of Lyman Beecher, who was pastor of the First Congregational church of Litchfield from 1810 to 1826.

See Payne K. Kilbourne, *Sketches and Chronicles of the Town of Litchfield, Connecticut* (Hartford, Conn., 1859); George C. Boswell, *The Litchfield Book of Days* (Litchfield, 1900); and for an account of the Litchfield Female Seminary, Emily N. Vanderpoel, *Chronicles of a Pioneer School* (Cambridge, Mass., 1903).

LITCHFIELD, a city of Montgomery county, Illinois, U.S.A., about 50 m. N. E. of St Louis, Missouri. Pop. (1900) 5918; (1910) 5971. Its principal importance is as a railway and manufacturing centre; it is served by the Chicago, Burlington & Quincy, the Chicago & Alton, the Cleveland, Cincinnati, Chicago & St Louis, the Illinois Central, the Wabash, and the Litchfield & Madison railways, and by electric lines connecting with St Louis and the neighbouring towns. In the vicinity are deposits of bituminous coal, fire-clay and moulding sand. There are various manufactures in the city. Litchfield was incorporated as a town in 1856, and was first chartered as a city in 1859.

LITCHI, or LEE-CHEE, the fruit of *Nephelium Litchi*, a small tree, native of southern China and one of the most important indigenous fruits. It is also cultivated in India. The tree bears large compound leaves with two to four pairs of leathery lanceolate pointed leaflets about 3 in. long, and panicles of small flowers without petals. The fruits are commonly roundish, about 1½ in. in diameter, with a thin, brittle, red shell which bears rough protuberances. In the fresh state they are filled with a sweet white pulp which envelops a large brown seed, but in the dried condition the pulp forms a blackish fleshy substance. The pulp is of the nature of an aril, that is, an additional seed-coat.

Nephelium Longana, the longan tree, also a native of southern China, is cultivated in that country, in the Malay Peninsula, India and Ceylon for its fruit, which is smaller than that of the litchi, being half an inch to an inch in diameter with a nearly smooth yellowish-brown brittle skin, and containing a pulpy aril resembling that of the litchi in flavour. Another species, *N. lappaceum*, a tall tree native of the Malay Peninsula, where it is known under the names Rambutan or Rambosteen, is also cultivated for its pleasantly acid pulpy aril. The fruit is oval, bright red in colour, about 2 in. long and covered with long fleshy hairs.

Nephelium belongs to the natural order Sapindaceae, and contains about twenty-two species.

LITERATURE, a general term which, in default of precise definition, may stand for the best expression of the best thought reduced to writing. Its various forms are the result of race peculiarities, or of diverse individual temperaments, or of political circumstances securing the predominance of one social class which is thus enabled to propagate its ideas and sentiments. In early stages of society, the classes which first attain a distinct literary utterance are priests who compile the chronicles of tribal religious development, or rhapsodes who celebrate the prowess of tribal chiefs. As man feels before he reasons, so poetry generally precedes prose. It embodies more poignantly the sentiment of unsophisticated man. Hence sacred books and war-songs are everywhere the earliest literary monuments, and both are essentially poetic compositions which have received a religious or quasi-religious sanction. The recitation of the Homeric poems at the Panathenaea corresponds to the recitation elsewhere of the sacred texts in the temple; the statement of Phemios (*Odyssey*, xxii. 347) that a god inspired his soul with all the varied ways of song expresses the ordinary belief of early historical times. Versicles of the sacred chronicles, or fragments of epic poems, were learned by heart and supplied a standard of popular literary taste. The public declamation of long chosen passages by priests, and still more by contending rhapsodes, served to evoke the latent sense of literary criticism; and, at a later stage, the critical spirit was still further stimulated by the performance of dramatic pieces written by competing poets. The epical record of the past was supplemented by the

lyrical record of contemporary events, and as the Homeric poets had immortalized the siege of Troy, so Pindar commemorated Salamis. Prose of any permanent value would first show itself in the form of oratory, and the insertion of speeches by early historians indicates a connexion with rhetoric. The development of abstract reasoning would tend to deprive prose of its superfluous ornament and to provide a simpler and more accurate instrument.

No new *genre* has been invented since the days of Plato. The evolution of literature is completed in Greece, and there its subdivisions may best be studied. Epic poetry is represented by the Homeric cycle, lyrical poetry by Tyrtaeus, dramatic poetry by Aeschylus, history by Herodotus, oratory by Pericles, philosophy by Plato, and criticism by Zoilus, the earliest of slashing reviewers; and in each department there is a long succession of illustrious names. Roughly speaking, all subsequent literature is imitative. Ennius transplanted Greek methods to Rome; his contemporary L. Fabius Pictor, the earliest Roman historian, wrote in Greek; and the later Roman poets from Lucretius to Horace abound in imitations of Greek originals. The official adoption of Christianity as the state religion changed the spirit of literature, which became more and more provincial after the downfall of the empire. Literature did not perish during the “dark ages” which extend from the sixth century to the beginning of the 11th, but it was subordinate to scholarship. The dissolution of Latin was not complete till about the middle of the 9th century, and the new varieties of Romance did not become ripe for literary purposes till a hundred years later. Meanwhile, not a single literary masterpiece was produced in western Europe for five centuries; by comparison only do Boëthius and Venantius Fortunatus seem to be luminous points in the prolonged night; the promise of a literary renaissance at the court of Charlemagne was unfulfilled, and the task of creating a new literature devolved upon the descendants of the barbarians who had destroyed the old. The Celtic and Teutonic races elaborated literary methods

of their own; but the fact that the most popular form of Irish verse is adopted from Latin prosody is conclusive evidence that the influence of Roman—and therefore of Greek—models persisted in the literature of the outlying provinces which had attained political independence. The real service rendered to literature by the provincials lay in the introduction and diffusion of legends freighted with a burden of mystery which had disappeared with Pan, and these new valuable materials went to form the substance of the new poetry.

The home of modern European literature must be sought in France, which assimilated the best elements in Celtic and Teutonic literature. From the 11th to the 14th century, France was the centre of intellectual life in Europe, as Greece and Rome had been before, and as Italy was to be afterwards. The *chansons de geste*, inspired by the sense of patriotism and the yearning for religious unity, inculcate feudal and Catholic doctrine, and as society in the western world was universally committed to feudalism and Catholicism, these literary expressions of both theories were widely accepted and copied. The Germanic origin of the French epic is lost sight of, and imitators are attracted by the French execution, and by the creative power of the *chansons de geste*. Again, France takes the stories of the Arthurian court from Welsh texts or from the lips of Welsh settlers, rehandles the romantic element, and, through Marie de France and Chrétien de Troyes, imparts to the whole a touch of personal artistry which is absent from the *chansons de geste*. The *matière de Bretagne* goes forth to Italy, Germany and England—later to Portugal and Spain—bearing the imprint of the French genius. Thus France internationalizes local subjects, and first assumes a literary function which, with few interruptions, she has since discharged. She further gives to Europe models of allegory in the *Roman de la rose*, founds the school of modern history through Villehardouin, inaugurates the religious drama and the secular theatre. She never again dominated the literatures of Europe so absolutely.

The literary sceptre passed from France to Italy during the 14th century. Brunetto Latini, who wrote in French as well as in Italian, is the connecting link between the literatures of the two countries; but Italy owes its eminence not so much to a general diffusion of literary accomplishment as to the emergence of three great personalities. Dante, Boccacio and Petrarch created a new art of poetry and of prose. England yielded to the fascination in the person of Chaucer, Spain in the person of her chancellor López de Ayala, and France in the person of Charles d'Orléans, the son of an Italian mother. Petrarch, once ambassador in France, alleged that there were no poets out of Italy, and indeed there were no living poets to compare with him elsewhere. But in all countries he raised up rivals—Chaucer, Marot, Garcilaso de la Vega—as Sannazaro did a century and a half later. Sannazaro's *Arcadia* captured the Portuguese Montemôr, whose pastoral novel the *Diana*, written in Spanish, inspired d'Urfé no less than Sidney, and, as d'Urfé's *Astrée* is considered the starting-point of the modern French novel, the historical importance of the Italian original cannot be exaggerated. Spain never obtained any intellectual predominance corresponding to that exercised by France and Italy, or to her political authority during the 16th and 17th centuries. This may be attributed partly to her geographical position which lies off the main roads of Europe, and partly to the fact that her literature is essentially local. Cervantes, indeed, may be said to have influenced all subsequent writers of fiction, and the influence of Spanish literature is visible in the body of European picaresque tales; but, apart from Corneille and a few other dramatists who preceded Molière in France, and apart from the Restoration drama in England, the influence of the Spanish drama was relatively small. In some respects it was too original to be imitated with success. Much the same may be said of England as of Spain. Like Spain, she lies outside the sphere of continental influence; like Spain, she has innumerable great names in every province of literature, and, in both cases, to Europe at large these long remained names

and nothing more; like Spain, she is prone to reproduce borrowed materials in shapes so transformed and rigid as to be unrecognizable and unadaptable. Moreover, the Reformation isolated England from literary commerce with the Latin races, and till the 18th century Germany was little more than a geographical expression. Even when Germany recovered her literary independence, Lessing first heard of Shakespeare through Voltaire. Neither Shakespeare nor Milton was read in France before the 18th century—the first translated by Ducis, the second by Dupré de Saint-Maur—and they were read with curiosity rather than with rapture. On the other hand, Boileau, Rapin and Le Bossu were regarded as oracles in England, and through them French literature produced the "correctness" of Queen Anne's reign. Horace Walpole is half a Frenchman, Hume imitates Montesquieu's cold lucidity, Gibbon adapts Bossuet's majestic periods to other purposes. On the other hand Voltaire takes ideas from Locke, but his form is always intensely personal and inimitably French. After the 16th century English literature, as a whole, is refractory to external influence. Waves of enthusiasm pass over England—for Rousseau, for Goethe—but leave no abiding trace on English literature. During the latter half of the 18th century France resumed something of her old literary supremacy; the literatures of Italy and Spain at this period are purely derivative, and French influence was extended still further on the continent as the result of the Romantic movement. Since that impulse was exhausted, literature everywhere has been in a state of flux: it is less national, and yet fails to be cosmopolitan. All writers of importance, and many of no importance, are translated into other European languages; the quick succession of diverse and violent impressions has confused the scheme of literature. Literature suffers likewise from the competition of the newspaper press, and as the press has multiplied it has grown less literary. The diversities of modern interests, the want of leisure for concentrated thought, suggest that literature may become once more the pleasure of a small caste. But the desire for the one just form

which always inspires the literary artist visits most men sometimes, and it cannot be doubted that literature will continue to accommodate itself to new conditions.

(J. F.-K.)

LITERNUM, an ancient town of Campania, Italy, on the low sandy coast between Cumae and the mouth of the Volturnus. It was probably once dependent on Cumae. In 194 B.C. it became a Roman colony. It is mainly famous as the residence of the elder Scipio, who withdrew from Rome and died here. His tomb and villa are described by Seneca. Augustus is said to have conducted here a colony of veterans,[1] but the place never had any great importance, and the lagoons behind it made it unhealthy, though the construction of the Via Domitiana through it must have made it a posting station. It ceased to exist in the 8th century. No remains are visible.

See J. Beloch, *Campanien*, ed. ii. (Breslau, 1890), 377.

1 Mommsen in C.I.L. x. 343 does not accept this statement, but an inscription found in 1885 confirms it.

LITHGOW, WILLIAM (1582-? 1650), Scottish traveller and writer, was born and educated in Lanark. He was caught in a love-adventure, mutilated of his ears by the brothers of the lady (hence the sobriquet "Cut-lugged Willie"), and forced to leave Scotland. For nineteen years he travelled, mostly on foot, through Europe, the Levant, Egypt and northern Africa, covering, according to his estimate, over 36,000 m. The story of his adventures may be drawn from *The Totall Discourse of the Rare Adventures and painfull Peregrinations of long nineteene Yeares* (London, 1614; fuller edition, 1632, &c.); *A True and Experimentall Discourse upon the last siege of Breda* (London, 1637); and a similar book giving an account of the siege of Newcastle and the battle of Marston Moor (Edinburgh, 1645). He is the author of a *Present Surveigh of London* (London, 1643). He left six poems, written between 1618 and 1640 (reprinted by Maidment, Edinburgh, 1863). Of these "Scotland's Welcome to King Charles, 1633" has considerable antiquarian interest. His writing has no literary merit; but its excessively aureate style deserves notice.

The best account of Lithgow and his works is by F. Hindes Groome in the *Dict. Nat. Biog.* The piece entitled *Scotland's Paraenesis to King Charles II.* (1660), ascribed to him in the catalogue of the Advocates' Library, Edinburgh, cannot, from internal evidence, be his.

LITHGOW, a town of Cook county, New South Wales, Australia, 96 m. W.N.W. of Sydney by rail. Pop. (1901) 5268. The town is situated at an

altitude of 3000 ft., in a valley of the Blue Mountains. It has pottery and terra-cotta works, breweries, a tweed factory, iron-works, saw-mills, soap-works and brickfields. Coal, kerosene shale, iron ore and building stone are found in the district.

LITHIUM [symbol Li, atomic weight 7.00 (O = 16)], an alkali metal, discovered in 1817 by J. A. Arfvedson (*Ann. chim. phys.* 10, p. 82). It is only found in combination, and is a constituent of the minerals petalite, triphyline, spodumene and lepidolite or lithia mica. It occurs in small quantities in sea, river and spring water, and is also widely but very sparingly distributed throughout the vegetable kingdom. It may be obtained (in the form of its chloride) by fusing lepidolite with a mixture of barium carbonate and sulphate, and potassium sulphate (L. Troost, *Comptes rendus*, 1856, 43, p. 921). The fused mass separates into two layers, the upper of which contains a mixture of potassium and lithium sulphates; this is lixiviated with water and converted into the mixed chlorides by adding barium chloride, the solution evaporated and the lithium chloride extracted by a mixture of dry alcohol and ether. The metal may be obtained by heating dry lithium hydroxide with magnesium (H. N. Warren, *Chem. News*, 1896, 74, p. 6). L. Kahlenberg (*Jour. phys. Chem.*, 3, p. 601) obtained it by electrolysing the chloride in pyridine solution, a carbon anode and an iron or platinum cathode being used. O. Ruff and O. Johannsen (*Zeit. elektrochem.*, 1906, 55, p. 537) electrolyse a mixture of bromide and chloride which melts at 520°. It is a soft, silvery-white metal, which readily

tarnishes on exposure. Its specific gravity is 0.59, and it melts at 180° C. It burns on ignition in air, and when strongly heated in an atmosphere of nitrogen it forms lithium nitride, Li_3N. It decomposes water at ordinary temperature, liberating hydrogen and forming lithium hydroxide.

Lithium hydride, LiH, obtained by heating the metal in a current of hydrogen at a red heat, or by heating the metal with ethylene to 700° C. (M. Guntz, *Comptes rendus*, 1896, 122, p. 244; 123, p. 1273), is a white solid which inflames when heated in chlorine. With alcohol it forms lithium ethylate, $LiOC_2H_5$, with liberation of hydrogen. *Lithium oxide*, Li_2O, is obtained by burning the metal in oxygen, or by ignition of the nitrate. It is a white powder which readily dissolves in water to form the *hydroxide*, LiOH, which is also obtained by boiling the carbonate with milk of lime. It forms a white caustic mass, resembling sodium hydroxide in appearance. It absorbs carbon dioxide, but is not deliquescent. *Lithium chloride* LiCl, prepared by heating the metal in chlorine, or by dissolving the oxide or carbonate in hydrochloric acid, is exceedingly deliquescent, melts below a red heat, and is very soluble in alcohol. *Lithium carbonate*, Li_2CO_3, obtained as a white amorphous precipitate by adding sodium carbonate to a solution of lithium chloride, is sparingly soluble in water. *Lithium phosphate*, Li_3PO_4, obtained by the addition of sodium phosphate to a soluble lithium salt in the presence of sodium hydroxide, is almost insoluble in water. *Lithium ammonium*, $LiNH_3$, is obtained by passing ammonia gas over lithium, the product being heated to 70° C. in order to expel any excess of ammonia. It turns brown-red on exposure to air, and is inflammable. It is decomposed by water evolving hydrogen, and when heated *in vacuo* at 50°-60° C. it gives lithium and ammonia. With ammonia solution it gives hydrogen and *lithiamide*, $LiNH_2$ (H. Moissan, *ibid.*, 1898, 127, p. 685). *Lithium carbide*, Li_2C_2, obtained by heating lithium carbonate and carbon in the electric furnace, forms a transparent crystalline mass of specific

gravity 1.65, and is readily decomposed by cold water giving acetylene (H. Moissan, *ibid.*, 1896, 122, p. 362).

Lithium is detected by the faint yellow line of wave-length 6104, and the bright red line of wave-length 6708, shown in its flame spectrum. It may be distinguished from sodium and potassium by the sparing solubility of its carbonate and phosphate. The atomic weight of lithium was determined by J. S. Stas from the analysis of the chloride, and also by conversion of the chloride into the nitrate, the value obtained being 7.03 (O = 16).

The preparations of lithium used in medicine are: *Lithii Carbonis*, dose 2 to 5 grs.; *Lithii Citras*, dose 5 to 10 grs.; and *Lithii Citras effervescens*, a mixture of citric acid, lithium citrate, tartaric acid and sodium bicarbonate, dose 60 to 120 grs. Lithium salts render the urine alkaline and are in virtue of their action diuretic. They are much prescribed for acute or chronic gout, and as a solvent to uric acid calculi or gravel, but their action as a solvent of uric acid has been certainly overrated, as it has been shown that the addition of medicinal doses of lithium to the blood serum does not increase the solubility of uric acid in it. In concentrated or large doses lithium salts cause vomiting and diarrhoea, due to a gastro-enteritis set up by their action. In medicinal use they should therefore be always freely diluted.

LITHOGRAPHY

(Gr. λίθος, a stone, and γράφειν, to write), the process of drawing or laying down a design or transfer, on a specially prepared stone or other suitable surface, in such a way that impressions may

be taken therefrom. The principle on which lithography is based is the antagonism of grease and water. A chemically pure surface having been secured on some substance that has an equal affinity for both grease and water, in a method hereafter to be described, the parts intended to print are covered with an unctuous composition and the rest of the surface is moistened, so that when a greasy roller is applied, the portion that is wet resists the grease and that in which an affinity for grease has been set up readily accepts it; and from the surface thus treated it will be seen that it is an easy thing to secure an impression on paper or other material by applying suitable pressure.

The inventor of lithography was Alois Senefelder (1771-1834); and it is remarkable what a grip he at once seemed to get of his invention, for whereas the invention of printing seems almost a matter of evolution, lithography seems to come upon the scene fully equipped for the battle of life, so that it would be a bold craftsman at the present day who would affirm that he knew more of the principles underlying his trade than Senefelder (*q.v.*) did within thirty years of its invention. Of course practice has led to dexterity, and the great volume of trade has induced many mechanical improvements and facilities, but the principles have not been taken any further, while some valuable methods have been allowed to fall into desuetude and would well repay some experimentally disposed person to revive.

Lithography may be divided into two main branches—that which is drawn with a greasy crayon (rather illogically called “chalk”) on a grained stone, and that which is drawn in “ink” on a polished stone. Whatever may be thought in regard to the original work of the artists of various countries who have used lithography as a means of expression, there can be little doubt that in the former method the English professed lithographer has

always held the pre-eminence, while French, German and American artists have surpassed them in the latter.

Chalk lithography subdivides itself into work in which the black predominates, although it may be supported by 5 or 6 shades of modified colour—this branch is known as "black and tint" work—and that in which the black is only used locally like any other colour. Frequently this latter class of work will require a dozen or more colours, while some of the finest examples have had some twenty to thirty stones employed in them. Work of this description is known as chromo-lithography. Each colour requires a separate stone, and work of the highest quality may want two or three blues with yellows, reds, greys and browns in proportion, if it is desired to secure a result that is an approximate rendering of the original painting or drawing. The question may perhaps be asked: "If the well-known three-colour process" (see PROCESS) "can give the full result of the artist's palette, why should it take so many more colours in lithography to secure the same result?" The answer is that the stone practically gives but three gradations—the solid, the half tint and the quarter tint, so that the combination of three very carefully prepared stones will give a very limited number of combinations, while a moderate estimate of the shades on a toned block would be six; so that a very simple mathematical problem will show the far greater number of combinations that the three blocks will give. Beyond this, the chromo-lithographer has to exercise very great powers of colour analysis; but the human mind is quite unable to settle offhand the exact proportion of red, blue and yellow necessary to produce some particular class say of grey, and this the camera with the aid of colour filters does with almost perfect precision.

Notwithstanding these disadvantages, lithography has these strong points: (1) its utility for small editions on account of its, at present, smaller prime cost; (2) its suitability for subjects of large size; (3) its superiority for

subjects with outlines, for in such cases the outline can be done in one colour, whereas to secure this effect by the admixture of the three colours requires marvellously good registration, the absence of which would produce a very large proportion of “waste” or faulty copies; (4) capacity for printing on almost any paper, whereas, at the time of writing, the tri-colour process is almost entirely limited to printing on coated papers that are very heavy and not very enduring.

With regard to the two branches of chalk lithography, the firms that maintained the English supremacy for black and tint work in the early days were Hulemandel, Day and Haghe and Maclure, while the best chromo-lithographic work in the same period was done by Vincent Brooks, the brothers Hanhart, Thomas Kell and F. Kell. In reference to the personal work of professed lithographers during the same period, the names of Louis Haghe, J. D. Harding, J. Needham, C. Baugniet, L. Ghemar, William Simpson, R. J. Lane, J. H. Lynch, A. Maclure and Rimanozcy stand for black and tint work; while in chromo-lithography J. M. Carrick, C. Risdon, William Bunney, W. Long, Samuel Hodson, Edwin Buckman and J. Lewis have been conspicuous among those who have maintained the standard of their craft. In the foregoing list will be recognized the names of several who have had admirable works on the walls of the Royal Academy and other exhibitions; Mr Lane, who exhibited lithographs from 1824 to 1872, was for many years the doyen of lithographers, and the only one of their number to attain academic rank, but Lynch and John Cardwell Bacon were his pupils, and Bacon’s son, the painter John H. F. Bacon, was elected to the Royal Academy in 1903. In the first decade of the 20th century the number of firms doing high-class work, and the artists who aided them in doing it, were more numerous than ever, and scarcely less able, but it would be outside the present purpose to differentiate between them.

The *raison d'être* of "stipple" work is its capacity for retransferring without serious loss of quality, for it can scarcely be contended that it is as artistic as the methods just described. Retransferring is the process of pulling impressions from the original stones with a view to making up a large sheet of one or more small subjects, or where it is desired to print a very large number without deterioration of the original or matrix stone. The higher class work in this direction has been done in France, Germany and the United States, where for many years superiority has been shown in regard to the excellence and rapidity of retransferring. To this cause may be attributed the fact that the box tops and Christmas cards on the English market were so largely done abroad until quite recent times. The work of producing even a small face in the finest hand stipple is a lengthy and tedious affair, and the English craftsman has seldom shown the patience necessary for this work; but since the American invention known as Ben Day's shading medium was introduced into England the trade has largely taken it up, and thereby much of the tedium has been avoided, so that it has been found possible by its means to introduce a freedom into stipple work that had not before been found possible, and a very much better class of work has since been produced in this department.

About the year 1868 grained paper was invented by Maclure, Macdonald & Co. This method consists in impressing on ordinary Scotch transfer or other suitable paper a grain closely allied to that of the lithographic stone. It appears to have been rather an improvement than a new invention, for drawing paper and even canvas had been coated previously with a material that adhered to a stone and left on the stone the greasy drawing that had been placed thereon; but still from this to the beautifully prepared paper that was placed on the market by the firm of which the late Andrew Maclure was the head was a great advance, and although the first use was by the ordinary craftsman it was not long before artists of eminence saw that a new and convenient mode of expression was opened up to them.

On the first introduction of lithography the artists of every nation hastened to avail themselves of it, but soon the cumbrous character of the stone, and the fact that their subjects had to be drawn backwards in order that they might appear correctly on the paper, wore down their newly-born zeal, and it was only when the grained paper system was perfected, by which they could make their drawings in the comfort of their studios without reversing, that any serious revival took place. Although excellent work on grained paper had been done by Andrew Maclure, Rimanozcy, John Cardwell Bacon, Rudofsky and other craftsmen, the credit for its furtherance among artists must be given to Thomas Way and his son T. R. Way, who did much valuable pioneer work in this direction. The adhesion of such artists of eminence as Whistler, Legros, Frank Short, Charles Shannon, Fantin Latour, William Strang, Will Rothenstein, Herbert Railton and Joseph Pennell, did not a little to aid lithography in resisting the encroachments of other methods into what may still be considered its sphere. As a means of reproducing effects which an artist would otherwise get by pencil or crayon, it remains entirely unequalled, and it is of obvious advantage to art that twenty-five or fifty copies of an original work should exist, which, without the aid of lithography, might have only been represented by a single sketch, perhaps stowed away among the possessions of one private collector.

In regard to grained paper work, undue stress has often been placed upon the rapid deterioration of the stone, some contending that only a few dozen first-class proofs can be taken; this has led to the feeling that it is unsuited to book illustration, and damage has been done to the trade of lithography thereby. It may be mentioned that quite recently about 100 auto-lithographs in black and three colours, the combined work of Mr and Mrs Herbert Railton, have been treated by the Eberle system of etching described below, and although an infinitesimal loss of quality may have arisen, such as occurs when a copper etching is steel faced, some 2000 to 3000 copies were

printed without further deterioration, and an edition of vignetted sketches was secured, far in advance of anything that could have been attained from the usual screen or half-toned blocks.

Grained paper is much used in the ordinary lithographic studio for work such as the hill shading of maps that can be done without much working up, but the velvety effects that in the hands of Louis Haghe and his contemporaries were so conspicuous, cannot be secured by this method. The effects referred to were obtained by much patient work of a “tinter,” who practically laid a ground on which the more experienced and artistic craftsman did his work either by scraping or accentuation. Where fine rich blacks are needed, artists will do well to read the notes on the “aquatint” and “wash” methods described by Senefelder in his well-known treatise, and afterwards practised with great skill by Hulemandel.

Lithography is of great service in educational matters, as its use for diagrams, wall pictures and maps is very general; nor does the influence end with schooldays, for in the form of pictures at a moderate price it brings art into homes and lives that need brightening, and even in the form of posters on the much-abused hoardings does something for those who have to spend much of their time in the streets of great cities.

According to the census of 1901, 14,686 people in the United Kingdom found their occupation within the trade, while according to a Home Office return (1906), 20,367 persons other than lithographic printers were employed by the firms carrying on the business. As it may be assumed that an equal number are employed in France, Germany, the United States of America and the world at large, it is clear that a vast industrial army is employed in a trade that, like letterpress printing, has a very beneficial influence upon those engaged in it.

Technical Details.—The following description of the various methods of lithography is such as may be considered of interest to the general reader, but the serious student who will require formulas and more precise directions will do well to consult one of the numerous text-books on the subject.

Stone and Stone Substitutes.—The quality of stone first used by Alois Senefelder, and discovered by him at the village of Solenhofen in Bavaria, still remains unsurpassed. This deposit, which covers a very large area and underlies the villages of Solenhofen, Moernsheim and Langenaltheim, has often been described, sometimes for interested motives, as nearly exhausted; but a visit in 1906 revealed that the output—considerable as it had been during a period little short of a century—was very unimportant when compared to the great mass of carbonaceous limestone existing in the neighbourhood. The strong point in favour of this source of supply, in addition to its unrivalled quality, is the evenness of its stratification, and the fact that after the removal of the surface deposits, which are very thin, the stones come out of large size, in thickness of 3 to 5 in., and thus just suited for lithographic purposes and needing only to be wrought in the vertical direction. Other deposits of suitable stone have been found in France, Spain, Italy and Greece, but transit and the absence of suitable stratification have restricted them to little more than local use. Beyond this, few of the deposits other than in the neighbourhood of Solenhofen have been of the exact degree of density necessary, and the heavier varieties do not receive the grease with sufficient readiness. The desire to find other sources of supply has been stimulated by the social conditions existing in southern Bavaria, for the quarries are largely owned by peasant proprietors, who have very well-defined business habits of their own which make transactions difficult. Among other things, they will seldom supply the highest grades and the largest sizes to those who will not take their proportion of lower quality and smaller sizes; and this, in view of the very

expensive transit down the Rhine to Rotterdam, with a railway journey at one end and a sea journey at the other, is a source of difficulty to the importer in other countries.

The earliest substitute for lithographic stone was zinc, which has been used from early days and is now more in demand than ever; it requires very careful printing as the grease only penetrates the material to a very slight extent, and the same must be said in regard to the water. From this cause, when not in experienced hands, trouble is likely to arise; and when this has occurred, remedial methods are much more difficult than with stones. When put away for storage, a dry place is very essential, as corrosion is easily set up. At first the plates were quite thick, and almost invariably grained by a zinc "muller" and acid; now a bath of acid is more generally used, and the operation is known as "passing," while the plates are quite thin, which renders them suitable for bending round the cylinders of rotary machines.

So far we have been dealing with plain zinc, but variations are caused, either by the oxidization of the surface or by coating the plate with a composition closely allied to lithographic stone and applied in a form of semi-solution. This class of plate was first invented by Messrs C. & E. Layton, and a modification was invented by Messrs Wezel and Naumann of Leipzig, who brought its use to a high pitch of perfection for transferred work such as Christmas cards. A treatment of iron plates by exposing them to a high temperature has recently been patented, and has had some measure of success, while the Parker printing plate, which is practically a sheet of zinc so treated as to secure greater porosity and freedom from oxidization, is rapidly securing a good position as a stone substitute.

Preparation of the Stones.—In this department the cleanliness so necessary right through the lithographic process must be carefully observed, and a leading point is to secure a level surface and to ensure that the front and back of the stone are strictly parallel, *i.e.* that the stones stand the test of

both the straight edge and the callipers. A good plan to ensure evenness on the surface is to mark the front with two diagonal lines of some non-greasy substance till the top stone (which should not be too small, and should be constantly revolved on the larger one) has entirely removed them. The application of the straight edge from time to time will end in securing the desired flatness, on which so much of the future printing quality depends. The usual method is to rub out with sand, and then rub with pumice and polish with water of Ayr or snake stone. For chalk work, the further work of graining has to be done by revolving a small stone muller on the surface with exceedingly fine sand or powdered glass. Many appliances (some very expensive) have been devised for doing the principal part of this work by machine—none more effective than those methods by which a disk of about 12 in. is kept revolving on a rod attached to the ceiling, guided by hand over all parts of the stone; but for large surfaces the ceiling needs to be rather high so as to allow of a long expanding rod reaching the surface at a moderate angle. When this machine is fitted with friction disk driving, very wide variations of speed are possible, and the machine can be driven so slowly and evenly as to secure a very fair (but not first class) grain, in addition to speedy rubbing out, which is the chief aim of the apparatus.

Preparing a Subject in Chalk or Chalk and Tints.—This branch of work is much less in demand than formerly. A grey stone having been selected and finely grained with sand or powdered glass passed through a sieve of 80 to 120 meshes to the lineal inch, and the artist having made his tracing, this tracing is reversed upon the stone with the interposition of a piece of paper coated with red chalk, and the chalk side towards the surface; the lines on the tracing are then gone over with a tracing point, so that a reproduction in red chalk is left upon the stone. It will then be desirable to secure a stock of pointed Lemercier chalks of at least two grades, hard and soft: the pointing is a matter that requires experience, and is done by the worker drawing a sharp pen-knife towards him in a slicing manner as though trying to put a

point upon a piece of cheese. Care should be taken that the falling pieces are gathered into a box, or they may do irreparable mischief to the work. The work of outlining is done with No. 1 or hard chalk, and until experience is gained it will be well to depend chiefly on this grade, securing rich dark effects by tinting or going over the stone in various directions and then finishing with lithographic ink where absolute blacks are required. This ink (Vanhymbeck's or Lemercier's are two good makes) needs careful preparation, the method being to warm a saucer and rub the ink dry upon it, then add a little distilled water and incorporate with the finger. It is of great importance not to use any ink left over for the next day, but always to have a fresh daily supply.

When the drawing is thus completed, it will require what is termed etching, by which the parts intended to receive the printing ink, and already protected by an acid-resisting grease, will be left above the unprotected surface. The acid and gum mixture varies in accordance with the quality of the work and the character of the stone. A patiently executed specimen will, for instance, stand more etching than a hastily drawn one; while a grey stone will require more of the nitric acid than a yellow one. This is one of the most important tasks that a lithographer has to perform. A proportion of 1.5 parts of acid to 100 parts of a strong solution of gum arabic will be found to be approximately what is required, but the exact proportion must be settled by experience, a safe course being to watch the action that occurs when a small quantity is placed on the unused margin of the stone. Many put the etching mixture on with a flat camel-hair brush, which should be of good width to avoid streaks. The present writer's own preference is to pour the mixture on to the stone when it is in a slanting position; or it is perhaps better to have an etching trough, a strong box lined with pitch, with bearers at the bottom to prevent the stone coming in contact with it, and a hole through which the diluted acid may pass away for subsequent use. The etching is then done with acid and water poured over the stone while in a

sloping position, and the subsequent pouring of a solution of gum arabic completes the preparation. The late Mr William Simpson, whose Crimean lithographs are well known, once stated at the Society of Arts that in his opinion Mr Louis Haghe's reproduction of David Robert's great picture of "The Taking of Jerusalem" was the most important piece of chalk lithography ever executed, and that he well remembered that it took two years to execute it, and that all the combined talent of Messrs Day & Haghe's establishment was utilized in its etching. He stated that, notwithstanding every precaution, it was under-etched, and that after half a dozen impressions the great beauty and brilliancy of the work had departed. This incident indicates sufficiently the serious nature of this part of the lithographer's work.

If the chalk drawing has to have tints, it will be necessary to make as many dusted offsetts as there are colours to be used; in this class of work there are generally only two,—one warm or sandy shade and the other a quiet blue—and these, with the black and the neutral colour secured by the superposition of the two shades, give an excellent result, of which Haghe's sketches in Belgium may be taken as a leading example.

In making such subjects suitable for present-day printing in the machine, the paper will require to be of a good "rag" quality, free from size and damped before printing. To secure accuracy of register the paper must be kept in a damp cloth to prevent the edges drying, and other machines should be kept available for each of the tints so that all work printed in black in the morning may be completed the same night. In this way large editions might be printed of either original or retransferred work at prices rendering the prints suitable for high-class magazines.

Preparing a Chromo Lithograph.—For this purpose the proceedings will be much the same as those suggested for the black and tint work, but the preliminary tracing will be done in lithographic ink on tracing transfer

paper or scratched on gelatine, the lines being subsequently filled in with transfer ink, and will be used as a "key," a guide stone that will not be printed; and the number of stones necessary will probably be much more numerous. The initial point will be to consider if the work is to have the edition printed from it, or whether it has to be transferred after proving and before printing; generally speaking, large subjects such as diagrams or posters will be worked direct, while Christmas cards, postcards, handbills or labels, will be repeated many times on larger stones. For the former class a much wider range of methods is possible, but many of these are difficult to transfer, and the deterioration that arises makes it desirable to limit their use when transferring is contemplated. Therefore, chalk-rubbed tints, varnish tints, stumping, wash, air brush, are the methods for original work, while work that has to be transferred is limited to ink work in line or stipple on a polished stone with the aid of "mediums" as before described, and ink "spluttered" on to the stone from a tooth brush. It should be mentioned that work done on grained paper is more suitable for retransfer than ordinary chalk work, and so is often very useful when a chalk effect is desired from a polished stone. In proving, opaque colours will be got on first, and it will often be found a good plan to put the black on early, for it gives a good idea of how the work is proceeding, and the strength of the touches (for the black should generally be used sparingly) is often pleasantly softened by the semi-opaque colours which should come on next. It is desirable to pull impressions of each colour on thoroughly white paper, and beyond this in important work there should be a progressive colour pattern that will show how the work looked when two, three or more colours were on, for this may at the finish be invaluable to show where error has crept in, and is in any event an immense aid to the machine minder.

In regard to paper, a description made of rag or rag and esparto is most desirable for all work on grained stones, but for work in ink and

consequently from polished stone a good coated paper with sufficient “size” in it is frequently desirable; this paper is generally called “chromo” paper.

There is at the present time very little encouragement for the high class of chromo-lithography that was so much in evidence from 1855 to 1875, but there is little doubt that the work could be done equally well by the present-day craftsmen if the demand revived. Belonging to the period mentioned, distinguished examples of chromo-lithography are “Blue Lights,” after Turner, by Carrick; “Spanish Peasants” and the Lumley portrait of Shakespeare, by Risdon; “Queen Victoria receiving the Guards,” by W. Bunney, after John Gilbert; and the series of chromos after John Leech, produced under the general direction of Vincent Brooks. A small proportion only of the Arundel Society’s prints were executed in England, but many reproductions of water-colours after Birket Foster, Richardson, Wainwright and others were executed by Samuel Hodson, James Lewis and others. Perhaps the most consistently good work of modern times has been the reproduction of Pellegrini’s and Leslie Ward’s drawings for *Vanity Fair*, which from 1870 to 1906 were with very few exceptions executed by the firm of Vincent Brooks, Day & Son.

Transfers.—A very large proportion of work is got on to the stone by transfer, and there is no more important part of the business perhaps at the present time. When there is so much original lithography done on grained paper by artists of eminence, the transferring of grained paper drawings is the most important. The stone most desirable for this purpose will be neither a grey nor a light yellow, but one that stands mid-way between the two; it should be very carefully polished so as to be quite free from scratches, and brought to blood-heat by being gradually heated in an iron cupboard prepared with the necessary apparatus. The methods that sometimes prevail of pouring boiling water over the stone, heating with the flame of an ordinary plumber’s lamp, or even heating the surface in front of

a fire, are ineffective substitutes, for the surface may thus become unduly hot and spread the work, and there is no increased tendency for the chalk to enter into the stone and thus give the work a long life. If there are no colours or registration troubles to be considered, it is well to place the transfer in a damping book till the composition adheres firmly to the finger, before placing it on the stone; it should then be pulled through twice, after which it should be damped on the back and pulled through several times; after this has again been well damped the paper will be found to peel easily off the stone, leaving the work and nearly all the composition attached; the latter should then be very gently washed away.

In cases where the work for some reason must not stretch, such as the hills on a map, it will be necessary to keep the transfer dry and put it on a wet stone, but a piece of the margin of the paper should be tested to see that it is of a class that will adhere to the stone the first time it is pulled through. Unless the adhesion is very complete it may not be safe to pull it through more than once. For a small number of copies a very moderate “etch” is desirable, but for a long run, where the object is to secure a good edition rather than a few good proofs, the Eberle system may be adopted. This method consists in protecting the work with finely powdered resin and then applying the flame of an ordinary plumber’s lamp; this will melt the protecting medium round the base of each grain of work and allow of a very vigorous “etch” being applied. As before stated it is not unusual to secure 2000 to 3000 good copies in the machine after this treatment; but the rollers, the ink and the superintendence must be of the best.

When the artist who is not a professed lithographer desires to make tints to his work, a reversed offset on grained paper should be made for each colour; this is done by pulling an impression in the usual way on a hard piece of paper, and while it is yet wet this should be faced with a piece of grained paper and pulled through again, when the grained paper will be

found to have received the greater portion of the ink; this should be immediately dusted with offset powder of a red shade to prevent the grease passing into the paper, and the drawing of the tints should then be proceeded with in the usual way. Another method of transfer work is to pull impressions from copper or steel plates in transfer ink; it is in such way that simple etchings like those of Cruikshank, Phiz and others are produced, and nearly all commercial work such as maps, bill heads, &c., are prepared in the same manner.

Beyond this, much work is done in lithographic ink on what is called writing transfer paper, such as circulars, law writing for abstracts, specifications and plans.

Machinery.—The chief items are the hand presses and the machines, whether flat bed or rotary, the principal places of manufacture being Leeds, Otley and Edinburgh. Stimulated by American competition, the standard of excellence in the United Kingdom has been very considerably raised of late years. The rotary machines have only been possible since the more frequent use of aluminium and zinc, but these materials are more suitable to receive transfer than for the general use of an office, the chief reason being that corrections on stone are more easily accomplished and more lasting when done. Preliminary work is therefore frequently done on the stone and transferred to plates for the machine.

The question is very frequently asked as to how the necessary registration of the colours is secured; it may be stated for the benefit of the amateur that in hand printing this is generally done by pricking with a pair of needles through printed marks present on each stone; but in the machine this has been done in different ways, although in quite early days “pointing” or “needling” was done even on the machine. On modern machines this registration depends on the accurate cutting of the edge of the paper, of which at least one corner must be an absolute right angle. The paper is then

laid on a sloping board in such a way that the longest of the two true edges gravitates into the gripper of the machine, the stops of which move slightly forward as the gripper closes; simultaneously what is called the “side lay” moves forward automatically to a given extent, and in this way at the critical moment the sheet is always in the same position in regard to the stone, which has already been firmly secured in the bed of the machine.

Quite recently a new method has come into use that is probably destined to be a great aid to the craft in its competition with other methods. This is known as offset printing; it is more a matter of evolution than invention, and proceeds from the method adopted in tin-plate decoration so much used for box-making and lasting forms of advertisement. It consists in bringing a sheet of rubber into contact with the charged stone and then setting-off the impression so obtained upon card, paper, pegamoid, cloth or other material, the elasticity of the rubber making it possible to print upon rough surfaces that have been previously unsuited to lithographic printing. Both flat bed and rotary machines are available for this system, the latter being restricted to zinc or aluminium plates, but giving a high speed, while the former can use both stones and metal plates and may be more effective for the highest grade of colour work; by both classes of machines the finest engraved note headings can be printed on rough paper, and colour work that has for so long been confined to coated or burnished papers will be available on surfaces such as the artists themselves use.

The following treatises may be referred to with advantage by those in search of more detailed information: *A Complete Course of Lithography*, by Alois Senefelder (R. Ackermann, London, 1819); *The Grammar of Lithography*, by W. D. Richmond (13th edition, E. Menken, London); *Handbook of Lithography*, by David Cumming (London, A. & C. Black). The first of these will only be found in libraries of importance; the others are present-day text-books.

LITHOSPHERE (Gr. λίθος, a stone, and σφαῖρα, a sphere), the crust of the earth surrounding the earth's nucleus. The superficial soil, a layer of loose earthy material from a few feet to a few hundreds of feet in thickness, lies upon a zone of hard rock many thousands of feet in thickness but varying in character, and composed mainly of sandstones, shales, clays, limestones and metamorphic rocks. These two layers form the lithosphere. All the tectonic movements of the solid nucleus produce changes in the mobile lithosphere. Volcanic and seismic activity is manifested, mountains are folded, levels change, fresh surfaces are exposed to denudation, erosion and deposition. The crust is thus subject to constant change while retaining its more or less permanent character.

LITHUANIANS and LETTS, two kindred peoples of Indo-European origin, which inhabit several western provinces of Russia and the north-eastern parts of Poland and Prussia, on the shores of the Baltic Sea, and in the basins of the Niemen and of the Duna. Large colonies of Lithuanian and Lettic emigrants have been established in the United States. The two races number about 3,500,000, of whom 1,300,000 are Letts. Little is known about

their origin, and nothing about the time of their appearance in the country they now inhabit. Ptolemy mentions (iii. 5) two clans, the Galindae and Sudeni, who probably belonged to the western subdivision of this racial group, the Borussians. In the 10th century the Lithuanians were already known under the name of Litva, and, together with two other branches of the same stem—the Borussians and the Letts—they occupied the south-eastern coast of the Baltic Sea from the Vistula to the Duna, extending north-east towards the Lakes Vierzi-järvi and Peipus, south-east to the watershed between the affluents of the Baltic and those of the Black Sea, and south to the middle course of the Vistula (Brest Litovsk)—a tract bounded by Finnish tribes in the north, and by Slavs elsewhere.

Inhabiting a forested, marshy country the Lithuanians have been able to maintain their national character, notwithstanding the vicissitudes of their history. Their chief priest, *Krive-Kriveyto* (the judge of the judges), under whom were seventeen classes of priests and elders, worshipped in the forests; the Waidelots brought their offerings to the divinities at the foot of oaks; even now, the veneration of great oaks is a widely spread custom in the villages of the Lithuanians, and even of the Letts.

Even in the 10th century the Lithuanian stem was divided into three main branches:—the *Borussians* or *Prussians*; the *Letts* (who call themselves *Latvis*, whilst the name under which they are known in Russian chronicles, *Letygola*, is an abbreviation of *Latvin-galas*, “the confines of Lithuania”); and the *Lithuanians*, or rather *Lituanians*, *Litva* or *Letuvininkaï*,—these last being subdivided into Lithuanians proper, and *Zhmud’* (*Zmudz*, *Samogitians* or *Zemailey*), the “Lowlanders.” To these main branches must be added the *Yatvyags*, or *Yadzvings*, a warlike, black-haired people who inhabited the forests at the upper tributaries of the Niemen and Bug, and the survivors of whom are easily distinguishable as a mixture with White-Russians and Mazurs in some parts of Grodno, Plotsk, Lomza and Warsaw. Nestor’s chronicle distinguishes also the *Zhemgala*, who later became known under the

name of *Semigallia*, and in the 10th century inhabited the left bank of the Duna. Several authors consider also as Lithuanians the *Kors* of Russian chronicles, or *Courons* of Western authors, who inhabited the peninsula of Courland, and the *Golad*, a clan settled on the banks of the Porotva, tributary of the Moskva river, which seems to have been thrown far from the main stem during its migration to the north. The *Krivichi*, who inhabited what is now the government of Smolensk, seem to belong to the same stem. Their name recalls the Krive-Kriveyto, and their ethnological features recall the Lithuanians; but they are now as much Slavonic as Lithuanian.

All these peoples are only ethnographical subdivisions, and each of them was subdivided into numerous independent clans and villages, separated from one another by forests and marshes; they had no towns or fortified places. The Lithuanian territory thus lay open to foreign invasions, and the Russians as well as the German crusaders availed themselves of the opportunity. The Borussians soon fell under the dominion of Germans, and ceased to constitute a separate nationality, leaving only their name to the state which later became Prussia. The Letts were driven farther to the north, mixing there with Livs and Ehsts, and fell under the dominion of the Livonian order. Only the Lithuanians proper, together with Samogitians, succeeded in forming an independent state. The early history of this state is imperfectly known. During the continuous petty war carried on against Slavonic invasions, the military chief of one of the clans, Ryngold, acquired, in the first half of the 13th century, a certain preponderance over other clans of Lithuania and Black Russia (Yatvyags), as well as over the republics of Red Russia. At this time, the invasions of the Livonian order becoming more frequent, and always extending southward, there was a general feeling of the necessity of some organization to resist them, and Ryngold's son, Mendowg, availed himself of this opportunity to pursue the policy of his father. He made different concessions to the order, ceded to it several parts of Lithuania, and even agreed to be baptized, in 1250, at Novograd Litovsk, receiving in exchange a crown from Innocent IV., with which he was crowned king of Lithuanians. He also ceded the whole of

Lithuania to the order in case he should die without leaving offspring. But he had accepted Christianity only to increase his influence among other clans; and, as soon as he had consolidated a union between Lithuanians, Samogitians and Cours, he relapsed, proclaiming, in 1260, a general uprising of the Lithuanian people against the Livonian order. The yoke was shaken off, but internal wars followed, and three years later Mendowg was killed. About the end of the 13th century a new dynasty of rulers of Lithuania was founded by Lutuwer, whose second son, Gedymin (1316-1341), with the aid of fresh forces he organized through his relations with Red Russia, established something like regular government; he at the same time extended his dominions over Russian countries—over Black Russia (Novogrodok, Zditov, Grodno, Slonim and Volkovysk) and the principalities of Polotsk, Tourovsk, Pinsk, Vitebsk and Volhynia. He named himself *Rex Lethowinorum et multorum Ruthenorum*. In 1325 he concluded a treaty with Poland against the Livonian order, which treaty was the first step towards the union of both countries realized two centuries later. The seven sons of Gedymin considered themselves as quite independent; but two of them, Olgierd and Keistut, soon became the more powerful. They represented two different tendencies which existed at that time in Lithuania. Olgierd, whose family relations attracted him towards the south, was the advocate of union with Russia; rather politician than warrior, he increased his influence by diplomacy and by organization. His wife and sons being Christians, he also soon agreed to be baptized in the Greek Church. Keistut represented the revival of the Lithuanian nationality. Continually engaged in wars with Livonia, and remaining true to the national religion, he became the national legendary hero. In 1345 both brothers agreed to re-establish the great principality of Lithuania, and, after having taken Vilna, the old sanctuary of the country, all the brothers recognized the supremacy of Olgierd. His son, Jagiello, who married the queen of Poland, Yadviga, after having been baptized in the Latin Church, was crowned, on the 14th of February 1386, king of Poland. At the beginning of the 15th century Lithuania extended her dominions as far east as Vyazma on the banks of the

Moskva river, the present government of Kaluga, and Poutivl, and south-east as far as Poltava, the shores of the Sea of Azov, and Haji-bey (Odessa), thus including Kiev and Lutsk. The union with Poland remained, however, but nominal until 1569, when Sigismund Augustus was king of Poland. In the 16th century Lithuania did not extend its power so far east and south-east as two centuries before, but it constituted a compact state, including Polotsk, Moghilev, Minsk, Grodno, Kovno, Vilna, Brest, and reaching as far south-east as Chernigov. From the union with Poland, the history of Lithuania becomes a part of Poland's history, Lithuanians and White-Russians partaking of the fate of the Polish kingdom (see POLAND: *History*). After its three partitions, they fell under the dominion of the Russian empire. In 1792 Russia took the provinces of Moghilev and Polotsk, and in 1793 those of Vilna, Troki, Novgorod-Syeversk, Brest and Vitebsk. In 1797 all these provinces were united together, constituting the "Lithuanian government" (Litovskaya Gubernia). But the name of Lithuanian provinces was usually given only to the governments of Vilna and Kovno, and, though Nicholas I. prohibited the use of this name, it is still used, even in official documents. In Russia, all the White-Russian population of the former Polish Lithuania are usually considered as Lithuanians, the name of Zhmud being restricted to Lithuanians proper.

The ethnographical limits of the Lithuanians are undefined, and their number is variously estimated. The Letts occupy a part of the Courland peninsula of Livonia and of Vitebsk, a few other settlements being spread also in the governments of Kovno, St Petersburg and Moghilev. The Lithuanians proper inhabit the governments of Kovno, Vilna, Suvalki and Grodno; while the Samogitians or Zhmud inhabit the governments of Kovno and Suvalki. To these must be added about 200,000 Borussians, the whole number of Lithuanians and Letts in Russia being, according to the census of 1897, 3,094,469. They are slowly extending towards the south, especially the Letts; numerous emigrants have penetrated into Slavonic lands as far as the government of Voronezh.

The Lithuanians are well built; the face is mostly elongated, the features fine; the very fair hair, blue eyes and delicate skin distinguish them from Poles and Russians. Their dress is usually plain in comparison with that of Poles, and the predominance in it of greyish colours has been frequently noticed. Their chief occupation is agriculture. The trades in towns are generally carried on by men of other races—mostly by Germans, Jews or Poles. The only exception is afforded to some extent by the Letts. The Samogitians are good hunters, and all Lithuanians are given to apiculture and cattle breeding. But the Lithuanians, as well in the Baltic provinces as in the central ones, were not until the most recent time proprietors of the soil they tilled. They have given a few families to the Russian nobility, but the great mass of the people became serfs of foreign landowners, German and Polish, who reduced them to the greatest misery. Since the Polish insurrection of 1863, the Russian government has given to the Lithuanians the land of the Polish proprietors on much easier terms than in central Russia; but the allotments of soil and the redemption taxes are very unequally distributed; and a not insignificant number of peasants (the *chinsheviki*) were even deprived of the land they had for centuries considered their own. The Letts remain in the same state as before, and are restrained from emigrating *en masse* only by coercive measures.

The Letts of Courland, with the exception of about 50,000 who belong to the Greek Church, are Lutherans. Nearly all can read. Those of the government of Vitebsk, who were under Polish dominion, are Roman Catholics, as well as the Lithuanians proper, a part of whom, however, have returned to the Greek Church, in which they were before the union with Poland. The Samogitians are Roman Catholics; they more than other Lithuanians have conserved their national features. But all Lithuanians have maintained much of their heathen practices and creed; the names of pagan divinities, very numerous in the former mythology, are continually mentioned in songs, and also in common speech.

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Language and Literature.—The Lithuanian, Lettic or Lettish and Borussian or Old Prussian languages together constitute a distinct linguistic subdivision, commonly called the Baltic subdivision, within the Indo-European family. They have many affinities to the Slavonic languages, and are sometimes included with them in a single linguistic group, the Balto-Slavic. In their phonology, however, though not in their structure the Baltic languages appear to be more primitive than the Slavonic. Lithuanian, for example, retains the archaic diphthongs which disappear in Slavonic—Lith. *véidas*, "face," Gr. εἶδος, O.S. *vidŭ*. Among other noteworthy phonological characteristics of Lithuanian are the conversion of *k* into a sibilant, the loss of *h* and change of all aspirates into tenues and the retention of primitive consonantal noun-terminations, *e.g.* the final *s* in Sans. *Vṛkás*, Lith. *vīlkas*, O.S. *vŭlkŭ*. Lettic is phonologically less archaic than Lithuanian, although in a few cases it has preserved Indo-European forms which have been changed in Lithuanian, *e.g.* the *s* and *z* which have become Lith. *sz* (*sh*) and *ž* (*zh*). The accent in Lithuanian is free; in Lettic, and apparently in Old Prussian, it ultimately became fixed on the first syllable.

In its morphology Lettic represents a later stage of development than Lithuanian, their mutual relationship being analogous to that between Old High German and Gothic. Both languages have preserved seven out of the eight Indo-European cases; Lithuanian has three numbers, but Lettic has lost the dual (except in *diwi*, "two" and *abbi*, "both"); the neuter gender, which still appears in Lithuanian pronouns, has also been entirely lost in Lettic; in Lithuanian there are four simple tenses (present, future, imperfect, preterite), but in Lettic the imperfect is wanting. In both languages the number of periphrastic verb-forms and of diminutives is large; in both there are traces of

a suffix article; and both have enriched their vocabularies with many words of foreign, especially German, Russian and Polish origin. The numerous Lithuanian dialects are commonly divided into High or Southern, which changes *ty* and *dy* into *cz*, *dz*, and Low or Northern, which retains *ty*, *dy*. Lettic is divided into High (the eastern dialects), Low (spoken in N.W. Courland) and Middle (the literary language). Old Prussian ceased to be a spoken language in the 17th century; its literary remains, consisting chiefly of three catechisms and two brief vocabularies, date almost entirely from the period 1517-1561 and are insufficient to permit of any thorough reconstruction of the grammar.

The literary history of the Lithuanians and Letts dates from the Reformation and comprises three clearly defined periods. (1) Up to 1700 the chief printed books were of a liturgical character. (2) During the 18th century a vigorous educational movement began; dictionaries, grammars and other instructive works were compiled, and written poems began to take the place of songs preserved by oral tradition. (3) The revival of national sentiment at the beginning of the 19th century resulted in the establishment of newspapers and the collection and publication of the national folk-poetry. In both literatures, works of a religious character predominate, and both are rich in popular ballads, folk-tales and fables.

The first book printed in Lithuanian was a translation of Luther's shorter Catechism (Königsberg, 1547); other translations of devotional or liturgical works followed, and by 1701 59 Lithuanian books had appeared, the most noteworthy being those of the preacher J. Bretkun (1535-1602). The spread of Calvinism led to the publication, in 1701, of a Lithuanian New Testament. The first dictionary was printed in 1749. But perhaps the most remarkable work of the second period was *The Four Seasons*, a pastoral poem in hexameters by Christian Donalitius (1714-1780), which was edited by Nesselmann (Königsberg, 1869) with a German translation and notes. In the 19th century various collections of fables and folk-tales were published, and an epic, the

Onikshta Grove, was written by Bishop Baranoski. But it was in journalism that the chief original work of the third period was done. F. Kelch (1801-1877) founded the first Lithuanian newspaper, and between 1834 and 1895 no fewer than 34 Lithuanian periodicals were published in the United States alone.

Luther's Catechism (Königsberg, 1586) was the first book printed in Lettic, as in the sister speech. In the 17th century various translations of psalms, hymns and other religious works were published, the majority being Calvinistic in tone. The educational movement of the 18th century was inaugurated by G. F. Stender (1714-1796), author of a Lettic dictionary and grammar, of poems, tales and of a *Book of Wisdom* which treats of elementary science and history. Much educational work was subsequently done by the Lettic Literary Society, which publishes a magazine (*Magazin*, Mitau, from 1827), and by the "Young Letts," who published various periodicals and translations of foreign classics, and endeavoured to free their language and thought from German influences. Somewhat similar tasks were undertaken by the "Young Lithuanians," whose first magazine the *Auszra* ("Dawn") was founded in 1883. From 1890 to 1910 the literature of both peoples was marked by an ever-increasing nationalism; among the names most prominent during this period may be mentioned those of the dramatist Steperman and the poet Martin Lap, both of whom wrote in Lettic.

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LITMUS (apparently a corruption of *lacmus*, Dutch *lacmoes*, *lac*, lac, and *moes*, pulp, due to association with "lit," an obsolete word for dye, colour; the Ger. equivalent is *Lackmus*, Fr. *tournesol*), a colouring matter which

occurs in commerce in the form of small blue tablets, which, however, consist mostly, not of the pigment proper, but of calcium carbonate and sulphate and other matter devoid of tinctorial value. Litmus is extensively employed by chemists as an indicator for the detection of free acids and free alkalis. An aqueous infusion of litmus, when exactly neutralized by an acid, exhibits a violet colour, which by the least trace of free acid is changed to red, while free alkali turns it to blue. The reagent is generally used in the form of test paper—bibulous paper dyed red, purple or blue by the respective kind of infusion. Litmus is manufactured in Holland from the same kinds of lichens (species of *Roccella* and *Lecanora*) as are used for the preparation of archil (*q.v.*).

LITOPTERNA, a suborder of South American Tertiary ungulate mammals typified by *Macrauchenia*, and taking their name ("smooth-heel") from the presence of a flat facet on the heel-bone, or calcaneum for the articulation of the fibula. The more typical members of the group were digitigrade animals, recalling in general build the llamas and horses; they have small brains, and a facet on the calcaneum for the fibula. The cheek-dentition approximates more or less to the perissodactyle type. Both the terminal faces of the cervical vertebrae are flat, the femur carries a third trochanter, the bones of both the carpus and tarsus are arranged in linear series, and the number of toes, although commonly three, varies between one and five, the third or middle digit being invariably the largest.

Of the two families, the first is the *Proterotheriidae*, which exhibits, in respect of the reduction of the digits, a curious parallelism to the equine line

among the Perissodactyla; in this feature, as well as in the reduction of the teeth, it is more specialized than the second family.

The molar teeth approximate to the *Palaeotherium* type, but have a more or less strongly developed median longitudinal cleft. The three-toed type is represented by *Diadiaphorus*, in which the dental formula is i.½, c.0/1, p.4/3, m.3/3, and the feet are very like those of *Hipparion*. The cervical vertebrae are of normal form, the orbit (as in the second family) is encircled by bone, the last molar has a third lobe, the single pair of upper incisors are somewhat elongated, and have a gap between and behind them, while the outer lower incisors are larger than the inner pair, the canines being small. The skull has a short muzzle, with elongated nasals. Remains of this and the other representatives of the group are found in the Patagonian Miocene. In *Proterotherium*, which includes smaller forms having the same, or nearly the same, dental formula, the molar teeth differ from those of *Diadiaphorus* by the deeper median longitudinal cleft, which completely divides the crown into an inner and an outer moiety, the two cones of the inner half being united. According to the description given by Argentine palaeontologists, this genus is also three-toed, the single-toed representative of the family being *Thoatherium*, in which the lateral metapodials, or splint-bones, are even more reduced than in the *Equidae*.

In the second family—*Macraucheniidae*—the dentition is complete (forty-four) and without a gap, the crowns of nearly all the teeth being of nearly uniform height, while the upper molars are distinguished from those of the *Proterotheriidae* by a peculiar arrangement of their two inner cones, and the elevation of the antero-posterior portion of the cingulum so as to form an extra pit on the crown. To describe this arrangement in detail is impossible here, but it may be stated that the two inner cones are closely approximated, and separated by a narrow V-shaped notch on the inner side of the crown. The elongated cervical vertebrae are peculiar in that the arch is perforated by the artery in the same manner as in the llamas.

In the Santa Cruz beds of Patagonia the family is represented by the generalized genus *Oxyodontotherium* (in which *Theosodon* may apparently be included). It comprises animals ranging up to the size of a tapir, in which the nostrils were more or less in the normal anterior position, and the cheek-teeth short-crowned, with the inner cones of the upper molars well developed and separated by a notch, and the pits of moderate depth. The last upper premolar is simpler than the molars, and the canine, which may be double-rooted, is like the earlier premolars. The radius and ulna, like the tibia and fibula, are distinct, and the metapodials rudimentary. On the other hand, in *Macrauchenia*, which was a much larger llama-like animal, the skull is elongated and narrow, with rudimentary nasals, and the aperture of the nose placed nearly on the line of the eyes and directed upwards, the muzzle not improbably terminating in a short trunk. Deep pits on the forehead probably served for the attachment of special muscles connected with the latter. Very curious is the structure of the cheek-teeth, which are high-crowned, with the two inner cones reduced to mere points, and the pits on the crown-surface large and funnel-shaped. In fact, the perissodactyle type is almost lost. The cervical vertebrae and limb-bones are very long, the radius and ulna being completely, and the tibia and fibula partially, united. The typical *M. patagonica* is a Pleistocene form as large as a camel, ranging from Patagonia to Brazil, but remains of smaller species have been found in the Pliocene (?) of Bolivia and Argentina.

The imperfectly known *Scalabrinia* of the Argentine Pliocene appears to occupy a position intermediate between *Oxyodontotherium* and *Macrauchenia*, having the nasal aperture situated in the middle of the length of the skull, and the crowns of the cheek-teeth nearly as tall as in the latter, but the lower molars furnished with a projecting process in the hinder valley, similar to one occurring in those of the former.

In this place may be mentioned another strange ungulate from the Santa Cruz beds of Patagonia, namely, *Astrapotherium*, sometimes regarded as

typifying a suborder by itself. This huge ungulate had cheek-teeth singularly like those of a rhinoceros, and an enormous pair of tusk-like upper incisors, recalling the upper canines of *Machaerodus* on an enlarged scale. In the lower jaw are two large tusk-like canines between which are three pairs of curiously-formed spatulate incisors, and in both jaws there is a long diastema. The dental formula appears to be $i.\frac{1}{3}$, $c.\frac{0}{1}$, $p.\frac{2}{1}$, $m.\frac{3}{3}$.

Next *Astrapotherium* may be provisionally placed the genus *Homalodontotherium*, of which the teeth have much lower crowns, and are of a less decidedly rhinocerotic type than in *Astrapotherium*, and the whole dentition forms an even and unbroken series. The bodies of the cervical vertebrae are short, with flattened articular surfaces, the humerus has an enormous deltoid crest, suggestive of fossorial powers, and the femur is flattened, with a third trochanter. According to the Argentine palaeontologists, the carpus is of the alternating type, and the terminal phalanges of the pentedactyle feet are bifid, and very like those of Edentata. Indeed, this type of foot shows many edentate resemblances. The astragalus is square and flattened, articulating directly with the navicular, although not with the cuboid, and having a slightly convex facet for the tibia. From the structure of the above-mentioned type of foot, which is stated to have been found in association with the skull, it has been suggested that *Homalodontotherium* should be placed in the *Ancylopoda* (*q.v.*), but, to say nothing of the different form of the cheek-teeth, all the other South American Santa Cruz ungulates are so distinct from those of other countries that this seems unlikely. It may be suggested that we have rather to deal with an instance of parallelism—a view supported by the parallelism to the *Equidae* presented by certain members of the *Proterotheriidae*.

(R. L.*)

LITOTES (Gr. λιτότης, plainness, λιτός, plain, simple, smooth), a rhetorical figure in which emphasis is secured for a statement by turning it into a denial of the contrary, *e.g.* "a citizen of no mean city," *i.e.* a citizen of a famous city, "A. is not a man to be neglected." Litotes is sometimes used for what should be more strictly called "meiosis" (Gr. μείωσις, lessening, diminution, μείων, lesser), where the expressions used apparently are weak or understated, but the effect is to intensify.

LITTER (through O. Fr. *litere* or *litiere*, mod. *litière* from Med. Lat. *lectaria*, classical *lectica*, *lectus*, bed, couch), a word used of a portable couch, shut in by curtains and borne on poles by bearers, and of a bed of straw or other suitable substance for animals; hence applied to the number of young produced by an animal at one birth, and also to any disordered heap of waste material, rubbish, &c. In ancient Greece, prior to the influence of Asiatic luxury after the Macedonian conquest, the litter (φορεῖον) was only used by invalids or by women. The Romans, when the *lectica* was introduced, probably about the latter half of the 2nd century B.C. (Gellius x. 3), used it only for travelling purposes. Like the Greek or Asiatic litter, it had a roof of

skin (*pellis*) and side curtains (*vela*, *plagae*). Juvenal (iv. 20) speaks of transparent sides (*latis specularibus*). The slaves who bore the litter on their shoulders (*succollare*) were termed *lecticarii*, and it was a sign of luxury and wealth to employ six or even eight bearers. Under the Empire the litter began to be used in the streets of Rome, and its use was restricted and granted as a privilege (Suet. *Claudius*). The travelling *lectica* must be distinguished from the much earlier *lectica funebris* or *feretrum*, the funeral bier on which the dead were carried to their burial-place.

LITTLE FALLS, a city and the county-seat of Morrison county, Minnesota, U.S.A., on both banks of the Mississippi river, about 88 m. N.W. of Minneapolis. Pop. (1890) 2354; (1900) 5774, of whom 1559 were foreign-born, chiefly Germans and Swedes; (1905) 5856; (1910) 6078. It is served by the Northern Pacific railway. The city is situated in a prosperous farming region, and has excellent water-power and various manufactures. Little Falls was settled about 1850, was chartered as a city in 1889 and adopted a new charter in 1902. Here was buried the Chippewa chief, Hole-in-the-Day (*c.* 1827-1868), or Bagwunagijik, who succeeded his father, also named Hole-in-the-Day, as head chief of the Chippewas in 1846. Like his father, the younger Hole-in-the-Day led his tribe against the Sioux, and he is said to have prevented the Chippewas from joining the Sioux rising in 1862. His body was subsequently removed by his relatives.

LITTLE FALLS, a city of Herkimer county, New York, U.S.A., on the Mohawk river, 21 m. E.S.E. of Utica. Pop. (1890) 8783; (1900) 10,381, of whom 1915 were foreign-born; (1910 census) 12,273. It is served by the New York Central & Hudson River, the West Shore, the Utica & Mohawk Valley (electric), and the Little Falls & Dolgeville railways (the last named being 13 m. long and running only to Salisbury Center and by the Erie canal). The Mohawk river falls here by a series of rapids 45 ft. in less than a mile, furnishing water power. Among the manufactures are cotton yarn, hosiery and knit goods, leather, &c. In 1905 the city's factory products were valued at $4,471,080. The city has one of the largest cheese-markets in the United States. The manufacture of flour and grist-mill products was formerly an important industry; a mill burned in 1782 by Tories and Indians had supplied almost the entire Mohawk Valley, and particularly Forts Herkimer and Dayton. Near the city is the grave of General Nicholas Herkimer, to whom a monument was erected in 1896. Little Falls was settled by Germans in 1782, and was almost immediately destroyed by Indians and Tories. It was resettled in 1790, and was incorporated as a village in 1811 and as a city in 1895.

See George A. Hardin, *History of Herkimer County* (Syracuse, 1893).

LITTLEHAMPTON, a seaport and watering-place in the Chichester parliamentary division of Sussex, England, at the mouth of the Arun, 62 m. S. by W. from London by the London, Brighton & South Coast railway. Pop. of urban district (1901) 7363. There is a beach of firm sand. The harbour is easily accessible in all weathers, and has a small general trade.

LITTLE ROCK, the capital of Arkansas, U.S.A., and the county-seat of Pulaski county, situated near the centre of the state and on the S. bank of the Arkansas river, at the E. edge of the Ozark foothills. Pop. (1890) 25,874; (1900) 38,307, of whom 14,694 were of negro blood, and 2099 were foreign-born; (1910 census) 45,941. Little Rock is served by the Chicago, Rock Island & Pacific, the St Louis South Western, and the St Louis, Iron Mountain & Southern railways and by river boats. It occupies a comparatively level site of 11 sq. m. at an altitude of 250 to 400 ft. above sea-level and 50 ft. or more above the river, which is crossed here by three railway bridges and by a county bridge. The city derived its name (originally “le Petit Roche” and “The Little Rock”) from a rocky peninsula in the Arkansas, distinguished from the “Big Rock” (the site of the army post, Fort Logan H. Roots), 1 m. W. of the

city, across the river. The Big Rock is said to have been first discovered and named “Le Rocher Français” in 1722 by Sieur Bernard de la Harpe, who was in search of an emerald mountain; the Little Rock is now used as an abutment for a railway bridge. The state capitol, the state insane asylum, the state deaf mute institute, the state school for the blind, a state reform school, the penitentiary, the state library and the medical and law departments of the state university are at Little Rock; and the city is also the seat of the United States court for the eastern district of Arkansas, of a United States land office, of Little Rock College, of the St Mary’s Academy, of a Roman Catholic orphanage and a Roman Catholic convent, and of two schools for negroes—the Philander Smith College (Methodist Episcopal, 1877), co-educational, and the Arkansas Baptist College. The city is the seat of Protestant Episcopal and Roman Catholic bishops. Little Rock has a Carnegie library (1908), an old ladies’ home, a Florence Crittenton rescue home, a children’s home, St Vincent’s infirmary, a city hospital, a Catholic hospital, a physicians’ and surgeons’ hospital and the Arkansas hospital for nervous diseases. A municipal park system includes City, Forest, Wonderland and West End parks. Immigration from the northern states has been encouraged, and northern men control much of the business of the city. In 1905 the value of factory products was $4,689,787, being 38.8% greater than the value in 1900. Cotton and lumber industries are the leading interests; the value of cotton-seed oil and cake manufactured in 1905 was $967,043, of planing mill products $835,049, and of lumber and timber products $342,134. Printing and publishing and the manufacture of foundry and machine shop products and of furniture are other important industries. Valuable deposits of bauxite are found in Pulaski county, and the mines are the most important in the United States.

Originally the site of the city was occupied by the Quapaw Indians. The earliest permanent settlement by the whites was about 1813-1814; the county was organized in 1818 while still a part of Missouri Territory; Little Rock was surveyed in 1821, was incorporated as a town and became the capital of Arkansas in 1821, and was chartered as a city in 1836. In 1850 its population

was only 2167, and in 1860 3727; but in 1870 it was 12,380. Little Rock was enthusiastically anti-Union at the outbreak of the Civil War. In February 1861, the United States Arsenal was seized by the state authorities. In September 1863 the Federal generals William Steele (1819-1885) and John W. Davidson (1824-1881), operating against General Sterling Price, captured the city, and it remained throughout the rest of the war under Federal control. Constitutional conventions met at Little Rock in 1836, 1864, 1868 and 1874, and also the Secession Convention of 1861. The *Arkansas Gazette*, established at Arkansas Post in 1819 and soon afterwards removed to the new capital, was the first newspaper published in Arkansas and one of the first published west of the Mississippi.

LITTLETON (or LYTTELTON), EDWARD, BARON (1589-1645), son of Sir Edward Littleton (d. 1621) chief-justice of North Wales, was born at Munslow in Shropshire; he was educated at Oxford and became a lawyer, succeeding his father as chief-justice of North Wales. In 1625 he became a member of parliament and acted in 1628 as chairman of the committee of grievances upon whose report the Petition of Right was based. As a member of the party opposed to the arbitrary measures of Charles I. Littleton had shown more moderation than some of his colleagues, and in 1634, three years after he had been chosen recorder of London, the king attached him to his own side by appointing him solicitor-general. In the famous case about ship-money Sir Edward argued against Hampden. In 1640 he was made chief-justice of the common pleas and in 1641 lord keeper of the great seal, being created a peer as Baron Lyttelton. About this time, the lord keeper began to display a certain

amount of indifference to the royal cause. In January 1642 he refused to put the great seal to the proclamation for the arrest of the five members and he also incurred the displeasure of Charles by voting for the militia ordinance. However, he assured his friend Edward Hyde, afterwards earl of Clarendon, that he had only taken this step to allay the suspicions of the parliamentary party who contemplated depriving him of the seal, and he undertook to send this to the king. He fulfilled his promise, and in May 1642 he himself joined Charles at York, but it was some time before he regained the favour of the king and the custody of the seal. Littleton died at Oxford on the 27th of August 1645; he left no sons and his barony became extinct. His only daughter, Anne, married her cousin Sir Thomas Littleton, Bart. (d. 1681), and their son Sir Thomas Littleton (*c.* 1647-1710), was speaker of the House of Commons from 1698 to 1700, and treasurer of the navy from 1700 to 1710. Macaulay thus sums up the character of Speaker Littleton and his relations to the Whigs: “He was one of their ablest, most zealous and most steadfast friends; and had been, both in the House of Commons and at the board of treasury, an invaluable second to Montague” (the earl of Halifax).

LITTLETON, SIR THOMAS DE (*c.* 1407-1481), English judge and legal author, was born, it is supposed, at Frankley Manor House, Worcestershire, about 1407. Littleton’s surname was that of his mother, who was the sole daughter and heiress of Thomas de Littleton, lord of Frankley. She married one Thomas Westcote. Thomas was the eldest of four sons of the marriage, and took the name of Littleton, or, as it seems to have been more commonly spelt, Luttelton. The date of his birth is uncertain; a MS. pedigree

gives 1422, but it was probably earlier than this. If, as is generally accepted, he was born at Frankley Manor, it could not have been before 1407, in which year Littleton's grandfather recovered the manor from a distant branch of the family. He is said by Sir E. Coke to have "attended one of the universities," but there is no corroboration of this statement. He was probably a member of the Inner Temple, and lectured there on the statute of Westminster II., *De Donis Conditionalibus*. His name occurs in the Paston Letters (ed. J. Gairdner, i. 60) about 1445 as that of a well-known counsel and in 1481/2 he received a grant of the manor of Sheriff Hales, Shropshire, from a Sir William Trussel as a reward for his services as counsel. He appears to have been recorder of Coventry in 1450; he was made escheator of Worcestershire, and in 1447/8 was under-sheriff of the same county; he became serjeant-at-law in 1453 and was afterwards a justice of assize on the northern circuit. In 1466 he was made a judge of the common pleas, and in 1475 a knight of the Bath. He died, according to the inscription on his tomb in Worcester cathedral, on the 23rd of August 1481. He married, about 1444, Joan, widow of Sir Philip Chetwind of Ingestrie in Staffordshire, and by her had three sons, through whom he became ancestor of the families holding the peerages of Cobham (formerly Lyttelton, *q.v.*) and Hatherton.

His *Treatise on Tenures* was probably written after he had been appointed to the bench. It is addressed to his second son Richard, who went to the bar, and whose name occurs in the year books of the reign of Henry VII. The book, both historically and from its intrinsic merit, may be characterized as the first text-book upon the English law of property. The law of property in Littleton's time was mainly concerned with rights over land, and it was the law relating to this class of rights which Littleton set himself to digest and classify. The time was ripe for the task. Ever since the Conquest regular courts of justice had been at work administering a law which had grown out of an admixture of Teutonic custom and of Norman feudalism. Under Henry II. the courts had been organized, and the practice of keeping regular records of the proceedings had been carefully observed. The centralizing influence of the royal courts and

of the justices of assize, working steadily through three centuries, had made the rules governing the law of property uniform throughout the land; local customs were confined within certain prescribed limits, and were only recognized as giving rise to certain well-defined classes of rights, such, for instance, as the security of tenure acquired by villeins by virtue of the custom of the manor, and the rights of freeholders, in some towns, to dispose of their land by will. Thus, by the time of Littleton (Henry VI. and Edward IV.), an immense mass of material had been acquired and preserved in the rolls of the various courts. Reports of important cases were published in the "year books." A glance at Statham's *Abridgment*, the earliest digest of decided cases, published nearly at the same time as Littleton's *Tenures*, is sufficient to show the enormous bulk which reported cases had already attained as materials for the knowledge of English law.

Littleton's treatise was written in that peculiar dialect compounded of Norman-French and English phrases called law French. Although it had been provided by a statute of 36 Edward III. that *viva voce* proceedings in court should no longer be conducted in the French tongue, "which was much unknown in the realm," the practice of reporting proceedings in that language, and of using it in legal treatises, lingered till a much later period, and was at length prohibited by a statute passed in the time of the Commonwealth in 1650. Unlike the preceding writers on English law, Glanville, Bracton and the authors of the treatises known by the names of Britton and Fleta, Littleton borrows nothing from the sources of Roman law or the commentators. He deals exclusively with English law.

The book is written on a definite system, and is the first attempt at a scientific classification of rights over land. Littleton's method is to begin with a definition, usually clearly and briefly expressed, of the class of rights with which he is dealing. He then proceeds to illustrate the various characteristics and incidents of the class by stating particular instances, some of which refer to decisions which had actually occurred, but more commonly they are

hypothetical cases put by way of illustration of his principles. He occasionally refers to reported cases. His book is thus much more than a mere digest of judicial decisions; to some extent he pursues the method which gave to Roman law its breadth and consistency of principle. In Roman law this result was attained through the practice of putting to jurisconsults hypothetical cases to be solved by them. Littleton, in like manner, is constantly stating and solving by reference to principles of law cases which may or may not have occurred in actual practice.

In dealing with freehold estates Littleton adopts a classification which has been followed by all writers who have attempted to systematize the English law of land, especially Sir M. Hale and Sir William Blackstone. It is indeed the only possible approach to a scientific arrangement of the intricate "estates in land" known to English law. He classifies estates in land by reference to their duration, or in other words by reference to the differences between the persons who are entitled to succeed upon the death of the person in possession or "tenant." First of all, he describes the characteristics of tenancy in fee simple. This is still as it was in Littleton's time the largest interest in land known to the law. Next in order comes tenancy in fee tail, the various classes of which are sketched by Littleton with brevity and accuracy, but he is silent as to the important practice, which first received judicial recognition shortly before his death, of "suffering a recovery," whereby through a series of judicial fictions a tenant in tail was enabled to convert his estate tail into a fee simple, thus acquiring full power of alienation. After discussing in their logical order other freehold interests in land, he passes to interests in land called by later writers interests less than freehold, namely, tenancies for terms of years and tenancies at will. With the exception of tenancy from year to year, now so familiar to us, but which was a judicial creation of a date later than the time of Littleton, the first book is a complete statement of the principles of the common law, as they for the most part still exist, governing and regulating interests in lands. The first book concludes with a very interesting chapter on copyhold tenures, which marks the exact point at which

the tenant by copy of court roll, the successor of the villein, who in his turn represented the freeman reduced to villenage by the growth of the manorial system, acquired security of tenure.

The second book relates to the reciprocal rights and duties of lord and tenant, and is mainly of historical interest to the modern lawyer. It contains a complete statement of the law as it stood in Littleton's time relating to homage, fealty and escuage, the money compensation to be paid to the lord in lieu of military service to be rendered to the king, a peculiar characteristic of English as distinguished from Continental feudalism.

Littleton then proceeds to notice the important features of tenure by knight's service with its distinguishing incidents of the right of wardship of the lands and person of the infant heir or heiress, and the right of disposing of the ward in marriage. The non-military freehold tenures are next dealt with; we have an account of "socage tenure," into which all military tenures were subsequently commuted by a now unrecognized act of the Long Parliament in 1650, afterwards re-enacted by the well-known statute of Charles II. (1660), and of "frankalmoign," or the spiritual tenure by which churchmen held. In the description of burgage tenure and tenure in villenage, the life of which consists in the validity of ancient customs recognized by law, we recognize survivals of a time before the iron rule of feudalism had moulded the law of land in the interests of the king and the great lords. Finally he deals with the law of rents, discussing the various kinds of rents which may be reserved to the grantor upon a grant of lands and the remedies for recovery of rent, especially the remedy by distress.[1]

The third and concluding book of Littleton's treatise deals mainly with the various ways in which rights over land can be acquired and terminated in the case of a single possessor or several possessors. This leads him to discuss the various modes in which several persons may simultaneously have rights over the same land, as parceners:—daughters who are co-heiresses, or sons in gavelkind; joint tenants and tenants in common. Next follows an elaborate

discussion upon what are called estates upon condition—a class of interests which occupied a large space in the early common law, giving rise on one side to estates tail, on another to mortgages. In Littleton's time a mortgage, which he carefully describes, was merely a conveyance of land by the tenant to the mortgagee, with a condition that, if the tenant paid to the mortgagee a certain sum on a certain day, he might re-enter and have the land again. If the condition was not fulfilled, the interest of the mortgagee became absolute, and Littleton gives no indication of any modification of this strict rule, such as was introduced by courts of equity, permitting the debtor to redeem his land by payment of all that was due to the mortgagee although the day of payment had passed, and his interest had become at law indefeasible. The remainder of the work is occupied with an exposition of a miscellaneous class of modes of acquiring rights of property, the analysis of which would occupy too large a space.

The work is thus a complete summary of the common law as it stood at the time. It is nearly silent as to the remarkable class of rights which had already assumed vast practical importance—equitable interests in lands. These are only noticed incidentally in the chapter on "Releases." But it was already clear in Littleton's time that this class of rights would become the most important of all. Littleton's own will, which has been preserved, may be adduced in proof of this assertion. Although nothing was more opposed to the spirit of Norman feudalism than that a tenant of lands should dispose of them by will, we find Littleton directing by his will the feoffees of certain manors to make estates to the persons named in his will. In other words, in order to acquire over lands powers unknown to the common law, the lands had been conveyed to "feoffees" who had full right over them according to the common law, but who were under a conscientious obligation to exercise those rights at the direction and for the exclusive benefit of the person to whose "use" the lands were held. This conscientious obligation was recognized and enforced by the chancellor, and thus arose the class of equitable interests in lands. Littleton is

the first writer on English law after these rights had risen into a prominent position, and it is curious to find to what extent they are ignored by him.

BIBLIOGRAPHY.—The work of Littleton occupies a place in the history of typography as well as of law. The earliest printed edition seems to be that by John Lettou and William de Machlinia, two printers who probably came from the Continent, and carried on their business in partnership, as their note to the edition of Littleton states, "in civitate Londoniarum, juxta ecclesiam omnium sanctorum." The date of this edition is uncertain, but the most probable conjecture, based on typographical grounds, places it about the latter part of 1481. The next edition is one by Machlinia alone, probably about two or three years later than the former. Machlinia was then in business alone "juxta pontem quae vulgo dicitur Fleta brigge." Next came the Rohan or Rouen edition, erroneously stated by Sir E. Coke to be the earliest, and to have been printed about 1533. It was, however, of a much earlier date. Tomlins, the latest editor of Littleton, gives reasons for thinking that it cannot have been later than 1490. It is stated in a note to have been printed at Rouen by William le Tailleur "ad instantiam Richardi Pynson." Copies of all these editions are in the British Museum. In all these editions the work is styled *Tenores Novelli*, probably to distinguish it from the "Old Tenures."

There are three early MSS. of Littleton in the University Library at Cambridge. One of these formerly contained a note on its first page to the effect that it was bought in St Paul's Churchyard on July 20, 1480. It was therefore in circulation in Littleton's lifetime. The other two MSS. are of a somewhat later date; but one of them contains what seems to be the earliest English translation of the *Tenures*, and is probably not later than 1500.

In the 16th century editions of Littleton followed in rapid succession from the presses of Pynson, Redmayne, Berthelet, Tottyl and others. The practice of annotating the text caused several additions to be introduced, which, however, are easily detected by comparison of the earlier copies. In 1581 West divided the text into 746 sections, which have ever since been preserved. Many of

these editions were printed with large margins for purposes of annotation, specimens of which may be seen in Lincoln's Inn Library.

The practice of annotating Littleton was very general, and was adopted by many eminent lawyers besides Sir E. Coke, amongst others by Sir M. Hale. One commentary of this kind, by an unknown hand of earlier date than Sir E. Coke's, was edited by Cary in 1829. Following the general practice of dealing with Littleton as the great authority on the law of England, "the most perfect and absolute work that ever was written in any human science," Sir E. Coke made it in 1628 the text of that portion of his work which he calls the first part of the institutes of the law of England, in other words, the law of property.

The first printed English translation of Littleton was by Rastell, who seems to have combined the professions of author, printer and serjeant-at-law, between 1514 and 1533. Many English editions by various editors followed, the best of which is Tottyl's in 1556. Sir E. Coke adopted some translation earlier than this, which has since gone by the name of Sir E. Coke's translation. He, however, throughout comments not on the translation but on the French text; and the reputation of the commentary has to some extent obscured the intrinsic merit of the original.

See E. Wambaugh, *Littleton's Tenures in English* (Washington, D.C., 1903).

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1 These two books are stated, in a note to the table at the conclusion of the work, to have been made for the better understanding of certain chapters of the *Antient Book of Tenures*. This refers to a tract called *The Old Tenures*, said to have been written in the reign of Edward III. By way of distinguishing it from this work, Littleton's book is called in all the early editions "Tenores Novelli."

LITTRÉ, MAXIMILIEN PAUL ÉMILE (1801-1881), French lexicographer and philosopher, was born in Paris on the 1st of February 1801. His father had been a gunner, and afterwards sergeant-major of marine artillery, in the French navy, and was deeply imbued with the revolutionary ideas of the day. Settling down as a collector of taxes, he married Sophie Johannot, a free-thinker like himself, and devoted himself to the education of his son Émile. The boy was sent to the Lycée Louis-le-Grand, where he had for friends Hachette and Eugène Burnouf. After he had completed his course at school, he hesitated for a time as to what profession he should adopt, and meanwhile made himself master, not only of the English and German languages, but of the classical and Sanskrit literature and philology. At last he determined to study medicine, and in 1822 entered his name as a student of medicine. He passed all his examinations in due course, and had only his thesis to prepare in order to obtain his degree as doctor when in 1827 his father died, leaving his mother absolutely without resources. He at once renounced his degree, and, while attending the lectures of P. F. O. Rayer and taking a keen interest in medicine, began teaching Latin and Greek for a livelihood. He carried a musket on the popular side in the revolution of February 1830, and was one of the national guards who followed Charles X. to Rambouillet. In 1831 he obtained an introduction to Armand Carrel, the editor of the *National*, who gave him the task of reading the English and German papers for excerpts. Carrel by chance, in 1835, discovered the ability of his reader, who from that time became a constant contributor, and eventually director of the paper. In 1836 Littré began to contribute articles on

all sorts of subjects to the *Revue des deux mondes*; in 1837 he married; and in 1839 appeared the first volume of his edition of the works of Hippocrates. The value of this work was recognized by his election the same year into the Académie des Inscriptions et Belles-Lettres. At this epoch he came across the works of Auguste Comte, the reading of which formed, as he himself said, "the cardinal point of his life," and from this time onward appears the influence of positivism on his own life, and, what is of more importance, his influence on positivism, for he gave as much to positivism as he received from it. He soon became a friend of Comte, and popularized his ideas in numerous works on the positivist philosophy. At the same time he continued his edition of Hippocrates, which was not completed till 1862, published a similar edition of Pliny's *Natural History*, and after 1844 took Fauriel's place on the committee engaged on the *Histoire littéraire de la France*, where his knowledge of the early French language and literature was invaluable.

It was about 1844 that he started working on his great *Dictionnaire de la langue française*, which was, however, not to be completed till thirty years after. In the revolution of July 1848 he took part in the repression of the extreme republican party in June 1849. His essays, contributed during this period to the *National*, were collected together and published under the title of *Conservation, révolution et positivisme* in 1852, and show a thorough acceptance of all the doctrines propounded by Comte. However, during the later years of his master's life, he began to perceive that he could not wholly accept all the dogmas or the more mystic ideas of his friend and master, but he concealed his differences of opinion, and Comte failed to perceive that his pupil had outgrown him, as he himself had outgrown his master Saint-Simon. Comte's death in 1858 freed Littré from any fear of embittering his master's later years, and he published his own ideas in his *Paroles de la philosophie positive* in 1850, and at still greater length in his work in *Auguste Comte et la philosophie positive* in 1863. In this book he traces the origin of Comte's ideas through Turgot, Kant and Saint-Simon, then eulogizes Comte's own life, his method of philosophy, his great services to the cause and the effect of his

works, and finally proceeds to show where he himself differs from him. He approved wholly of Comte's philosophy, his great laws of society and his philosophical method, which indeed he defended warmly against J. S. Mill, but declared that, while he believed in a positivist philosophy, he did not believe in a religion of humanity. About 1863, after completing his Hippocrates and his Pliny, he set to work in earnest on his French dictionary. In the same year he was proposed for the Académie Française, but rejected, owing to the opposition of Mgr. Dupanloup, bishop of Orleans, who denounced him in his *Avertissement aux pères de famille* as the chief of the French materialists. He also at this time started with G. Wyrouboff the *Philosophie Positive*, a review which was to embody the views of modern positivists. His life was thus absorbed in literary work till the overthrow of the empire called on him to take a part in politics. He felt himself too old to undergo the privations of the siege of Paris, and retired with his family to Britanny, whence he was summoned by M. Gambetta to Bordeaux, to lecture on history, and thence to Versailles to take his seat in the senate to which he had been chosen by the department of the Seine. In December 1871 he was elected a member of the Académie Française in spite of the renewed opposition of Mgr. Dupanloup, who resigned his seat rather than receive him. Littré's *Dictionary* was completed in 1873. An authoritative interpretation is given of the use of each word, based on the various meanings it had held in the past. In 1875 Littré was elected a life senator. The most notable of his productions in these years were his political papers attacking and unveiling the confederacy of the Orleanists and legitimists, and in favour of the republic, his republication of many of his old articles and books, among others the *Conservation, révolution et positivisme* of 1852 (which he reprinted word for word, appending a formal, categorical renunciation of many of the Comtist doctrines therein contained), and a little tract *Pour la dernière fois*, in which he maintained his unalterable belief in materialism. When it became obvious that the old man could not live much longer, his wife and daughter, who had always been fervent Catholics, strove to convert him to their religion. He had

long interviews with Père Milléríot, a celebrated controversialist, and was much grieved at his death; but it is hardly probable he would have ever been really converted. Nevertheless, when on the point of death, his wife had him baptized, and his funeral was conducted with the rites of the Catholic Church. He died on the 2nd of June 1881.

The following are his most important works: his editions of Hippocrates (1839-1861), and of Pliny's *Natural History* (1848-1850); his translation of Strauss's *Vie de Jésus* (1839-1840), and Müller's *Manuel de physiologie* (1851); his edition of the works of Armand Carrel, with notes (1854-1858); the *Histoire de la langue française*, a collection of magazine articles (1862); and his *Dictionnaire de la langue française* (1863-1872). In the domain of science must be noted his edition, with Charles Robin, of Nysten's *Dictionnaire de médicine, de chirurgie*, &c. (1855); in that of philosophy, his *Analyse raisonnée du cours de philosophie positive de M. A. Comte* (1845); *Application de la philosophie positive au gouvernement* (1849); *Conservation, révolution et positivisme* (1852, 2nd ed., with supplement, 1879); *Paroles de la philosophie positive* (1859); *Auguste Comte et la philosophie positive* (1863); *La Science au point de vue philosophique* (1873); *Fragments de philosophie et de sociologie contemporaine* (1876); and his most interesting miscellaneous works, his *Études et glanures* (1880); *La Verité sur la mort d'Alexandre le grand* (1865); *Études sur les barbares et le moyen âge* (1867); *Médecine et médecins* (1871); *Littérature et histoire* (1875); and *Discours de réception à l'Académie française* (1873).

For his life consult C. A. Sainte-Beuve, *Notice sur M. Littré, sa vie et ses travaux* (1863); and *Nouveaux Lundis*, vol. v.; also the notice by M. Durand-Gréville in the *Nouvelle Revue* of August 1881; E. Caro, *Littré et le positivisme* (1883); Pasteur, *Discours de réception* at the Academy, where he succeeded Littré, and a reply by E. Renan.

(H. M. S.)

LITURGY (Low Lat. *liturgia*; Gr. λεῖτος, public, and ἔργον, work; λειτουργός, a public servant), in the technical language of the Christian Church, the order for the celebration and administration of the Eucharist. In Eastern Christendom the Greek word λειτουργία is used in this sense exclusively. But in English-speaking countries the word "liturgy" has come to be used in a more popular sense to denote any or all of the various services of the Church, whether contained in separate volumes or bound up together in the form of a Book of Common Prayer. In this article the liturgy is treated in the former and stricter sense. (For the ancient Athenian λειτουργίαι, as forms of taxation, see FINANCE.)

In order to understand terms and references it will be convenient to give the tabular form the chief component parts of a liturgy, selecting the Liturgy of Rome as characteristic of Western, and that of Constantinople as characteristic of Eastern, Christendom; at the same time appending an explanation of some of the technical words which must be employed in enumerating those parts.

ORDER OF THE ROMAN LITURGY

Ordinary of the Mass.

1. Introit, or as it is always called in the Sarum rite, "Office," a Psalm or part of a Psalm sung at the entry of the priest, or clergy and choir.

2. Kyrie eleison, ninefold, and sometimes lengthily farsed representing an older, now obsolete, litany.

3. Collect, *i.e*. the collect for the day.

4. Prophetic lection, now obsolete, except on the Wednesday and Saturday Ember Days, Good Friday and Easter Even, and Wednesday after fourth and sixth Sundays in Lent.

5. Epistle.

6. Gradual. A few verses from the Psalms, the shrunken remainder of a whole Psalm.

7. Sequence. A hymn now obsolete except on Feast of the Seven Dolours, Easter, Pentecost, Corpus Christi and at Masses for the dead.

8. Gospel.

9. Creed.

10. Collect, now obsolete, though the unanswered invitation, “Let us pray,” still survives.

11. Offertory. A verse or verses from the Psalms sung at the offering of the elements.

12. Secret. A prayer or prayers said at the conclusion of the Offertory.

13. Sursum Corda. “Lift up your hearts,” with following versicles.

14. Preface. There are now ten proper or special prefaces and one common preface. In older missals they were extremely numerous, almost every Sunday and Holy-day having one assigned to it. Many of them were very beautiful. In older missals, Nos. 13, 14 and 15 were sometimes arranged not as the concluding part of the Ordinary, but as the opening part of the Canon of the mass.

15. Sanctus, or Tersanctus, or Triumphal Hymn, “Holy, Holy, Holy,” &c., ending with the Benedictus, “Blessed is he that cometh,” &c.

Canon of the Mass.

1. Introductory prayer for acceptance. Te igitur, &c.

2. Intercession for the living. Memento, Domine famulorum, &c.

3. Commemoration of apostles and martyrs. Communicantes et memoriam, &c.

4. Prayer for acceptance and consecration of offering. Hanc igitur oblationem, &c.

5. Recital of words of institution. Qui pridie quam pateretur, &c.

6. Oblation. Unde et memores, &c.

7. Invocation. A passage difficult of interpretation, but apparently meant to be equivalent to the Eastern Epiklesis or invocation of the Holy Ghost. Supplices te rogamus, &c.

8. Intercession for the dead. Memento etiam, Domine, famulorum, &c.

9. Lord’s Prayer, with a short introduction and the expansion of the last petition into a prayer known as the “Embolismus.”

10. Fraction, *i.e.* breaking of the host into three parts, to symbolize the death and passion of Christ.

11. Commixture, *i.e.* placing a small portion of the consecrated bread into the chalice symbolizing the reunion of Christ’s body and soul at the resurrection.

12. Agnus Dei, *i.e.* a three-fold petition to the Lamb of God.

13. Pax, *i.e.* the kiss of peace. The ancient ritual of the Pax has become almost obsolete.

14. Three prayers, accompanying the Pax and preliminary to communion.

15. Communion of priest and people (if any), a short anthem called "Communio" being sung meanwhile.

16. Ablution of paten and chalice.

17. Post-communion, *i.e.* a concluding prayer.

18. Dismissal.

The Canon of the Mass strictly ends with No. 9; Nos. 10-18 being an appendix to it.

Liturgy of Constantinople

Mass of the Catechumens. After preparation and vesting.

1. The Deacon's Litany.

2. Three Anthems with accompanying prayers.

3. Little Entrance, *i.e.* ceremonial bringing in of the Book of the Gospels.

4. The Trisagion, *i.e.* an anthem with an accompanying prayer different from the Latin Sanctus or Tersanctus.

5. Epistle.

6. Gospel with a prayer preceding it.

7. Bidding prayer.

8. Prayer for catechumens.

9. Dismissal of catechumens.

10. Spreading of the corporal.

Mass of the Faithful.

11. Prayers of the faithful.

12. Cherubic Hymn, “Let us who mystically represent the Cherubim, &c.” not represented in the Latin liturgy.

13. Great Entrance, *i.e.* of the unconsecrated elements with incense and singing and intercessions.

14. Kiss of Peace.

15. Creed.

16. The Benediction, *i.e.* 2 Cor. xiii. 14.

17. Sursum corda.

18. Preface.

19. Sanctus, or Tersanctus, or “Triumphal Hymn.”

20. Recital of Words of Institution, prefaced by recital of the Redemption.

21. The oblation.

22. The invocation or Epiklesis.

23. Intercession for the dead.

24. Intercession for the living.

25. The Lord’s Prayer.

26. Prayer of humble access (*a*) for people (*b*) for priest.

27. Elevation with the invitation “Holy things to holy people.”

28. Fraction.

29. Commixture.

30. Thanksgiving.

31. Benediction.

In both these lists many interesting features of ceremonial, the use of incense, the infusion of warm water (Byzantine only), &c., have not been referred to. The lists must be regarded as skeletons only.

There are six main families or groups of liturgies, four of them being of Eastern and two of them of Western origin and use. They are known either by the names of the apostles with whom they are traditionally connected, or by the names of the countries or cities in which they have been or are still in use.

Group I. *The Syrian Rite* (St James).—The principal liturgies to be enumerated under this group are the Clementine liturgy, so called from being found in the eighth book of the Apostolic Constitutions, which claim in their title, though erroneously, to have been compiled by St Clement, the 1st-century bishop of Rome; the Greek liturgy of St James; the Syriac liturgy of St James. Sixty-four more liturgies of this group have existed, the majority being still in existence. Their titles are given in F. E. Brightman’s *Liturgies, Eastern and Western* (1896), pp. lviii.-lxi.

Group II. *The Egyptian Rite* (St Mark).—This group includes the Greek liturgies of St Mark, St Basil and St Gregory, and the Coptic liturgies of St Basil, St Gregory, St Cyril or St Mark; together with certain less known liturgies the titles of which are enumerated by Brightman (*op. cit.* pp. lxxiii.

lxxiv.). The liturgy of the Ethiopian church ordinances and the liturgy of the Abyssinian Jacobites, known as that of the Apostles, fall under this group.

Group III. *The Persian Rite* (SS. Adaeus and Maris).—This Nestorian rite is represented by the liturgy which bears the names of SS. Adaeus and Maris together with two others named after Theodore of Mopsuestia and Nestorius. This group has sometimes been called "East-Syrian." The titles of three more of its now lost liturgies have been preserved, namely those of Narses, Barsumas and Diodorus of Tarsus. The liturgy of the Christians of St Thomas, on the Malabar coast of India, formerly belonged to this group, but it was almost completely assimilated to the Roman liturgy by Portuguese Jesuits at the synod of Diamper in 1599.

Group IV. *The Byzantine Rite*.—The Greek liturgies of St Chrysostom, St Basil and St Gregory Dialogus, or The Presanctified, also extant in other languages, are the living representatives of this rite. The Greek liturgy of St Peter is classified under this group, but it is merely the Roman canon of the Mass &c., inserted in a Byzantine framework, and seems to have been used at one time by some Greek communities in Italy. To this group also belongs the Armenian liturgy, of which ten different forms have existed in addition to the liturgy now in general use named after St Athanasius.

We now come to the two western groups of liturgies, which more nearly concern the Latin-speaking nations of Europe, and which, therefore, must be treated of more fully.

Group V. *The Hispano-Gallican Rite* (St John).—This group of Latin liturgies, which once prevailed very widely in Western Europe, has been almost universally superseded by the liturgy of the Church of Rome. Where it survives, it has been more or less assimilated to the Roman pattern. It prevailed once throughout Spain, France, northern Italy, Great Britain and Ireland. The term "Ephesine" has been applied to this group or family of liturgies, chiefly by English liturgiologists, and the names of St John and of

Ephesus, his place of residence, have been pressed into service in support of a theory of Ephesine origin, which, however, lacks proof and may now be regarded as a discarded hypothesis. Other theories represent the Gallican to be a survival of the original Roman liturgy, or as an importation into Western Europe from the east through a Milanese channel. The latter is Duchesne's theory (*Christian Worship*, London, 1904, 2nd ed., p. 94).

We must be content with mentioning these theories without attempting to discuss them.

The chief traces of oriental influence and affinity lie in the following points: —(1) various proclamations made by the deacon, including that of "Silentium facite" before the epistle (Migne, *Pat. Lat.* tom. lxxxv. col. 534); (2) the presence of a third lesson preceding the epistle, taken from the Old Testament; (3) the occasional presence of "preces" a series of short intercessions resembling the Greek "Ektené" or deacon's litany; (4) the position of the kiss of peace at an early point in the service, before the canon, instead of the Roman position after consecration; (5) the exclamation "Sancta sanctis" occurring in the Mozarabic rite, being the counterpart of the Eastern "Τὰ ἅγια τοῖς ἁγίοις," that is "holy things to holy people"; (6) traces of the presence of the "Epiklesis," that is to say, the invocation of the Holy Spirit, in its Eastern position after the words of institution, as in the prayer styled the Post-pridie in the Mozarabic service for the second Sunday after the octave of the Epiphany: "We beseech thee that thou wouldest sanctify this oblation with the permixture of thy Spirit, and conform it with full transformation into the body and blood of our Lord Jesus Christ." (Migne, *Pat. Lat.* tom. lxxxv. col. 250). On the other hand the great variableness of its parts, and the immense number of its proper prefaces, ally it to the Western family of liturgies.

We proceed now to give a more detailed account of the chief liturgies of this group.

1. *The Mozarabic Liturgy.*—This was the national liturgy of the Spanish church till the close of the 11th century, when the Roman liturgy was forced upon it. Its use, however, lingered on, till in the 16th century Cardinal Jimenes, anxious to prevent its becoming quite obsolete, had its books restored and printed, and founded a college of priests at Toledo to perpetuate its use. It survives now only in several churches in Toledo and in a chapel at Salamanca, and even there not without certain Roman modifications of its original text and ritual.

Its date and origin, like the date and origin of all existing liturgies, are uncertain, and enveloped in the mists of antiquity. It is not derived from the present Roman liturgy. Its whole structure, as well as separate details disprove such a parentage, and therefore it is strange to find St Isidore of Seville (*Lib. de Eccles. Offic*. i. 15) attributing it to St Peter. No proof is adduced, and the only value which can be placed upon such an unsupported assertion is that it shows that a very high and even apostolic antiquity was claimed for it. A theory, originating with Pinius, that it may have been brought by the Goths from Constantinople when they invaded Spain, is as improbable as it is unproven. It may have been derived from Gaul. The Gallican sister stood to it in the relation of twin-sister, if it could not claim that of mother. The resemblance was so great that when Charles the Bald (843-877) wished to get some idea of the character of the already obsolete Gallican rite, he sent to Toledo for some Spanish priests to perform Mass according to the Mozarabic rite in his presence. But there is no record of the conversion of Spain by Gallican missionaries. Christianity existed in Spain from the earliest times. Probably St Paul travelled there (Rom. xv. 24). It may be at least conjectured that its liturgy was Pauline rather than Petrine or Johannine.

2. *Gallican Liturgy*.—This was the ancient and national liturgy of the church in France till the commencement of the 9th century, when it was suppressed by order of Charlemagne, who directed the Roman missal to be everywhere substituted in its place. All traces of it seemed for some time to

have been lost until three Gallican sacramentaries were discovered and published by Thomasius in 1680 under the titles of *Missale Gothicum*, *Missale Gallicum* and *Missale Francorum*, and a fourth was discovered and published by Mabillon in 1687 under the title of *Missale Gallicanum*. Fragmentary discoveries have been made since. Mone discovered fragments of eleven Gallican masses and published them at Carlsruhe in 1850. Other fragments from the library at St Gall have been published by Bunsen (*Analecta Ante-Nicaena*, iii. 263-266), and from the Ambrosian library at Milan by Cardinal Mai (*Scriptt. Vet. Vat. Coll.* iii. 2. 247). A single page was discovered in Gonville and Caius College, Cambridge, published in *Zeitschrift für Kath. Theologie*, vi. 370.

These documents, illustrated by early Gallican canons, and by allusions in the writings of Sulpicius Severus, Caesarius of Arles, Gregory of Tours, Germanus of Paris and other authors, enable us to reconstruct the greater part of this liturgy. The previously enumerated signs of Eastern origin and influence are found here as well as in the Mozarabic liturgy, together with certain other more or less minute peculiarities, which would be of interest to professed liturgiologists, but which we must not pause to specify here. They are the origin of the Ephesine theory that the Gallican liturgy was introduced into use by Irenaeus, bishop of Lyons (*c.* 130-200) who had learned it in the East from St Polycarp, the disciple of the apostle St John.

3. *Ambrosian Liturgy.*—Considerable variety of opinion has existed among liturgical writers as to the proper classification of the "Ambrosian" or "Milanese" liturgy. If we are to accept it in its present form and to make the present position of the great intercession for quick and dead the test of its *genus*, then we must classify it as "Petrine" and consider it as a branch of the Roman family. If, on the other hand, we consider the important variations from the Roman liturgy which yet exist, and the traces of still more marked variation which confront us in the older printed and MS. copies of the Ambrosian rite, we shall detect in it an original member of the Hispano-

Gallican group of liturgies, which for centuries underwent a gradual but ever-increasing assimilation to Rome. We know this as a matter of history, as well as a matter of inference from changes in the text itself. Charlemagne adopted the same policy towards the Milanese as towards the Gallican church. He carried off all the Ambrosian church books which he could obtain, with the view of substituting Roman books in their place, but the completion of his intentions failed, partly through the attachment of the Lombards to their own rites, partly through the intercession of a Gallican bishop named Eugenius (Mabillon, *Mus. Ital.* tom. i. Pars. ii. p. 106). It has been asserted by Joseph Vicecomes that this is an originally independent liturgy drawn up by St Barnabas, who first preached the Gospel at Milan (*De Missae* Rit. 1 capp. xi. xii.), and this tradition is preserved in the title and proper preface for St Barnabas Day in the Ambrosian missal (Pamelius, *Liturgicon*, i. 385, 386), but it has never been proved.

We can trace the following points in which the Ambrosian differs from the Roman liturgy, many of them exhibiting traces of Eastern influence. Some of them are no longer found in recent Ambrosian missals and only survive in earlier MSS. such as those published by Pamelius (*Liturgicon*, tom. i. p. 293), Muratori (*Lit. Rom. Vet.* i. 132) and Ceriani (in his edition, 1881, of an ancient MS. at Milan). (*a*) The prayer entitled "oratio super sindonem" corresponding to the prayer after the spreading of the corporal; (*b*) the proclamation of silence by the deacon before the epistle; (*c*) the litanies said after the Ingressa (Introit) on Sundays in Lent, closely resembling the Greek Ektené; (*d*) varying forms of introduction to the Lord's Prayer, in Coena Domini (Ceriani p. 116) in Pascha (*Ib.* p. 129); (*e*) the presence of passages in the prayer of consecration which are not part of the Roman canon and one of which at least corresponds in import and position though not in words to the Greek Invocation: *Tuum vero, est, omnipotens Pater, mittere*, &c. (*Ib.* p. 116); (*f*) the survival of a distinctly Gallican formula of consecration in the Post-sanctus "in Sabbato Sancto." *Vere sanctus, vere benedictus Dominus noster,* &c. (*Ib.* p. 125); (*g*) the varying nomenclature of the Sundays after Pentecost; (*h*) the

position of the fraction or ritual breaking of bread before the Lord's Prayer; (*i*) the omission of the second oblation after the words of institution (Muratori, *Lit. Rom. Vet.* i. 133); (*k*) a third lection or *Prophetia* from the Old Testament preceding the epistle and gospel; (*l*) the lay offering of the oblations and the formulae accompanying their reception (Pamelius, *Liturgicon*, i. 297); (*m*) the position of the ablution of the hands in the middle of the canon just before the words of institution; (*n*) the position of the "oratio super populum," which corresponds in matter but not in name to the collect for the day, before the Gloria in Excelsis.

4. *Celtic Liturgy.*—We postpone the consideration of this liturgy till after we have treated of the next main group.

VI. *The Roman Rite* (St Peter).—There is only one liturgy to be enumerated under this group, viz. the present liturgy of the Church of Rome, which, though originally local in character and circumscribed in use, has come to be nearly co-extensive with the Roman Catholic Church, sometimes superseding earlier national liturgies, as in Gaul and Spain, sometimes incorporating more or less of the ancient ritual of a country into itself and producing from such incorporation a sub-class of distinct Uses, as in England, France and elsewhere. Even these subordinate Uses have for the most part become, or are rapidly becoming, obsolete.

The date, origin and early history of the Roman liturgy are obscure. The first Christians at Rome were a Greek-speaking community, and their liturgy must have been Greek, and is possibly represented in the so-called Clementine liturgy. But the date when such a state of things ceased, when and by whom the present Latin liturgy was composed, whether it is an original composition, or, as its structure seems to imply, a survival of some intermediate form of liturgy—all these are questions which are waiting for solution.

One MS. exists which has been claimed to represent the Roman liturgy as it existed in the time of Leo I., 440-461. It was discovered at Verona by

Bianchini in 1735 and assigned by him to the 8th century and published under the title of *Sacramentarium Leonianum*; but this title was from the first conjectural, and is in the teeth of the internal evidence which the MS. itself affords. The question is discussed at some length by Muratori (*Lit. Rom. Vet.* tom. i. cap. i. col. 16). Assemani published it under the title of *Sacramentarium Veronense* in tom. vi. of his *Codex Liturg. Eccles. Univ*.

A MS. of the 7th or 8th century was found at Rome by Thomasius and published by him in 1680 under the title of *Sacramentarium Gelasianum*. But it was written in France and is certainly not a pure Gelasian codex; and although there is historical evidence of Pope Gelasius I. (492-496) having made some changes in the Roman liturgy, and although MSS. have been published by Gerbertus and others, claiming the title of Gelasian, we neither have nor are likely to have genuine and contemporary MS. evidence of the real state of the liturgy in that pope's time. The most modern and the best edition of the Gelasian Sacramentary is that by H. A. Wilson (Oxford, 1894).

The larger number of MSS. of this group are copies of the Gregorian Sacramentary, that is to say, MSS. representing or purporting to represent, the state of Roman liturgy in the days of Pope Gregory the Great. But they cannot be accepted as certain evidence for the following reasons: not one of them was written earlier than the 9th century, not one of them was written in Italy, but every one north of the Alps; every one contains internal evidence of a post-Gregorian date in the shape of masses for the repose or for the intercession of St Gregory and in various other ways.

The Roman liturgy seems to have been introduced into England in the 7th, into France in the 9th and into Spain in the 11th century, though no doubt it was known in both France and Spain to some extent before these dates. In France certain features of the service and certain points in the ritual of the ancient national liturgy became interwoven with its text and formed those many varying medieval Gallican Uses which are associated with the names of different French sees.

The chief distinguishing characteristics of the Roman rite are these: (*a*) the position of the great intercession for quick and dead within the canon, the commemoration of the living being placed just before and the commemoration of the departed just after the words of institution; (*b*) the absence of an "Epiklesis" or invocation of the Holy Ghost upon the elements; (*c*) the position of the "Pax" or "Kiss of Peace after the consecration" and before the communion, whereas in other liturgies it occurs at a much earlier point in the service.

Liturgies of the British Islands.

Period I. *The Celtic Church.*—Until recently almost nothing was known of the character of the liturgical service of the Celtic church which existed in these islands before the Anglo-Saxon Conquest, and continued to exist in Ireland, Scotland, Wales and Cornwall for considerable though varying periods of time after that event. But in recent times a good deal of light has been thrown on the subject, partly by the publication or republication of the few genuine works of Patrick, Columba, Columbanus, Adamnan and other Celtic saints; partly by the discovery of liturgical remains in the Scottish *Book of Deer* and in the Irish *Books of Dimma and Mulling* and the *Stowe Missal*, &c.; partly by the publication of medieval Irish compilations, such as the *Lebar Brecc*, *Liber Hymnorum*, *Martyrology of Oengus*, &c., which contain ecclesiastical kalendars, legends, treatises, &c., of considerable but very varying antiquity. The evidence collected from these sources is sufficient to prove that the liturgy of the Celtic church was of the Gallican type. In central England the churches, with everything belonging to them, were destroyed by the heathen invaders at the close of the 5th century; but the Celtic church in the remoter parts of England, as well as in the neighbouring kingdoms of Scotland and Ireland, retained its independence for centuries afterwards.

An examination of its few extant service-books and fragments of service-books yields the following evidence of the Gallican origin and character of the Celtic liturgy: (*a*) the presence of collects and anthems which occur in the Gallican or Mozarabic but not in the Roman liturgy; (*b*) various formulae of thanksgiving after communion; (*c*) frequent biddings or addresses to the people in the form of Gallican *Praefationes*; (*d*) the Gallican form of consecration, being a prayer called "Post-Sanctus" leading up to the words of institution; (*e*) the complicated rite of "fraction" or "the breaking of bread," as described in the Irish treatise at the end of the *Stowe Missal*, finds its only counterpart in the elaborate ceremonial of the Mozarabic church; (*f*) the presence of the Gallican ceremonial of *Pedilavium* or "Washing of feet" in the earliest Irish baptismal office.

For a further description of these and other features which are characteristic of or peculiar to the Celtic liturgy the reader is referred to F. E. Warren's *Liturgy and Ritual of the Celtic Church* (Oxford, 1881).

Period II. *The Anglo-Saxon Church*.—We find ourselves here on firmer ground, and can speak with certainty as to the nature of the liturgy of the English church after the beginning of the 7th century. Information is drawn from liturgical allusions in the extant canons of numerous councils, from the voluminous writings of Bede, Alcuin and many other ecclesiastical authors of the Anglo-Saxon period, and above all from a considerable number of service-books written in England before the Norman Conquest. Three of these books are missals of more or less completeness: (1) the *Leofric Missal*, a composite 10th- to 11th-century MS. presented to the cathedral of Exeter by Leofric, the first bishop of that see (1046-1072), now in the Bodleian library at Oxford; edited by F. E. Warren (Oxford, 1883); (2) the missal of Robert of Jumièges, archbishop of Canterbury (1051-1052), written probably at Winchester and presented by Archbishop Robert to his old monastery of Jumièges in the neighbourhood of Rouen, in the public library of which it now lies; edited by H. A. Wilson (London, 1896); (3) the *Red Book of Derby*, a MS. missal of the

second half of the 11th century, now in the library of Corpus Christi College, Cambridge.

A perusal of these volumes proves what we should have expected a priori, that the Roman liturgy was in use in the Anglo-Saxon church. This was the case from the very first. That church owed its foundation to a Roman pontiff, and to Roman missionaries, who brought, as we are told by Bede, their native liturgical codices with them (*Hist. Eccles*. lib. ii. cap. 28). Accordingly, when we speak of an Anglo-Saxon missal, we mean a Roman missal only exhibiting one or more of the following features, which would differentiate it from an Italian missal of the same century. (*a*) Rubrics and other entries of a miscellaneous character written in the vernacular language of the country. (*b*) The commemoration of national or local saints in the kalendar, in the canon of the mass and in the litanies which occur for use on Easter Even and in the baptismal offices. (*c*) The presence of a few special masses in honour of those local saints, together with a certain number of collects of a necessarily local character, for the rulers of the country, for its natural produce, &c. (*d*) The addition of certain peculiarities of liturgical structure and arrangement interpolated into the otherwise purely Roman service from an extraneous source. There are two noteworthy examples of this in Anglo-Saxon service-books. Every Sunday and festival and almost every votive mass has its proper preface, although the number of such prefaces in the Gregorian sacramentary of the same period had been reduced to eight. There was a large but not quite equal number of triple episcopal benedictions to be pronounced by the bishop after the Lord's Prayer and before the communion. This custom must either have been perpetuated from the old Celtic liturgy or directly derived from a Gallican source.

Period III. *Anglo-Norman Church*.—The influx of numerous foreigners, especially from Normandy and Lorraine, which preceded, accompanied and followed the Conquest, and the occupation by them of the highest posts in church as well as state had a distinct effect on the liturgy of the English

church. These foreign ecclesiastics brought over with them a preference for and a habit of using certain features of the Gallican liturgy and ritual, which they succeeded in incorporating into the service-books of the church of England. One of the Norman prelates, Osmund, count of Séez, earl of Dorset, chancellor of England, and bishop of Salisbury (1078-1099), is credited with having undertaken the revision of the English service-books; and the missal which we know as the *Sarum Missal*, or the *Missal according to the Use of Sarum*, practically became the liturgy of the English church. It was not only received into use in the province of Canterbury, but was largely adopted beyond those limits—in Ireland in the 12th and in various Scottish dioceses in the 12th and 13th centuries.

It would be beyond our scope here to give a complete list of the numerous and frequently minute differences between a medieval Sarum and the earlier Anglo-Saxon or contemporaneous Roman liturgy. They lie mainly in differences of collects and lections, variations of ritual on Candlemass, Ash Wednesday and throughout Holy Week; the introduction into the canon of the mass of certain clauses and usages of Gallican character or origin; the wording of rubrics in the subjunctive or imperative tense; the peculiar "Preces in prostratione"; the procession of Corpus Christi on Palm Sunday; the forms of ejection and reconciliation of penitents, &c. The varying episcopal benedictions as used in the Anglo-Saxon church were retained, but the numerous proper prefaces were discarded, the number being reduced to ten.

Besides the famous and far-spreading Use of Sarum, other Uses, more local and less known, grew up in various English dioceses. In virtue of a recognized diocesan independence, bishops were able to regulate or alter their ritual, and to add special masses or commemorations for use within the limits of their jurisdiction. The better known and the more distinctive of these Uses were those of York and Hereford, but we also find traces of or allusions to the Uses of Bangor, Lichfield, Lincoln, Ripon, St Asaph, St Paul's, Wells and Winchester.

Service-books.—The Eucharistie service was contained in the volume called the Missal (*q.v.*), as the ordinary choir offices were contained in the volume known as the Breviary (*q.v.*). But besides these two volumes there were a large number of other service-books. Mr W. Maskell has enumerated and described ninety-one such volumes employed by the Western Church only. It must be understood, however, that many of these ninety-one names are synonyms (*Mon. Rit. Eccles. Anglic*. 1882, vol. i. p. ccxxx.). The list might be increased, but it will be possible here only to name and briefly describe a few of the more important of them. (1) The *Agenda* is the same as the Manual, for which see below. (2) The *Antiphonary* contained the antiphons or anthems, sung at the canonical hours, and certain other minor parts of the service. (3) The *Benedictional* contained those triple episcopal benedictions previously described as used on Sundays and on the chief festivals throughout the year. (4) The *Collectarium* contained the collects for the season, together with a few other parts of the day offices. It was an inchoate breviary. (5) The *Epistolarium* contained the epistles, and the *Evangelistarium* the gospels for the year. (7) The *Gradual* contained the introit, gradual, sequences, and the other portions of the communion service which were sung by the choir at nigh mass. (8) The *Legenda* contained the lections which were read at matins and at other times, and may be taken as a generic term to include the *Homiliarium, Passional* and other volumes. (9) The *Manual* was the name usually employed in England to denote the *Ritual*, which contained the baptismal, matrimonial and other offices which might be performed by the parish priest. (10) The *Pontifical* contained the orders of consecration, ordination, and such other rites as could, ordinarily, only be performed by a bishop. To these we must add a book which was not strictly a church office book, but a handy book for the use of the laity, and which was in very popular use and often very highly embellished from the 14th to the 16th century, the *Book of Hours*, or *Horae Beatae Mariae Virginis*, also known as the *Prymer* or *Primer*. It contained portions of the canonical hours, litanies, the penitential Psalms, and other devotions of a miscellaneous and private character. Detailed information

about all these and other books is to be found in C. Wordsworth and H. Littlehales', *The Old Service Books of the English Church*.

The Eastern Church too possessed and still possesses numerous and voluminous service-books, of which the chief are the following: (1) The *Euchologian*, containing the liturgy itself with the remaining sacramental offices bound up in the same volume. (2) The *Horologion*, containing the unvarying portion of the Breviary. (3) The *Menaea*, being equivalent to a complete Breviary. (4) The *Menologion* or Martyrology. (5) The *Octoechus* and (6) The *Paracletice*, containing Troparia and answering to the Western antiphonary. (7) The *Pentecostarion*, containing the services from Easter Day to All Saints' Sunday. (8) The *Triodion*, containing those from Septuagesima Sunday to Easter Even. (9) The *Typicum* is a general book of rubrics corresponding to the Ordinale or the Pie of Western Christendom.

Period IV. *The Reformed Church*.—The Anglican liturgy of Reformation and post-Reformation times is described under the heading of PRAYER, BOOK OF COMMON, but a brief description may be added here of the liturgies of other reformed churches.

The Liturgy of the Scottish Episcopal Church.—This liturgy in nearly its present form was compiled by Scottish bishops in 1636 and imposed—or, to speak more accurately, attempted to be imposed—upon the Scottish people by the royal authority of Charles I. in 1637. The prelates chiefly concerned in it were Spottiswood, bishop of Glasgow; Maxwell, bishop of Ross; Wedderburn, bishop of Dunblane; and Forbes, bishop of Edinburgh. Their work was approved and revised by certain members of the English episcopate, especially Laud, archbishop of Canterbury; Juxon, bishop of London; and Wren, bishop of Ely. This liturgy has met with varied fortune and has passed through several editions. The present Scottish office dates from 1764. It is now used as an alternative form with the English communion office in the Scottish Episcopal Church.

The general arrangements of its parts approximates more closely to that of the first book of Edward VI. than to the present Anglican Book of Common Prayer. Among its noteworthy features are (*a*) the retention in its integrity and in its primitive position after the words of institution of the invocation of the Holy Spirit. That invocation runs thus: "And we most humbly beseech thee, O merciful Father, to hear us and of thy almighty goodness vouchsafe to bless and sanctify with thy word and Holy Spirit these thy gifts and creatures of bread and wine that they may become the body and blood of thy most dearly beloved Son" (edit. 1764). This kind of petition thus placed is found in the Eastern but not in the Roman or Anglican liturgies. (*b*) The reservation of the sacrament is permitted, by traditional usage, for the purpose of communicating the absent or the sick. (*c*) The minimum number of communicants is fixed at one or two instead of three or four.

For fuller information see Bishop J. Dowden, *The Annotated Scottish Communion Service* (Edinburgh, 1884).

American Liturgy.—The Prayer Book of "the Protestant Episcopal Church" in America was adopted by the general convention of the American church in 1789. It is substantially the same as the English Book of Common Prayer, but among important variations we may name the following: (*a*) The arrangement and wording of the order for Holy Communion rather resembles that of the Scottish than that of the English liturgy, especially in the position of the oblation and invocation immediately after the words of institution. (*b*) The Magnificat, Nunc dimittis and greater part of Benedictus were disused; but these were reinstated among the changes made in the Prayer Book in 1892. (*c*) Ten selections of Psalms are appointed for use as alternatives for the Psalms of the day. (*d*) *Gloria in excelsis* is allowed as a substitute for *Gloria Patri* at the end of the Psalms at morning and evening prayer. In addition to these there are many more both important and unimportant variations from the English Book of Common Prayer.

The Irish Prayer Book.—The Prayer Book in use in the Irish portion of the United Church of England and Ireland was the Anglican Book of Common Prayer, but after the disestablishment of the Irish church several changes were introduced into it by a synod held at Dublin in 1870. These changes included such important points as: (*a*) the excision of all lessons from the Apocrypha, (*b*) of the rubric ordering the recitation of the Athanasian Creed, (*c*) of the rubric ordering the vestments of the second year of Edward VI., (*d*) of the form of absolution in the office for the visitation of the sick, (*e*) the addition to the Catechism of a question and answer bringing out more clearly the spiritual character of the real presence.

The Presbyterian Church.—The Presbyterian churches of Scotland at present possess no liturgy properly so called. Certain general rules for the conduct of divine service are contained in the "Directory for the Public Worship of God" agreed upon by the assembly of divines at Westminster, with the assistance of commissioners from the Church of Scotland, approved and established by an act of the general assembly, and by an act of parliament, both in 1645. In 1554 John Knox had drawn up an order of liturgy closely modelled on the Genevan pattern for the use of the English congregation to which he was then ministering at Frankfort. On his return to Scotland this form of liturgy was adopted by an act of the general assembly in 1560 and became the established form of worship in the Presbyterian church until the year 1645, when the Directory of Public Worship took its place. Herein regulations are laid down for the conduct of public worship, for the reading of Scripture and for extempore prayer before and after the sermon, and in the administration of the sacrament of baptism and the Lord's Supper, for the solemnization of marriage, visitation of the sick and burial of the dead, for the observance of days of public fasting and public thanksgiving, together with a form of ordination and a directory for family worship. In all these cases, though the general terms of the prayer are frequently indicated, the wording of it is left to the discretion of the minister, with these exceptions: At the act of baptism this formula must be used—"I baptize thee in the name of the Father,

and of the Son, and of the Holy Ghost"; and for the Lord's Supper these forms are suggested, but with liberty to the minister to use "other the like, used by Christ or his apostles upon this occasion"—"According to the holy institution, command, and example of our blessed Saviour, Jesus Christ, I take this bread, and having given thanks, break it, and give it unto you. Take ye, eat ye; this is the body of Christ which is broken for you; do this in remembrance of him." And again "According to the institution, command and example of our Lord Jesus Christ, I take this cup and give it unto you; this cup is the New Testament in the blood of Christ, which is shed for the remission of the sins of many; drink ye all of it."

There is also an unvarying form of words directed to be used before the minister by the man to the woman, and by the woman to the man in the case of the solemnization of matrimony. The form of words on all other occasions, including ordination, is left to the discretion of the officiating minister or of the presbytery.

European Protestant Churches. The Calvinistic Churches.—Rather more of the liturgical element in the shape of a set form of words enters into the service of the French and German Calvinistic Protestants. The Sunday morning service as drawn up by Calvin was to open with a portion of Holy Scripture and the recitation of the ten commandments. Afterwards the minister, inviting the people to accompany him, proceeded to a confession of sins and supplication for grace. Then one of the Psalms of David was sung. Then came the sermon, prefaced by an extempore prayer and concluding with the Lord's Prayer, creed and benediction. The communion service began with an exhortation leading up to the apostles' creed; then followed a long exhortation, after which the bread and wine were distributed to the people, who advanced in reverence and order, while a Psalm was being sung, or a suitable passage of Scripture was being read. After all had communicated a set form of thanksgiving was said by the minister. Then the Song of Simeon was sung by the congregation, who were then dismissed with the blessing. This

form of service has been modified in various ways from time to time, but it remains substantially the type of service in use among the reformed Calvinistic churches of Germany, Switzerland and France.

The Lutheran Church.—Luther was far more conservative than the rest of the Protestant reformers and his conservatism appeared nowhere more than in the service-books which he drew up for the use of the church which bears his name. In 1523 he published a treatise *Of the Order of the Service in the Congregation* and in 1526 he published the *German Mass*. Except that the vernacular was substituted for the Latin language, the old framework and order of the Roman missal were closely followed, beginning with the Confiteor, Introit, Kyrie eleison, still always sung in Greek, Gloria in excelsis, &c. The text of this and other Lutheran services is given in *Agende für christliche Gemeinden des Lutherischen Bekenntnisses* (Nördlingen, 1853). At the same time Luther was tolerant and expressed a hope that different portions of the Lutheran church would from time to time make such changes or adaptations in the order of service as might be found convenient. The Lutheran churches of northern Europe have not been slow to avail themselves of this advice and permission. Most of them have drawn up liturgies for themselves, sometimes following very closely, sometimes differing considerably from the original service composed by Luther himself. In 1822, on the union of the Lutheran and Reformed (Calvinistic) churches of Prussia, a new liturgy was published at Berlin. It is used in its entirety in the chapel royal, but great liberty as to its use was allowed to the parochical clergy, and considerable variations of text appear in the more recent editions of this service-book.

The Church of the New Jerusalem (Swedenborgians) and the Catholic Apostolic Church (Irvingites) and other Protestant bodies have drawn up liturgies for themselves, but they are hardly of sufficient historical importance to be described at length here.

The Old Catholics, lastly, published a *Rituale* in 1875 containing the occasional offices for baptism, matrimony, burial, &c., and a form for reception of Holy Communion, in the German language. This latter is for use in the otherwise unaltered service of the mass, corresponding in purpose to the order of Communion in English published the 8th of March 1548 and in use till Whitsunday 1549.

(F. E. W.)

LITUUS, the cavalry trumpet of the Romans, said by Macrobius (*Saturn*. lib. vi.) to have resembled the crooked staff borne by the Augurs. The lituus consisted of a cylindrical tube 4 or 5 ft. long, having a narrow bore, and terminating in a conical bell joint turned up in such a manner as to give the instrument the outline of the letter "J." Unlike the buccina, cornu and tuba, the other military service instruments of the Romans, the lituus has not been traced during the middle ages, the medieval instrument most nearly resembling it being the cromorne or tournebout, which, however, had lateral holes and was played by means of a reed mouthpiece. A lituus found in a Roman warrior's tomb at Cervetri (Etruria) in 1827 is preserved in the Vatican. Victor Mahillon gives its length as 1 m. 60, and its scale as in unison with that of the trumpet in G (*Catalogue descriptif*, 1896, pp. 29-30).

(K. S.)

LIUDPRAND (LIUTPRAND, LUITPRAND) (*c*. 922-972), Italian historian and author, bishop of Cremona, was born towards the beginning of the 10th century, of a good Lombard family. In 931 he entered the service of King Hugo of Italy as page; he afterwards rose to a high position at the court of Hugo's successor Berengar, having become chancellor, and having been sent (949) on an embassy to the Byzantine court. Falling into disgrace with Berengar on his return, he attached himself to the emperor Otto I., whom in 961 he accompanied into Italy, and by whom in 962 he was made bishop of Cremona. He was frequently employed in missions to the pope, and in 968 to Constantinople to demand for the younger Otto (afterwards Otto II.) the hand of Theophano, daughter of the emperor Nicephorus Phocas. His account of this embassy in the *Relatio de Legatione Constantinopolitana* is perhaps the most graphic and lively piece of writing which has come down to us from the 10th century. The detailed description of Constantinople and the Byzantine court is a document of rare value—though highly coloured by his ill reception and offended dignity. Whether he returned in 971 with the embassy to bring Theophano or not is uncertain. Liudprand died in 972.

He wrote (1) *Antapodoseos, seu rerum per Europam gestarum, Libri VI*, an historical narrative, relating to the events from 887 to 949, compiled with the object of avenging himself upon Berengar and Willa his queen; (2) *Historia Ottonis*, a work of greater impartiality and merit, unfortunately covering only the years from 960 to 964; and (3) the *Relatio de Legatione Constantinopolitana* (968-969). All are to be found in the *Monum. Germ. Hist*. of Pertz, and in the *Rer. Ital. Script*. of Muratori; there is an edition by E.

Dümmler (1877), and a partial translation into German, with an introduction by W. Wattenbach, is given in the second volume of the *Geschichtsschreiber der deutschen Vorzeit* (1853). Compare Wattenbach, *Deutschlands Geschichtsquellen im Mittelalter*. Three other works, entitled *Adversaria, Chronicon, 606-960*, and *Opusculum de vitis Romanorum pontificum*, are usually, but wrongly, assigned to Liudprand. An English translation of the embassy to Constantinople is in Ernest Henderson's *Select Documents of the Middle Ages* (Bohn series, 1896). A complete bibliography is in A. Potthast's *Bibl. Hist. Medii Aevi* (Berlin, 1896).

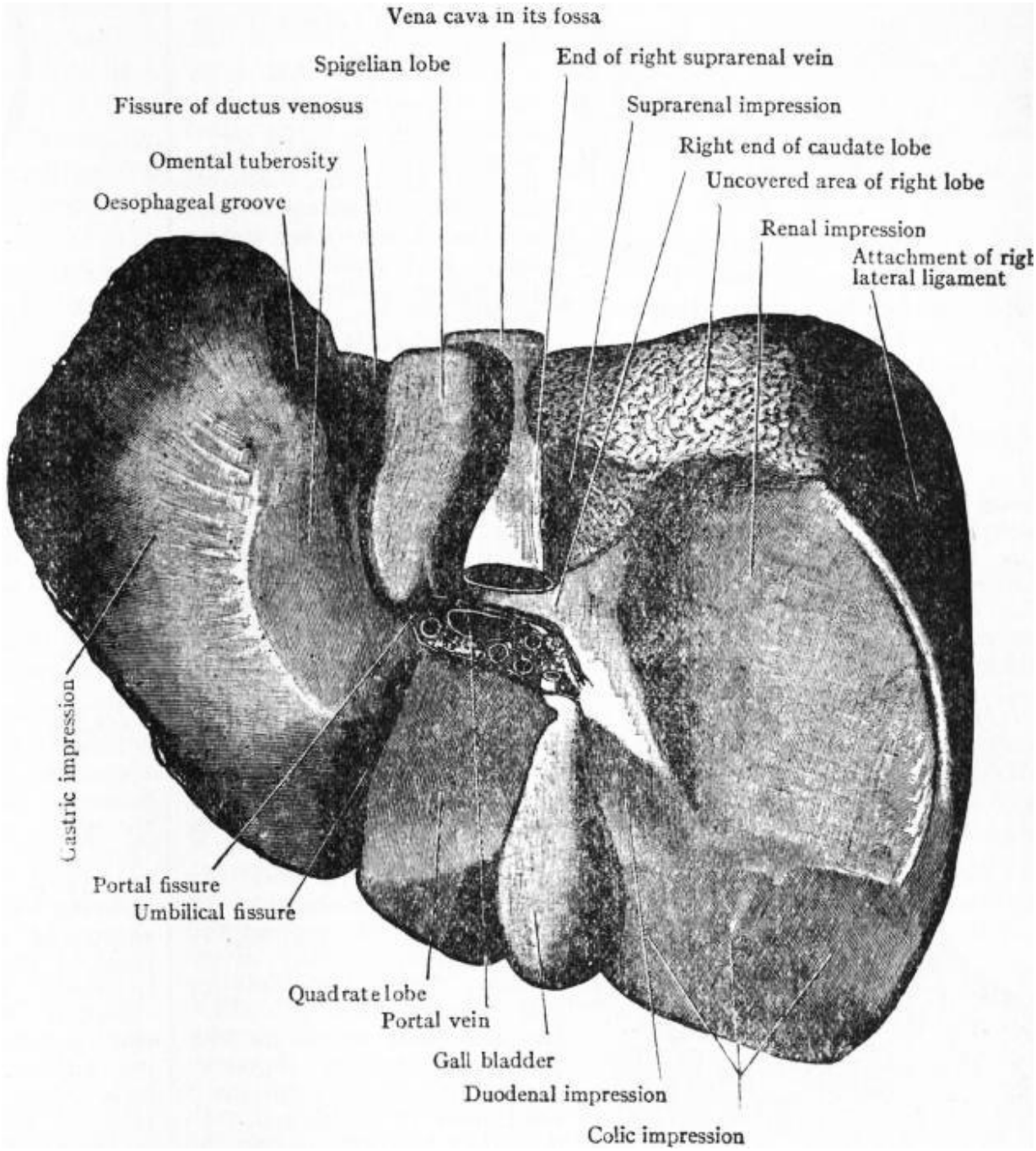
LIVE OAK, a city and the county-seat of Suwannee county, Florida, U.S.A., 81 m. by rail W. of Jacksonville. Pop. (1890) 687; (1900) 1659; (1905) 7200; (1910) 3450. Live Oak is served by the Atlantic Coast Line, the Seaboard Air Line, the Live Oak, Perry & Gulf and the Florida railways. There are extensive areas of pine lands in the vicinity, and large quantities of sea-island cotton are produced in the county. Lumber and naval stores are also important products. The first settlement on the site of the city was made in 1865 by John Parshley, of Massachusetts, who erected a large saw-mill here. Live Oak was first incorporated as a town in 1874, and in 1903 was chartered as a city.

LIVER (O. Eng. *lifer*; cf. cognate forms, Dutch *lever*, Ger. *Leber*, Swed. *lefver*, &c.; the O. H. Ger. forms are *libara, lipora*, &c.; the Teut. word has been connected with Gr. ἦπαρ and Lat. *jecur*), in anatomy, a large reddish-brown digestive gland situated in the upper and right part of the abdominal cavity. When hardened *in situ* its shape is that of a right-angled, triangular prism showing five surfaces—superior, anterior, inferior, posterior and right lateral which represents the base of the prism. It weighs about three pounds or one-fortieth of the body Weight.

Although the liver is a fairly solid organ, it is plastic, and moulds itself to even hollow neighbouring viscera rather than they to it. The superior surface is in contact with the diaphragm, but has peritoneum between (see COELOM AND SEROUS MEMBRANES). At its posterior margin the peritoneum of the great sac is reflected on to the diaphragm to form the anterior layer of the *coronary ligament*. Near the mid line of the body, and at right angles to the last, another reflection, the *falciform ligament*, runs forward, and the line of attachment of this indicates the junction of the *right* and *left lobes* of the liver. The anterior surface is in contact with the diaphragm and the anterior abdominal wall. The attachment of the falciform ligament is continued down it. The posterior surface is more complicated (see fig. 1); starting from the right and working toward the left, a large triangular area, uncovered by peritoneum and in direct contact with the diaphragm, is seen. This is bounded on the left by the inferior vena cava, which is sunk into a deep groove in the liver, and into the upper part of this the *hepatic veins* open. Just to the right of this and at the lower part of the bare area is a triangular depression for the right suprarenal body. To the

left of the vena cava is the *Spigelian lobe*, which lies in front of the bodies of the tenth and eleventh thoracic vertebrae, the lesser sac of peritoneum, diaphragm and thoracic aorta intervening. To the left of this is the fissure for the *ductus venosus*, and to the left of this again, the left lobe, in which a broad shallow groove for the oesophagus may usually be seen. Sometimes the left lobe stretches as far as the left abdominal wall, but more often it ends below the apex of the heart, which is 3½ in. to the left of the mid line of the body. The relations of the lower surface can only be understood if it is realized that it looks backward and to the left as well as downward (see fig. 1). Again starting from the right side, two impressions are seen; the anterior one is for the hepatic flexure of the colon, and the posterior for the upper part of the right kidney. To the left of the colic impression is a smaller one for the second part of the duodenum. Next comes the *gall bladder*, a pear-shaped bag, the fundus of which is in front and below, the neck behind and above. From the neck passes the *cystic duct*, which is often twisted into the form of an S. To the left of the gall bladder is the *quadrate lobe*, which is in contact with the pylorus of the stomach. To the left of this is the *left lobe* of the liver, separated from the quadrate lobe by the umbilical fissure in which lies the *round ligament* of the liver, the remains of the umbilical vein of the foetus. Sometimes this fissure is partly turned into a tunnel by a bridge of liver substance known as the *pons hepatis*. The under surface of the left lobe is concave for the interior surface of the stomach (see ALIMENTARY CANAL: *Stomach Chamber*), while a convexity, known as the *tuber omentale*, fits into the lesser curvature of that organ. The posterior boundary of the quadrate lobe is the *transverse fissure*, which is little more than an inch long and more than half an inch wide. This fissure represents the hilum of the liver, and contains the right and left hepatic ducts and the right and left branches of the hepatic artery and portal vein, together with nerves and lymphatics, the whole being enclosed in some condensed subperitoneal tissue known as *Glisson's capsule*. Behind the transverse fissure the lower end of the Spigelian lobe is seen as a knob called the *tuber papillare*, and from the right of this a narrow bridge runs

forward and to the right to join the Spigelian lobe to the right lobe and to shut off the transverse fissure from that for the vena cava. This is the *caudate lobe*. The right surface of the liver is covered with peritoneum and is in contact with the diaphragm, outside which are the pleura and lower ribs. From its lower margin the *right lateral ligament* is reflected on to the diaphragm. A similar fold passes from the tip of the left lobe as the *left lateral ligament*, and both these are the lateral margins of the coronary ligament. Sometimes, especially in women, a tongue-shaped projection downward of the right lobe is found, known as *Riedel's lobe*; it is of clinical interest as it may be mistaken for a tumour or floating kidney (see C. H. Leaf, *Proc. Anat. Soc*., February 1899; *Journ. Anat. and Phys*. vol. 33, p. ix.). The right and left *hepatic ducts*, while still in the transverse fissure, unite into a single duct which joins the cystic duct from the gall bladder at an acute angle. When these have united the duct is known as the *common bile duct*, and runs down to the second part of the duodenum (see ALIMENTARY CANAL).



From A. Birmingham Cunningham's *Text-book of Anatomy*.

FIG. 1.—The Liver from below and behind, showing the whole of the visceral surface and the posterior area of the parietal surface. The portal fissure has been slightly opened up to show the vessels passing through it; the other fissures are represented in their natural condition—closed. In this liver, which was hardened *in situ*, the impressions of the sacculations of the colon are distinctly visible at the colic impression. The round ligament and the remains of the ductus venosus are hidden in the depths of their fissures.

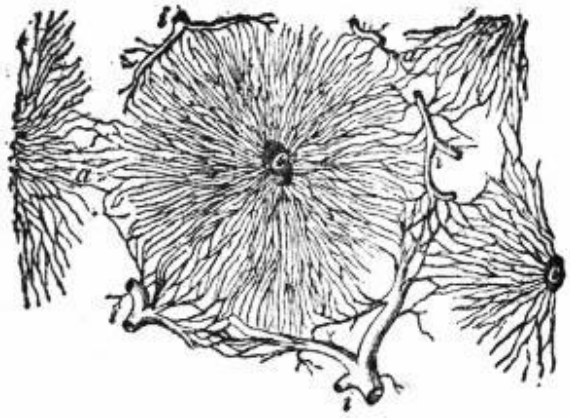


FIG. 2.—Transverse section through the hepatic lobules.

i, i, i, Interlobular veins ending in the intralobular capillaries.

c, c, Central veins joined by the intralobular capillaries. At *a, a* the capillaries of one lobule communicate with those adjacent to it.

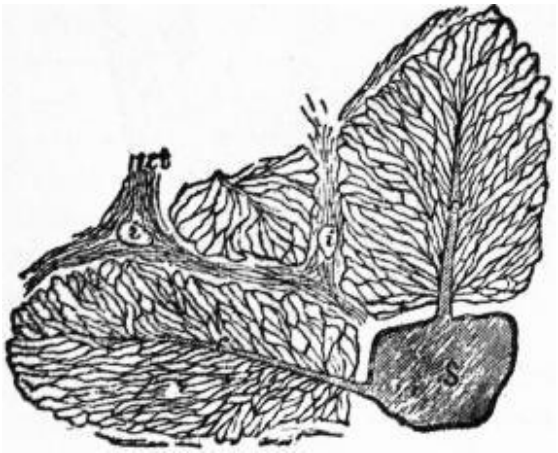


FIG. 3.—Vertical section through two hepatic lobules of a pig.

c, c, Central veins receiving the intralobular capillaries.

s, Sublobular vein.

ct, Interlobular connective tissue forming the capsules of the lobules.

i,i, Interlobular veins.

Minute Structure of the Liver.—The liver is made up of an enormous number of *lobules* of a conical form (see fig. 3). If the portal vein is followed from the transverse fissure, it will be seen to branch and rebranch until minute twigs called *interlobular veins* (fig. 2, *i*) ramify around the lobules. From these *intralobular capillaries* run toward the centre of the lobule, forming a network among the polygonal hepatic cells. On reaching the core of the conical lobule they are collected into a central or *intralobular vein* (fig. 2, *c*) which unites with other similar ones to form a *sublobular vein* (fig. 3, *s*). These eventually reach the hepatic radicles, and so the blood is conducted into the vena cava. In man the lobules are not distinctly separated one from the other, but in some animals, *e.g*. the pig, each one has a fibrous sheath derived from Glisson's capsule (fig. 3, *ct*.).

Embryology.—The liver first appears as an entodermal hollow longitudinal outgrowth from the duodenum into the ventral mesentery. The upper part of this forms the future liver, and grows up into the *septum transversum* from which the central part of the diaphragm is formed (see DIAPHRAGM). From the cephalic part of this primary diverticulum solid rods of cells called the *hepatic cylinders* grow out, and these branch again and again until a cellular network is formed surrounding and breaking up the umbilical and vitelline veins. The liver cells, therefore, are entodermal, but the supporting connective tissue mesodermal from the septum transversum. The lower (caudal) part of the furrow-like outgrowth remains hollow and forms the gall bladder. At first the liver is embedded in the septum transversum, but later the diaphragm and it are constricted off one from the other, and soon the liver becomes very large and fills the greater part of the abdomen. At birth it is proportionately much larger than in the adult, and forms one-eighteenth instead of one-fortieth of the body weight, the right and left lobes being nearly equal in size.

Comparative Anatomy.—In the Acrania (Amphioxus) the liver is probably represented by a single ventral diverticulum from the anterior end of the intestine, which has a hepatic portal circulation and secretes digestive fluid. In all the Craniata a solid liver is developed. In the adult lamprey among the Cyclostomata the liver undergoes retrogression, and the bile ducts and gall bladder disappear, though they are present in the larval form (Ammocoetes). In fishes and amphibians the organ consists of right and left lobes, and a gall-bladder is present. The same description applies to the reptiles, but a curious network of cystic ducts is found in snakes and to a less extent in crocodiles. In the Varanidae (Monitors) the hepatic duct is also retiform (see F. E. Beddard, *Proc. Zool. Soc*., 1888, p. 105). In birds two lobes are also present, but in some of them, *e.g*. the pigeon, there is no gall-bladder.

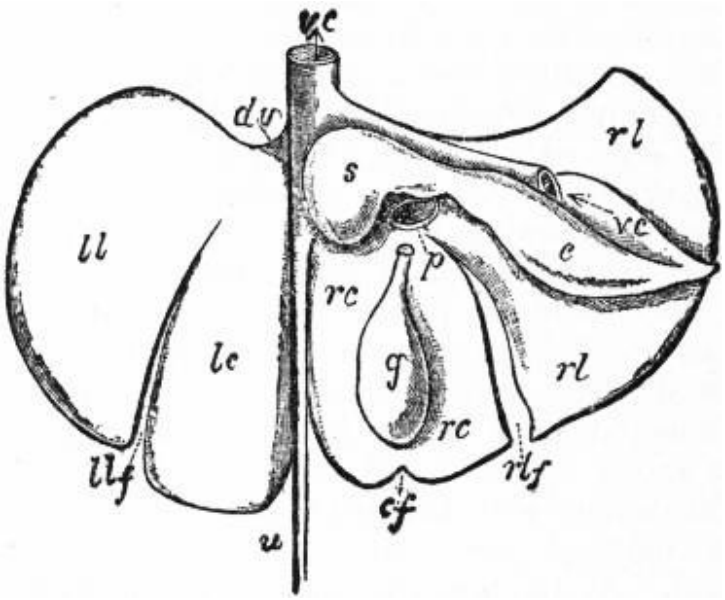


FIG. 4.—Diagrammatic Plan of the Inferior Surface of a Multi-lobed Liver of a Mammal. The posterior or attached border is uppermost.

u, Umbilical vein of the foetus, represented by the round ligament in the adult, lying in the umbilical fissure.
dv, The ductus venosus.
vc, The inferior vena cava.
p, The vena portae entering the transverse fissure.
llf, The left lateral fissure.
rlf, The right lateral fissure.
cf, The cystic fissure.
ll, The left lateral lobe.
lc, The left central lobe.
rc, The right central lobe.
rl, The right lateral lobe.
s, The Spigelian lobe.
c, The caudate lobe.
g, The gall bladder.

In mammals Sir William Flower pointed out that a generalized type of liver exists, from which that of any mammal may be derived by suppression or fusion of lobes. The accompanying diagram of Flower (fig. 4) represents an ideal mammalian liver. It will be seen that the umbilical fissure (*u*) divides the organ into right and left halves, as in the lower vertebrates, but that the ventral part of each half is divided into a central and lateral lobe. Passing from right to left there are therefore: right lateral (*rl*), right central (*rc*), left central (*lc*), and left lateral (*ll*) lobes. The gall-bladder (*g*), when it is present, is always

situated on the caudal surface or in the substance of the right central lobe. The Spigelian (*s*) and caudate lobes (*c*) belong to the right half of the liver, the latter being usually a leaf-shaped lobe attached by its stalk to the Spigelian, and having its blade flattened between the right lateral lobe and the right kidney. The vena cava (*vc*) is always found to the right of the Spigelian lobe and dorsal to the stalk of the caudate. In tracing the lobulation of man's liver back to this generalized type, it is evident at once that his quadrate lobe does not correspond to any one generalized lobe, but is merely that part of the right central which lies between the gall bladder and the umbilical fissure. From a careful study of human variations (see A. Thomson, *Journ. Anat. and Phys*. vol. 33, p. 546) compared with an Anthropoid liver, such as that of the gorilla, depicted by W. H. L. Duckworth (*Morphology and Anthropology*, Cambridge, 1904, p. 98), it is fairly clear that the human liver is formed, not by a suppression of any of the lobes of the generalized type, but by a fusion of those lobes and obliteration of certain fissures. This fusion is, probably correctly, attributed by Keith to the effect of pressure following the assumption of the erect position (Keith, *Proc. Anat. Soc. of Gt. Britain, Journ. Anat. and Phys*. vol. 33, p. xii.). The accompanying diagram (fig. 5) shows an abnormal human liver in the Anatomical Department of St Thomas's Hospital which reproduces the generalized type. In its lobulation it is singularly like, in many details, that of the baboon (*Papio maimon*) figured by G. Ruge (*Morph. Jahrb*., Bd. 35, p. 197); see F. G. Parsons, *Proc. Anat. Soc*., Feb. 1904, *Journ. Anat. and Phys*.

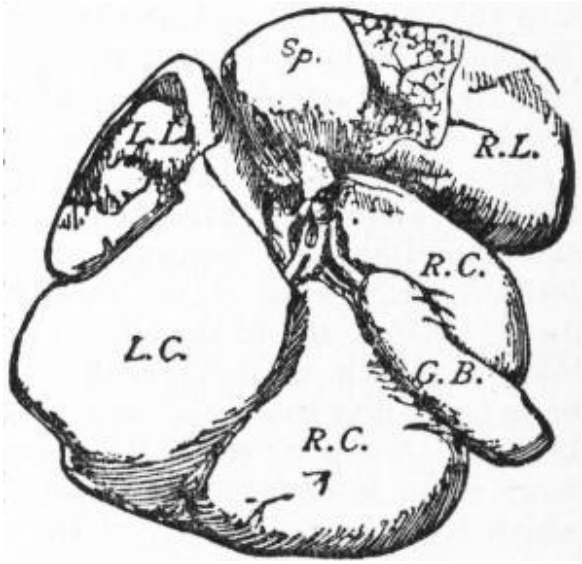


FIG. 5.—Human Liver showing a reversion to the generalised mammalian type.

vol. 33, p. xxiii. Georg Ruge "Die äusseren Formverhältnisse der Leber bei den Primaten," (*Morph. Jahrb*., Bd. 29 and 35) gives a critical study of the primate liver, and among other things suggests the recognition of the Spigelian and caudate lobes as parts of a single lobe, for which he proposes the name of lobus venae cavae. This doubtless would be an advantage morphologically, though for human descriptive anatomy the present nomenclature is not likely to be altered.

The gall-bladder is usually present in mammals, but is wanting in the odd-toed ungulates (Perissodactyla) and Procavia (Hyrax). In the giraffe it may be absent or present. The cetacea and a few rodents are also without it. In the otter the same curious network of bile ducts already recorded in the reptiles is seen (see P. H. Burne, *Proc. Anat. Soc., Journ. Anat. and Phys*. vol. 33 p. xi.). (P. G. P.)

SURGERY OF LIVER AND GALL-BLADDER.—Exposed as it is in the upper part of the abdomen, and being somewhat friable, the human liver is often torn or ruptured by blows or kicks, and, the large blood-vessels being thus laid open, fatal haemorrhage into the belly-cavity may take place. The individual becomes faint, and the faintness keeps on increasing; and there are pain and tenderness in the liver-region. The right thing to do is to open the belly in the middle line, search for a wound in the liver and treat it by deep sutures, or by plugging it with gauze.

Cirrhosis of the Liver.—As the result of chronic irritation of the liver increased supplies of blood pass to it, and if the irritation is unduly prolonged inflammation is the result. The commonest causes of this chronic hepatitis are alcoholism and syphilis. The new fibrous tissue which is developed throughout the liver, as the result of the chronic inflammation, causes general enlargement of the liver with, perhaps, nausea, vomiting and jaundice. Later the new fibrous tissue undergoes contraction and the liver becomes smaller than natural. Blood then finds difficulty in passing through it, and, as a result, dropsy occurs in the belly (ascites). This may be relieved by tapping the cavity with a small hollow needle (Southey's trocar), or by passing into it a large

sharp-pointed tube. This relieves the dropsy, but it does not cure the condition on which the dropsy depends. A surgical operation is sometimes undertaken with success for enabling the engorged veins to empty themselves into the blood-stream in a manner so as to avoid the liver-route.

Inflammation of the Liver (hepatitis) may also be caused by an attack of micro-organisms which have reached it through the veins coming from the large intestine, or through the main arteries. There are, of course, as the result, pain and tenderness, and there is often jaundice. The case should be treated by rest in bed, fomentations, calomel and saline aperients. But when the hepatitis is of septic origin, suppuration is likely to occur, the result being an hepatic abscess.

Hepatic Abscess is especially common in persons from the East who have recently undergone an attack of dysentery. In addition to the local pain and tenderness, there is a high temperature accompanied with shiverings or occasional rigors, the patient becoming daily more thin and miserable. Sometimes the abscess declares itself by a bulging at the surface, but if not an incision should be made through the belly-wall over the most tender spot, and a direct examination of the surface of the liver made. A bulging having been found, that part of the liver which apparently overlies the abscess should be stitched up to the sides of the opening made in belly-wall, and should then be explored by a hollow needle. Pus being found, the abscess should be freely opened and drained. It is inadvisable to explore for a suspected abscess with a hollow needle without first opening the abdomen, as septic fluid might thus be enabled to leak out, and infect the general peritoneal cavity. If an hepatic abscess is injudiciously left to itself it may eventually discharge into the chest, lungs or belly, or it may establish a communication with a piece of intestine. The only safe way for an abscess to evacuate itself is on to the surface of the body.

Hydatic Cysts are often met with in the liver. They are due to a peculiar development of the eggs of the tape-worm of the dog, which have been

received into the alimentary canal with infected water or uncooked vegetables, such as watercress. The embryo of the taenia echinococcus finds its way from the stomach or intestine into a vein passing to the liver, and, settling itself in the liver, causes so much disturbance there that a capsule of inflammatory material forms around it. Inside this wall is the special covering of the embryo which shortly becomes distended with clear hydatid fluid. The cyst should be treated like a liver-abscess, by incision through the abdominal or thoracic wall, by circumferential suturing and by exploration and drainage.

Tumours of the Liver may be innocent or malignant. The most important of the former is the *gumma* of tertiary syphilis; this may steadily and completely disappear under the influence of iodide of potassium. The commonest form of malignant tumour is the result of the growth of cancerous elements which have been brought to the liver by the veins coming up from a primary focus of the large intestine. Active surgical treatment of such a tumour is out of the question. Fortunately it is, as a rule, painless.

The Gall-bladder may be ruptured by external violence, and if bile escapes from the rent in considerable quantities peritonitis will be set up, whether the bile contains septic germs or not. If, on opening the abdomen to find out what serious effects some severe injury has caused, the gall-bladder be found torn, the rent may be sewn up, or, if thought better, the gall-bladder may be removed. The peritoneal surfaces in the region of the liver should then be wiped clean, and the abdominal wound closed, except for the passage through it of a gauze drain.

Biliary concretions, known as *gall stones*, are apt to form in the gall-bladder. They are composed of crystals of bile-fat, cholesterine. Sometimes in the course of a *post-mortem* examination a gall-bladder is found packed full of gall-stones which during life had caused no inconvenience and had given rise to no suspicion of their presence. In other cases gall-stones set up irritation in the gall-bladder which runs on to inflammation, and the gall-bladder being infected by septic germs from the intestine (*bacilli coli*) an abscess forms.

Abscess of the Gall-bladder gives rise to a painful, tender swelling near the cartilage of the ninth rib of the right side. If the abscess is allowed to take its course, adhesions may form around it and it may burst into the intestine or on to the surface of the abdomen, a *biliary fistula* remaining. Abscess in the gall-bladder being suspected, an incision should be made down to it, and, its covering having been stitched to the abdominal wall, the gall-bladder should be opened and drained. The presence of concretions in the gall-bladder may not only lead to the formation of abscess but also to invasion of the gall-bladder by cancer.

Stones in the gall-bladder should be removed by operation, as, if left, there is a great risk of their trying to escape with the bile into the intestine and thus causing a blockage of the common bile-duct, and perhaps a fatal leakage of bile into the peritoneum through a perforating ulcer of the duct. If before opening the gall-bladder the surface is stitched to the deepest part of the abdominal wound, the biliary fistula left as the result of the opening of the abscess will close in due course.

"Biliary colic" is the name given to the distressing symptoms associated with the passage of a stone through the narrow bile-duct. The individual is doubled up with acute pains which, starting from the hepatic region, spread through the abdomen and radiate to the right shoulder blade. Inasmuch as the stone is blocking the duct, the bile is unable to flow into the intestine; so, being absorbed by the blood-vessels, it gives rise to jaundice. The distress is due to spasmodic muscular contraction, and it comes on at intervals, each attack increasing the patient's misery. He breaks out into profuse sweats and may vomit. If the stone happily finds its way into the intestine the distress suddenly ceases. In the meanwhile relief may be afforded by fomentations, and by morphia or chloroform, but if no prospect of the stone escaping into the intestine appears likely, the surgeon will be called upon to remove it by an incision through the gall-bladder, or the bile-duct, or through the intestine at the spot where it is trying to make its escape. Sometimes a gall-stone which

has found its way into the intestine is large enough to block the bowel and give rise to intestinal obstruction which demands abdominal section.

A person who is of what used to be called a “biliary nature” should live sparingly and take plenty of exercise. He should avoid fat and rich food, butter, pastry and sauces, and should drink no beer or wine—unless it be some very light French wine or Moselle. He should keep his bowels regular, or even loose, taking every morning a dose of sulphate of soda in a glass of hot water. A course at Carlsbad, Vichy or Contrexéville, may be helpful. It is doubtful if drugs have any direct influence upon gall-stones, such as sulphate of soda, olive oil or oleate of soda. No reliance can be placed upon massage in producing the onward passage of a gall-stone from the gall-bladder towards the intestine. Indeed this treatment might be not only distressing but harmful.

(E. O.*)

LIVERMORE, MARY ASHTON [RICE]

(1821-1905), American reformer, was born in Boston, Massachusetts, on the 19th of December 1821. She studied at the female seminary at Charlestown, Mass.; taught French and Latin there, taught in a plantation school in southern Virginia; and for three years conducted a school of her own in Duxbury, Mass. Upon returning from Virginia she had joined the abolitionists, and she took an active part in the Washingtonian temperance movement.[1] In 1845 she married Daniel Parker Livermore (1819-1899), a Universalist clergyman. In 1857 they removed to Chicago, Illinois, where she assisted her husband in editing the religious weekly, *The New Covenant* (1857-1869). During the Civil War, as an associate member of the United States Sanitary

Commission, and as an agent of its North-western branch, she organized many aid societies, contributed to the success of the North-western Sanitary Fair in Chicago in 1863, and visited army posts and hospitals. After the war she devoted herself to the promotion of woman's suffrage and to temperance reform, founding in Chicago in 1869 *The Agitator*, which in 1870 was merged into the *Woman's Journal* (Boston), of which she was an associate editor until 1872. She died in Melrose, Mass. on the 23rd of May 1905. She had been president of the Illinois, the Massachusetts and the American woman's suffrage associations, the Massachusetts Woman's Christian Temperance Union and the Woman's Congress, and a member of many other societies. She lectured in the United States, England and Scotland, contributed to magazines and wrote: *The Children's Army* (1844), temperance stories; *Thirty Years Too Late* (1848), a temperance story; *A Mental Transformation* (1848); *Pen Pictures* (1863), short stories; *What Shall We Do With Our Daughters? and Other Lectures* (1883); *My Story of the War* (1888); and *The Story of My Life* (1897). With Frances E. Willard, she edited *A Woman of the Century: Biographical Sketches of Leading American Women* (1893).

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1 This movement was started in 1840 by habitués of a Baltimore (Md.) tavern, who then founded the Washington Temperance Society (named in honour of George Washington). The movement spread rapidly in 1841-1843, but by the close of 1843 it had nearly spent its force. The members of the Society made a pledge not to drink spirituous or malt liquors, wine or cider. Women organized Martha Washington Societies as auxiliary organizations.

LIVERPOOL, EARLS OF. Charles Jenkinson, 1st earl of Liverpool (1729-1808), English statesman, eldest son of Colonel Charles Jenkinson (d. 1750) and grandson of Sir Robert Jenkinson, Bart., of Walcot, Oxfordshire, was born at Winchester on the 16th of May 1729. The family was descended from Anthony Jenkinson (d. 1611), sea-captain, merchant and traveller, the first Englishman to penetrate into Central Asia. Charles was educated at Charterhouse school and University College, Oxford, where he graduated M.A. in 1752. In 1761 he entered parliament as member for Cockermouth and was made under-secretary of state by Lord Bute; he won the favour of George III., and when Bute retired Jenkinson became the leader of the "king's friends" in the House of Commons. In 1763 George Grenville appointed him joint secretary to the treasury; in 1766, after a short retirement, he became a lord of the admiralty and then a lord of the treasury in the Grafton administration; and from 1778 until the close of Lord North's ministry in 1782 he was secretary-at-war. From 1786 to 1801 he was president of the board of trade and chancellor of the duchy of Lancaster, and he was popularly regarded as enjoying the confidence of the king to a special degree. In 1772 Jenkinson became a privy councillor and vice-treasurer of Ireland, and in 1775 he purchased the lucrative sinecure of clerk of the pells in Ireland and became master of the mint. In 1786 he was created Baron Hawkesbury, and ten years later earl of Liverpool. He died in London on the 17th of December 1808. Liverpool was twice married: firstly to Amelia (d. 1770), daughter of William Watts, governor of Fort William, Bengal, and secondly to Catherine, daughter of Sir Cecil Bisshoff, Bart., and widow of Sir Charles Cope, Bart.; he had a son by each marriage. He wrote several political works, but except his *Treatise on the Coins of the Realm* (1805) these are without striking merits. They are, *Dissertation on the establishment of a national and constitutional force in England independent of a standing army* (1756); *Discourse on the conduct of the government of Great Britain respecting neutral nations* (1758, new ed., 1837); and *Collection of Treaties*

between Great Britain and other Powers 1648-1783 (1785). His *Coins of the Realm* was reprinted by the Bank of England in 1880.

His son, Robert Banks Jenkinson, 2nd earl (1770-1828), was educated at Charterhouse and at Christ Church, Oxford, where he had George Canning, afterwards his close political associate, for a contemporary. In 1790 he entered parliament as member for Appleby; he became master of the mint in 1799 and foreign secretary in Addington's administration in 1801, when he conducted the negotiations for the abortive treaty of Amiens. On the accession of Pitt to power in 1804, he obtained the home office, having in the previous year been elevated as Baron Hawkesbury to the House of Lords, where he acted as leader of the government. He declined the premiership on the death of Pitt in 1806, and remained out of office until Portland became prime minister in 1807, when he again became secretary of state for home affairs. In 1808 he succeeded his father as earl of Liverpool. In the ministry of Spencer Perceval (1809-1812) he was secretary for war and the colonies. After the assassination of Perceval in May 1812 he became prime minister, and retained office till compelled in February 1827 to resign by the illness (paralysis) which terminated his life on the 4th of December 1828.

The political career of the 2nd Lord Liverpool was of a negative character so far as legislation was concerned; but he held office in years of great danger and depression, during which he "kept order among his colleagues, composed their quarrels, and oiled the wheels to make it possible for the machinery of government to work" (Spencer Walpole). The energy of Castlereagh and Canning secured the success of the foreign policy of his cabinet, but in his home policy he was always retrograde. The introduction of the bill of pains and penalties against Queen Caroline greatly increased his unpopularity, originated by the severe measures of repression employed to quell the general distress, which had been created by the excessive taxation which followed the Napoleonic wars. Lord Liverpool was destitute

of wide sympathies and of true political insight, and his resignation of office was followed almost immediately by the complete and permanent reversal of his domestic policy. He was twice married but had no children, and he was succeeded by his half-brother CHARLES CECIL COPE JENKINSON, 3rd earl (1784-1851), who left three daughters. The baronetcy then passed to a cousin, and the peerage became extinct. But in 1905 the earldom was revived in the person of the 3rd earl's grandson, CECIL GEORGE SAVILE FOLJAMBE (1846-1907), who had been a Liberal member of parliament from 1880 to 1892, and in 1893 was created Baron Hawkesbury. He was succeeded in 1907 by his son, Arthur (b. 1870).

For the life of the 2nd earl see the anonymous *Memoirs of the Public Life and Administration of Liverpool* (1827); C. D. Yonge, *Life and Administration of the 2nd Earl of Liverpool* (1868); T. E. Kebbel, *History of Toryism* (1886); and Sir S. Walpole, *History of England*, vol. ii. (1890).

LIVERPOOL, a city, municipal, county and parliamentary borough, and seaport of Lancashire, England, 201 m. N.W. of London by rail, situated on the right bank of the estuary of the Mersey, the centre of the city being about 3 m. from the open sea. The form of the city is that of an irregular semicircle, having the base line formed by the docks and quays extending about 9 m. along the east bank of the estuary, which here runs nearly north and south, and varies in breadth from 1 to 2 m. On the north the city is partly bounded by the borough of Bootle, along the shore of which the line of docks is continued. The area of the city is 16,619 acres exclusive of water

area. The population at the census of 1901 was 684,958; the estimated population in 1908 was 753,203; the birth-rate for 1907 was 31.7 and the death-rate 18.3; in 1908 the rateable value was £4,679,520.

Scale of One Mile
0
¼
½
¾
1
RIVER MERSEY
NEW BRIGHTON
EGREMONT
SEACOMBE
LIVERPOOL
BIRKENHEAD
New Brighton Pier
Tower Pleasure Grounds
Ferry
Liscard Park
Poulton Road
Seacombe Ferry
Pier
Ferry
Seacombe Ferry
RIVERSIDE STATION
Landing Stage
Landing Stage (Cattle)
Tunnel
Mersey
Woodside Ferry Landing Stage
WOODSIDE STATION
Birkenhead Pk
Market
STA.
STATION
To Chester
Rock Ferry Pier
To New Ferry
Ferry
CANADA BASIN
GOODS STATIONS
Graving Docks
BRAMLEY MOORE DOCK
EXCHANGE STA.
CENTRAL STA.
LIME ST.
MARSH LANE STA.
BOOTLE STA.
KIRKDALE STA.
SPELLOW STA.
WALTON STA.
WALTON JUNC.
Stanley Park
Recreation Gd
Market
HERCULANEUM DOCK
WORNBY DOCK
ALEXANDRA DOCK
LANGTON DOCK
CANADA DOCK
HORNBY DOCK
SANDON DOCK
NELSON DOCK
HOWARD DOCK
WALLASEY D.
ALFRED DOCK
MORPETH DOCK
ALBERT DOCK
QUEENS DOCK
PRINCES DOCK
VICTORIA ST.
BRUNSWICK
CLEVELAND
CONWAY ST.
PARK RD. SOUTH
PARK ROAD NORTH
LAUGHTON RD.
HOLT HILL
WELL LANE
WOODWARD ROAD
BROOK ROAD
GRANGE RD.
MARSH ROAD
LISCARD ROAD
CHURCH ST.
BRIGHTON ST.
VICTORIA ROAD
WHETSTONE LANE
ALFRED ROAD
PENKETT RD.
STAR LINK ROAD
LOWER PARADE
WELLINGTON RD.
VICTORIA RD.
ST. PAUL'S SQ.
ST. PAUL'S ROAD
ST. PAUL'S PLACE
ST. PAUL'S SQUARE
ST. PAUL'S CHURCH

The city lies on a continuous slope varying in gradient, but in some districts very steep. Exposed to the western sea breezes, with a dry subsoil and excellent natural drainage, the site is naturally healthy. The old borough, lying between the pool, now completely obliterated, and the river, was a conglomeration of narrow alleys without any regard to sanitary provisions; and during the 16th and 17th centuries it was several times visited by plague. When the town expanded beyond its original limits, and spread up the slopes beyond the pool, a better state of things began to exist. The older parts of the town have at successive periods been entirely taken down and renovated. The commercial part of the city is remarkable for the number of palatial piles of offices, built chiefly of stone, among which the banks and insurance offices stand pre-eminent. The demand for cottages about the beginning of the 19th century led to the construction of what are called "courts," being narrow *culs de sac*, close packed, with no through ventilation. This resulted in a high rate of mortality, to contend with which enormous sums have been expended in sanitary reforms of various kinds. The more modern cottages and blocks of artisan dwellings have tended to reduce the rate of mortality.

Parks.—The earliest public park, the Prince's Park, was laid out in 1843 by private enterprise, and is owned by trustees, but the reversion has been acquired by the corporation. Sefton Park, the most extensive, containing 269 acres, was opened in 1872. A large portion of the land round the margin has been leased for the erection of villas. Wavertree, Newsham, Sheil and Stanley Parks have also been constructed at the public expense. Connected with Wavertree Park are the botanic gardens. A palm house in Sefton Park was opened in 1896 and a conservatory in Stanley Park in 1900. Since 1882 several of the city churchyards and burial grounds and many open spaces have been laid out as gardens and recreation grounds. A playground containing 108 acres in Wavertree was presented to the city in 1895 by an

anonymous donor, and in 1902 the grounds of a private residence outside the city boundaries containing 94 acres were acquired and are now known as Calderstones Park. In 1906 about 100 acres of land in Roby, also outside the boundaries, was presented to the city. The total area of the parks and gardens of the city, not including the two last named, is 881½ acres. A boulevard about 1 m. in length, planted with trees in the centre, leads to the entrance of Prince's Park.

Public Buildings.—Scarcely any of the public buildings date from an earlier period than the 19th century. One of the earliest, and in many respects the most interesting, is the town-hall in Castle Street. This was erected from the designs of John Wood of Bath, and was opened in 1754. The building has since undergone considerable alterations and extensions, but the main features remain. It is a rectangular stone building in the Corinthian style, with an advanced portico added to the original building in 1811, and crowned with a lofty dome surmounted by a seated statue of Britannia, added in 1802. The interior was destroyed by fire in 1795, and was entirely remodelled in the restoration. In 1900 considerable alterations in the internal structure were made, and the council chamber extended so as to afford accommodation for the enlarged council. It contains a splendid suite of apartments, including a ball-room approached by a noble staircase. The building is occupied by the mayor as the municipal mansion house. A range of municipal offices was erected in Dale Street in 1860. The building is in the Palladian style, with a dominating tower and square pyramidal spire.

The crowning architectural feature of Liverpool is St George's Hall, completed in 1854. The original intention was to erect a hall suited for the triennial music festivals which had been held in the town. About the same time the corporation proposed to erect law-courts for the assizes, which had been transferred to Liverpool and Manchester. In the competitive designs, the first prize was gained in both cases by Harvey Lonsdale Elmes. He was employed to combine the two objects in a new design, of which the present

building is the outcome. It is fortunate in its situation, occupying the most central position in the town, and surrounded by an area sufficiently extensive to exhibit its proportions, an advantage which was accentuated in 1898 by the removal of St John's church, which previously prevented an uninterrupted view of the west side. The plan is simple. The centre is occupied by the great hall, 169 ft. in length, and, with the galleries, 87 ft. wide and 74 ft. high, covered with a solid vault in masonry. Attached to each end, and opening therefrom, are the law-courts. A corridor runs round the hall and the courts, communicating with the various accessory rooms. Externally the east front is faced with a fine portico of sixteen Corinthian columns about 60 ft. in height. An advanced portico of similar columns fronts the south end crowned with a pediment filled with sculpture. The style is Roman, but the refinement of the details is suggestive of the best period of Grecian art. The great hall is finished with polished granite columns, marble balustrades and pavements, polished brass doors with foliated tracery. The fine organ was built by Messrs Willis of London, from the specification of Dr Samuel Wesley. Elmes having died in 1847 during the progress of the work, the building was completed by C. R. Cockerell, R.A.

Next to the public buildings belonging to the city, the most important is the exchange, forming three sides of a quadrangle on the north side of the town-hall. The town-hall was originally built to combine a mercantile exchange with municipal offices, but the merchants preferred to meet in the open street adjoining. This, with other circumstances, led to the erection of a new exchange, a building of considerable merit, which was begun in 1803 and opened in 1808. It had scarcely been in use for more than fifty years when it was found that the wants of commerce had outstripped the accommodation, and the structure was taken down to make room for the present building.

The revenue buildings, begun in 1828 on the site of the original Liverpool dock, formerly combined the customs, inland revenue, post-office and dock

board departments but are now only used by the two first named. It is a heavy structure, with three advanced porticoes in the Ilyssus Ionic style. Near by stands the sailors' home, a large building in the Elizabethan style. The Philharmonic Hall in Hope Street, with not much pretension externally, is one of the finest music rooms in the kingdom; it accommodates an audience of about 2500.

The group of buildings forming the county sessions house, the free public library, museum, central technical school and gallery of art are finely situated on the slope to the north of St George's Hall. The library and gallery of art are separate buildings, connected by the circular reading-room in the middle. The latter possesses some features in construction worthy of note, having a circular floor 100 ft. in diameter without columns or any intermediate support, and a lecture-room underneath, amphitheatrical in form, with grades or benches hewn out of the solid rock. In 1884 the county sessions house just mentioned, adjoining the art gallery was opened for public business. In 1899 new post-office buildings in Victoria Street were completed. In 1907 two important additions were made to the buildings of Liverpool, the new offices of the dock board, built on the site of a portion of the Old George's dock, and the new cotton exchange in Oldhall street. The fine mass of buildings which constitute the university and the Royal Infirmary, lying between Brownlow Hill and Pembroke Place, both groups designed by Alfred Waterhouse, was begun in 1885.

Liverpool cathedral, intended when completed to be the largest in the country, from designs by G. F. Bodley and G. Gilbert Scott, was begun in 1904, when the foundation stone was laid by King Edward VII. The foundations were completed in 1906 and the superstructure begun. The foundation of the chapter-house was laid in that year by the duke of Connaught, and work was then begun on the Lady chapel, the vestries and the choir.

Railways.—There are three terminal passenger stations in Liverpool, the London & North Western at Lime Street, the Lancashire & Yorkshire at Exchange and the combined station of the Midland, Great Northern & Great Central at Central. By the Mersey tunnel (opened in 1886) connexion is made with the Wirral railway, the Great Central, the Great Western and the London & North Western, on the Cheshire side of the river. The Liverpool electric overhead railway running along the line of docks from Seaforth to Dingle was opened in 1893, and in 1905 a junction was made with the Lancashire and Yorkshire railway by which through passenger traffic between Southport and the Dingle has been established. In 1895 the Riverside station at the Prince's dock was completed, giving direct access from the landing stage to the London and North Western system.

Water Supply.—The original supply of water was from wells in the sandstone rock, but in 1847 an act was passed, under which extensive works were constructed at Rivington, about 25 m. distant, and a much larger supply was obtained. The vast increase of population led to further requirements, and in 1880 another act gave power to impound the waters of the Vyrnwy, one of the affluents of the Severn. These works were completed in 1892, a temporary supply having been obtained a year earlier. The corporation had also, however, obtained power to impound the waters of the Conwy and Marchnant rivers, and to bring them into Lake Vyrnwy, the main reservoir, by means of tunnels. This work was completed and opened by the prince of Wales (George V.) in March 1910.

Tramways.—The corporation in 1896 purchased the property, rights, powers and privileges of the Liverpool Electric Supply Company, and in the following year the undertaking of the Liverpool Tramway Company, which they formally took over in the autumn of the same year. Since that date a large and extended system of electric tramways has been laid down, which has led to a very remarkable increase in the receipts and the number of passengers carried.

Administration of Justice.—The city has quarter-sessions for criminal cases, presided over by the recorder, and held eight times in the year. At least two police courts sit daily, and more if required. One is presided over by the stipendiary magistrate and the others by the lay magistrates and the coroner. The court of passage is a very ancient institution, possibly dating from the foundation of the borough by King John, and intended for cases arising out of the imports and exports passing through the town. Its jurisdiction has been confirmed and settled by parliament and it is competent to try civil cases arising within the city to any amount. The mayor is *ex-officio* the judge, but the presiding judge is an assessor appointed by the crown and paid by the corporation. The court sits about five times a year. There is a Liverpool district registry of the chancery of the County Palatine of Lancaster which has concurrent jurisdiction with the high court (chancery division) within the hundred of West Derby. The vice-chancellor holds sittings in Liverpool. There is a Liverpool district registry of the high court of justice with common law, chancery, probate and admiralty jurisdiction, under two district registrars. The Liverpool county court has the usual limited jurisdiction over a wide local area, together with bankruptcy jurisdiction over the county court districts of St Helens, Widnes, Ormskirk and Southport, and admiralty jurisdiction over the same districts with the addition of Birkenhead, Chester, Runcorn and Warrington. There are two judges attached to the court.

Ecclesiastical.—The see of Liverpool was created in 1880 under the act of 1879, by the authority of the ecclesiastical commissioners, an endowment fund of about £100,000 having been subscribed for the purpose. The parish, which was separated from Walton-on-the-Hill in 1699, contained two churches, St Nicholas, the ancient chapel, and St Peter’s, then built. There were two rectors, the living being held in medieties. Of recent years changes have been sanctioned by parliament. The living is now held by a single incumbent, and a large number of the churches which have since been built have been formed into parishes by the ecclesiastical commissioners. St

Peter's has been constituted the pro-cathedral, pending the erection of the cathedral. Besides the two original parish churches, there are 103 others belonging to the establishment. The Roman Catholics form a very numerous and powerful body in the city, and it is estimated that from a third to a fourth of the entire population are Roman Catholics. A large part of these are Irish settlers or their descendants, but this district of Lancashire has always been a stronghold of Roman Catholicism, many of the landed gentry belonging to old Roman Catholic families.

Charities.—The earliest charitable foundation is the Blue Coat hospital, established in 1708, for orphans and fatherless children born within the borough. The original building, opened in 1718, is a quaint and characteristic specimen of the architecture of the period. It now maintains two hundred and fifty boys and one hundred girls. In 1906 the school was removed to new buildings at Wavertree. There is an orphan asylum, established in 1840, for boys, girls and infants, and a seamen's orphan asylum, begun in 1869, for boys and girls. The Roman Catholics have similar establishments. The Liverpool dispensaries founded in 1778 were among the pioneers of medical charity. The Royal Infirmary (opened in 1749) had a school of medicine attached, which has been very successful, and is now merged in the university. The sailors' home, opened in 1852, designed to provide board, lodging and medical attendance at a moderate charge for the seamen frequenting the port, is one of Liverpool's best-known charities. The David Lewis Workmen's Hostel is an effort to solve the difficulty of providing accommodation for unmarried men of the artizan class.

Literature, Art and Science.—The free library, museum and gallery of arts, established and managed by the city council, was originated in 1850. The first library building was erected by Sir William Brown. The Derby museum, containing the collections of Edward, the 13th earl, was presented by his son. The Mayer museum of historical antiquities and art was contributed by Mr Joseph Mayer, F.S.A. Sir Andrew Walker (d. 1893)

erected in 1877 the art gallery which bears his name. Large additions were made in 1884, the cost being again defrayed by Sir Andrew Walker. An annual exhibition of painting is held in the autumn and a permanent collection has been formed, which was augmented in 1894 when the examples of early Italian art numbering altogether about 180 pictures, collected at the beginning of the 19th century by William Roscoe, were deposited in the gallery. The Picton circular reading-room, and the rotunda lecture-room were built by the corporation and opened in 1879. Alterations in the museum were completed in 1902 by which its size was practically doubled. The literary and philosophical society was established in 1812. The Royal Institution, established mainly through the efforts of Roscoe in 1817, possessed a fine gallery of early art in the Walker Art Gallery, and is the centre of the literary institutions of the town.

Education.—Sunday schools were founded for poor children in 1784, as the result of a town's meeting. These were soon followed by day-schools supplied by the various denominations. The first were the Old Church schools in Moorfields (1789), the Unitarian schools in Mount Pleasant (1790) and Manesty Lane (1792) and the Wesleyan Brunswick school (1790). In 1826 the corporation founded two elementary schools, one of which, the North Corporation school, was erected in part substitution for the grammar school founded by John Crosse, rector of St Nicholas Fleshshambles, London, a native of Liverpool, in 1515, and carried on by the Corporation until 1815. From this date onward the number rapidly increased until the beginning of the School Board in 1870, and afterwards. Mention should be made of the training ship "Indefatigable" moored in the Mersey for the sons and orphans of sailors, and the reformatory institution at Heswall, Co. Chester, which has recently replaced the training ship "Akbar" formerly moored in the Mersey. Semi-private schools were founded by public subscription—the Royal Institution school (1819), the Liverpool Institute (1825) and the Liverpool College (1840). The first has ceased to

exist. The Institute was a development of the Mechanics' Institute and was managed by a council of subscribers. It was divided into a high school and a commercial school. Under a scheme of the Board of Education under the Charitable Trusts Act this school, together with the Blackburne House high school for girls, became a public secondary school and was handed over to the corporation in 1905. Liverpool College was formerly divided into three schools, upper, middle and lower, for different classes of the community. The middle and lower schools passed into the control of the corporation in 1907. The Sefton Park elementary school and the Pupil Teachers' College in Clarence Street were transformed into municipal secondary schools for boys and girls in 1907; the corporation has also a secondary school for girls at Aigburth. There are several schools maintained by the Roman Catholics, two schools of the Girls' Public Day School Company and a large number of private schools. A cadet ship, the "Conway," for the training of boys intending to become officers in the mercantile marine, is moored in the Mersey. There are two training colleges for women, one undenominational, and the other conducted by the sisters of Notre Dame for Roman Catholic women. The central municipal technical school is in the Museum Buildings, and there are three branch technical schools. There are also a nautical college, a school of cookery and a school of art controlled by the Education Committee.

Liverpool University, as University College, received its charter of incorporation in 1881, and in 1884 was admitted as a college of the Victoria University. In the same year the medical school of the Royal Infirmary became part of the University College. In 1900 a supplemental charter extended the powers of self-government and brought the college into closer relations with the authorities of the city and with local institutions by providing for their fuller representation on the court of governors. In 1903 the charter of incorporation of the university of Liverpool was received, thus constituting it an independent university. The university is governed by the

king as visitor, by a chancellor, two pro-chancellors, a vice-chancellor and a treasurer, by a court of over 300 members representing donors and public bodies, a council, senate, faculties and convocation. The fine group of buildings is situated on Brownlow Hill.

Trade and Commerce.—In 1800 the tonnage of ships entering the port was 490,060; in 1908 it reached 17,111,814 tons. In 1800 4746 vessels entered, averaging 94 tons; in 1908 there were 25,739, averaging 665 tons. The commerce of Liverpool extends to every part of the world, but probably the intercourse with North America stands pre-eminent, there being lines of steamers to New York, Philadelphia, Boston, Baltimore, Galveston, New Orleans and the Canadian ports. Cotton is the great staple import. Grain comes next, American (North and South) and Australian wheat and oats occupying a large proportion of the market. An enormous trade in American provisions, including live cattle, is carried on. Tobacco has always been a leading article of import into Liverpool, along with the sugar and rum from the West Indies. Timber forms an important part of the imports, the stacking yards extending for miles along the northern docks. In regard to exports, Liverpool possesses decided advantages; lying so near the great manufacturing districts of Lancashire and the West Riding of Yorkshire, this port is the natural channel of transmission for their goods, although the Manchester ship canal diverts a certain proportion of the traffic, while coal and salt are also largely exported.

Manufactures.—The manufactures of Liverpool are not extensive. Attempts have been repeatedly made to establish cotton mills in and near the city, but have resulted in failure. Engineering works, especially connected with marine navigation, have grown up on a large scale. Shipbuilding, in the early part of the 19th century, was active and prosperous, but has practically ceased. During the latter half of the 18th century and the beginning of the 19th, pottery and china manufacture flourished in Liverpool. John Sadler, a Liverpool manufacturer, was the inventor of printing on pottery, and during

the early period of Josiah Wedgwood's career all his goods which required printing had to be sent to Liverpool. A large establishment, called the Herculaneum Pottery, was founded in a suburb on the bank of the Mersey, but the trade has long disappeared. Litherland, the inventor of the lever watch, was a Liverpool manufacturer, and Liverpool-made watches have always been held in high estimation. There are several extensive sugar refineries and corn mills. The confectionery trade has developed during recent years, several large works having been built, induced by the prospect of obtaining cheap sugar directly from the Liverpool quays. The cutting, blending and preparing of crude tobacco have led to the erection of factories employing some thousands of hands. There are also large mills for oil-pressing and making cattle-cake.

Docks.—The docks of the port of Liverpool on both sides of the Mersey are owned and managed by the same public trust, the Mersey Docks and Harbour Board. On the Liverpool side they extend along the margin of the estuary 6½ m., of which 1¼ m. is in the borough of Bootle. The Birkenhead docks have not such a frontage, but they extend a long way backward. The water area of the Liverpool docks and basins is 418 acres, with a lineal quayage of 27 m. The Birkenhead docks, including the great float of 120 acres, contain a water area of 165 acres, with a lineal quayage of 9½ m. The system of enclosed docks was begun by the corporation in 1709. They constituted from the first a public trust, the corporation never having derived any direct revenue from them, though the common council of the borough were the trustees, and in the first instance formed the committee of management. Gradually the payers of dock rates on ships and goods acquired influence, and were introduced into the governing body, and ultimately, by an act of 1857, the corporation was superseded. The management is vested in the Mersey Docks and Harbour Board, consisting of twenty-eight members, four of whom are nominated by the Mersey Conservancy commissioners, who consist of the first lord of the Admiralty,

the chancellor of the duchy of Lancaster and the president of the Board of Trade, and the rest elected by the payers of rates on ships and goods, of whom a register is kept and annually revised. The revenue is derived from tonnage rates on ships, dock rates on goods, town dues on goods, with various minor sources of income.

Down to 1843 the docks were confined to the Liverpool side of the Mersey. Several attempts made to establish docks in Cheshire had been frustrated by the Liverpool corporation, who bought up the land and kept it in their own hands. In 1843, however, a scheme for docks in Birkenhead was carried through which ultimately proved unsuccessful, and the enterprise was acquired in 1855 by Liverpool. The Birkenhead docks were for many years only partially used, but are now an important centre for corn-milling, the importation of foreign cattle and export trade to the East. In addition to the wet docks, there are in Liverpool fourteen graving docks and three in Birkenhead, besides a gridiron on the Liverpool side.

The first portion of the great landing stage, known as the Georges' stage, was constructed in 1847, from the plans of Mr (afterwards Sir) William Cubitt, F.R.S. This was 500 ft. long. In 1857 the Prince's stage, 1000 ft. long, was built to the north of the Georges' stage and distant from it 500 ft. In 1874 the intervening space was filled up and the Georges' stage reconstructed. The fabric had just been completed, and was waiting to be inaugurated, when on the 28th of July 1874 it was destroyed by fire. It was again constructed with improvements. In 1896 it was farther extended to the north, and its length is now 2478 ft. and its breadth 80 ft. It is supported on floating pontoons about 200 in number, connected with the river wall by eight bridges, besides a floating bridge for heavy traffic 550 ft. in length and 35 ft. in width. The southern half is devoted to the traffic of the Mersey ferries, of which there are seven—New Brighton, Egremont, Seacombe, Birkenhead, Rock Ferry, New Ferry and Eastham. The northern half is used by ocean-going steamers and their tenders. The warehouses for storing

produce form a prominent feature in the commercial part of the city. Down to 1841 these were entirely in private hands, distributed as chance might direct, but in that year a determined effort was made to construct docks with warehouses on the margin of the quays. This met with considerable opposition from those interested, and led to a municipal revolution, but the project was ultimately carried out in the construction of the Albert dock and warehouses, which were opened by Prince Albert in 1845. For general produce these warehouses are falling somewhat into disuse, but grain warehouses have been constructed by the dock board at Liverpool and Birkenhead, with machinery for discharging, elevating, distributing, drying and delivering. Warehouses for the storage of tobacco and wool have also been built by the board. The Stanley tobacco warehouse is the largest of its kind in the world, the area of its fourteen floors being some 36 acres.

Dredging operations at the bar of the Queen's channel, in the channel itself and at the landing stage enables the largest ocean liners to enter the river and approach the stage at practically all states of the tide. The dredging at the bar was begun as an experiment in September 1890 by two of the board's ordinary hopper barges of 500 tons capacity each fitted with centrifugal pumps. The result was favourable, and larger vessels have been introduced. Before dredging was begun the depth of water at dead low water of spring tides on the bar was only 11 ft.; now there is about 28 ft. under the same conditions. The space over which dredging has been carried on at the bar measures about 7000 ft. by 1250 ft., the latter being the average width of the buoyed cut or channel through the bar. Dredging has also taken place on shoals and projections of sand-banks in the main sea channels.

Municipality.—Under the Municipal Reform Act of 1835, the boundaries of the original borough were extended by the annexation of portions of the surrounding district, while further additions were made in 1895, 1902 and 1905. The city is divided into thirty-five wards with 103 councillors and 34 aldermen. In 1893 the title of mayor was raised to that of lord mayor. In

1885 the number of members of parliament was increased to nine by the creation of six new wards. The corporation of Liverpool has possessed from a very early period considerable landed property, the first grant having been made by Thomas, earl of Lancaster, in 1309. This land was originally of value only as a source of supply of turf for firing, but in modern times its capacity as building land has been a fruitful source of profit to the town. A large proportion of the southern district is held in freehold by the corporation and leased to tenants for terms of seventy-five years, renewable from time to time on a fixed scale of fines. There was formerly another source of income now cut off. The fee farm rents and town dues originally belonging to the crown were purchased from the Molyneux family in 1672 on a long lease, and subsequently in 1777 converted into a perpetuity. With the growth of the commerce of the port these dues enormously increased, and became a cause of great complaint by the shipping interest. In 1856 a bill was introduced into parliament, and passed, by which the town dues were transferred to the Mersey Docks and Harbour Board on payment of £1,500,000, which was applied in part to the liquidation of the bonded debt of the corporation, amounting to £1,150,000.

History.—During the Norse irruption of the 8th century colonies of Norsemen settled on both sides of the Mersey, as is indicated by some of the place-names. After the Conquest, the site of Liverpool formed part of the fief (inter Ripam et Mersham) granted by the Conqueror to Roger de Poictou, one of the great family of Montgomery. Although Liverpool is not named in Domesday it is believed to have been one of the six berewicks dependent on the manor of West Derby therein mentioned. After various forfeitures and regrants from the crown, it was handed over by Henry II. to his falconer Warine. In a deed executed by King John, then earl of Mortain, about 1191, confirming the grant of this with other manors to Henry Fitzwarine, son of the former grantee, the name of Liverpool first occurs. Probably its most plausible derivation is from the Norse *Hlithar-pollr*, “the pool of the slopes,”

the pool or inlet at the mouth of which the village grew up being surrounded by gently rising slopes. Another possible derivation is from the Prov. E. *lever*, the yellow flag or rush, A.S. *laefer*.

After the partial conquest of Ireland by Strongbow, earl of Pembroke, under Henry II., the principal ports of communication were Bristol for the south and Chester for the north. The gradual silting up of the river Dee soon so obstructed the navigation as to render Chester unsuitable. A quay was then constructed at Shotwick, about 8 m. below Chester, with a castle to protect it from the incursions of the neighbouring Welsh; but a better site was sought and soon found. Into the tidal waters of the Mersey a small stream, fed by a peat moss on the elevated land to the eastward, ran from north-east to south-west, forming at its mouth an open pool or sea lake, of which many existed on both sides of the river. The triangular piece of land thus separated formed a promontory of red sandstone rock, rising in the centre about 50 ft. above the sea-level, sloping on three sides to the water. The pool was admirably adapted as a harbour for the vessels of that period, being well protected, and the tide rising from 15 to 21 ft. King John repurchased the manor from Henry Fitzwarine, giving him other lands in exchange. Here he founded a borough, and by letters patent dated at Winchester, 28th of August 1207, invited his subjects to take up burgages.

From the patent rolls and the sheriff's accounts it appears that considerable use was made of Liverpool in the 13th century for shipping stores and reinforcements to Ireland and Wales.

In 1229 a charter was granted by Henry III., authorizing the formation of a merchants' gild, with hanse and other liberties and free customs, with freedom from toll throughout the kingdom. Charters were subsequently granted by successive monarchs down to the reign of William and Mary, which last was the governing charter to the date of the Municipal Reform

Act (1835). In 1880 when the diocese of Liverpool was created, the borough was transformed into a city by royal charter.

The crown revenues from the burgage rents and the royal customs were leased in fee-farm from time to time, sometimes to the corporation, at other times to private persons. The first lease was from Henry III., in 1229, at £10 per annum. In the same year the borough, with all its appurtenances, was bestowed with other lands on Ranulf, earl of Chester, from whom it passed to his brother-in-law William de Ferrers, earl of Derby, who seems to have built Liverpool castle between 1232 and 1237. His grandson, Robert de Ferrers, was implicated in the rising of Simon de Montfort and his lands were confiscated in 1266 when Liverpool passed into the hands of Edmund, earl of Lancaster. Ultimately Liverpool again became the property of the crown, when Henry IV. inherited it from his father John of Gaunt, duke of Lancaster. In 1628 Charles I., in great straits for means which were refused by parliament, offered for sale about a thousand manors, among which Liverpool was included. The portion containing Liverpool was purchased by certain merchants of London, who, in 1635, reconveyed the crown rights, including the fee-farm rent of £14, 6s. 8d., to Sir Richard Molyneux, then recently created Viscount Molyneux of Maryborough, for the sum of £450. In 1672 all these rights and interests were acquired by the corporation.

Apart from the national objects for which Liverpool was founded, its trade developed slowly. From £10 per annum, in the beginning of the 13th century, the crown revenues had increased towards the end of the 14th century, to £38; but then they underwent a decline. The black death passed over Liverpool about 1360, and carried off a large part of the population. The Wars of the Roses in the 15th century unsettled the north-western districts and retarded progress for at least a century. The crown revenues diminished from £38 to less than half that sum, and were finally leased at £14, 6s. 8d., at which they continued until the sale by Charles I. It is, however, not safe to conclude that the reduced fee-farm rent represents an

equivalent decline in prosperity; the privileges conferred by the various leases differed widely and may account for much of the apparent discrepancy.

Liverpool sent no representatives to Simon de Montfort's parliament in 1264, but to the first royal parliament, summoned in 1295, the borough sent two members, and again in 1307. The writs of summons were then suspended for two centuries and a half. In 1547 Liverpool resumed the privilege of returning members. In 1588 the borough was represented by Francis Bacon, the philosopher and statesman. During the Civil War the town was fortified and garrisoned by the parliament. It sustained three sieges, and in 1644 was escaladed and taken by Prince Rupert with considerable slaughter.

The true rise of the commerce of Liverpool dates from the Restoration. Down to that period its population had been either stationary or retrogressive, probably never exceeding about 1000. Its trade was chiefly with Ireland, France and Spain, exporting fish and wool to the continent, and importing wines, iron and other commodities. The rise of the manufacturing industry of south Lancashire, and the opening of the American and West Indian trade, gave the first impulse to the progress which has since continued. By the end of the century the population had increased to 5000. In 1699 the borough was constituted a parish distinct from Walton, to which it had previously appertained. In 1709, the small existing harbour being found insufficient to accommodate the shipping, several schemes were propounded for its enlargement, which resulted in the construction of a wet dock closed with flood-gates impounding the water, so as to keep the vessels floating during the recess of the tide. This dock was the first of its kind. The name of the engineer was Thomas Steers.

About this date the merchants of Liverpool entered upon the slave trade, into which they were led by their connexion with the West Indies. In 1709 a

single vessel of 30 tons burden made a venture from Liverpool and carried fifteen slaves across the Atlantic. In 1730, encouraged by parliament, Liverpool went heartily into the new trade. In 1751, fifty-three ships sailed from Liverpool for Africa, of 5334 tons in the aggregate. The ships sailed first to the west coast of Africa, where they shipped the slaves, and thence to the West India Islands, where the slaves were sold and the proceeds brought home in cargoes of sugar and rum. In 1765 the number of Liverpool slavers had increased to eighty-six, carrying 24,200 slaves. By the end of the century five-sixths of the African trade centred in Liverpool. Just before its abolition in 1807 the number of Liverpool ships engaged in the traffic was 185, carrying 49,213 slaves in the year.

Another branch of maritime enterprise which attracted the attention of the merchants of Liverpool was privateering, which, during the latter half of the 18th century, was a favourite investment. After the outbreak of the Seven Years' War with France and Spain, in 1756, the commerce of Liverpool suffered severely, the French having overrun the narrow seas with privateers, and the premiums for insurance against sea risks rose to an amount almost prohibitive. The Liverpool merchants took a lesson from the enemy, and armed and sent out their ships as privateers. Some of the early expeditions proving very successful, almost the whole community rushed into privateering, with results of a very chequered character. When the War of Independence broke out in 1775 American privateers swarmed about the West India Islands, and crossing the Atlantic intercepted British commerce in the narrow seas. The Liverpool merchants again turned their attention to retaliation. Between August 1778 and April 1779, 120 privateers were fitted out in Liverpool, carrying 1986 guns and 8745 men.

See W. Enfield, *Hist. of Leverpool* (1773); J. Aikin, *Forty Miles round Manchester* (1795); T. Troughton, *Hist. of Liverpool* (1810); M. Gregson, *Portfolio of Fragments relating to Hist. of Lancashire* (1817); H. Smithers, *Liverpool, its Commerce*, &c. (1825); R. Syers, *Hist. of Everton* (1830); E.

Baines, *Hist. of County Palatine of Lancaster*, vol. iv. (1836); T. Baines, *Hist. of Commerce and Town of Liverpool* (1852); R. Brooke, *Liverpool during the last quarter of 18th Century* (1853); J. A. Picton, *Memorials of Liverpool* (2 vols., 1873); Ramsay Muir and Edith M. Platt, *A History of Municipal Government in Liverpool* (1906); Ramsay Muir, *A History of Liverpool* (1907). (W. F. I.)

LIVERSEDGE, an urban district in the Spen Valley parliamentary division of the West Riding of Yorkshire, England, 7 m. S.S.E. of Bradford, on the Lancashire & Yorkshire, Great Northern, and London & North Western railways. Pop. (1901) 13,980. The industries are chiefly the manufacture of woollen goods, the making of machinery, chemical manufactures and coal mining.

LIVERY, originally the provision of food, clothing, &c., to household servants. The word is an adaptation of the Anglo-French *livrée*, from *livrer*, to deliver (Late Lat. *liberare*, to set free, to serve, to give freely), in the special sense of distributing. In the sense of a fixed allowance of provender

for horses, it survives now only in “livery-stable,” *i.e.* an establishment where horses and carriages are kept or let out for hire. From the meaning of provision of food and clothing the word is applied to a uniform worn by the retainers and servants of a household. In the 15th century in England a badge, collar or other insignia, the “livery,” was worn by all those who pledged themselves to support one of the great barons in return for his promise of “maintenance,” *i.e.* of protection against enemies; thus arose the custom of “livery and maintenance,” suppressed by Henry VII. The members of the London city companies wore a distinctive costume or “livery,” whence the term “livery companies.” In law, the term “livery” means “delivery,” the legal handing of property into the possession of another; for “livery of seisin” see FEOFFMENT.

LIVERY COMPANIES, the name given to particular companies or societies in the city of London. They belong to a class of institutions which at one time were universal in Europe. In most other countries they have disappeared; in England, while their functions have wholly changed, the organization remains. The origin of the city companies is to be found in the craftgilds of the middle ages. The absence of a strong central authority accounts for the tendency of confederation in the beginning of modern societies. Artificial groups, formed in imitation of the family, discharged the duties which the family was no longer able, and the state was not yet able, to undertake. The inhabitants of towns were forced into the societies known as gild-merchants, which in course of time monopolized the municipal

government, became exclusive, and so caused the growth of similar societies among excluded citizens. The craftgilds were such societies, composed of handicraftsmen, which entered upon a struggle with the earlier gilds and finally defeated them. The circumstances and results of the struggle were of much the same character in England and on the continent. In London the victory of the crafts is decisively marked by the ordinance of the time of Edward II., which required every citizen to be a member of some trade or mystery, and by another ordinance in 1375 which transferred the right of election of corporate officers (including members of parliament) from the ward-representatives to the trading companies. Henceforward, and for many years, the companies engrossed political and municipal power in the city of London.

The trading fraternities assumed generally the character of corporations in the reign of Edward III. Many of them had been chartered before, but their privileges, hitherto exercised only on sufferance and by payment of their terms, were now confirmed by letters patent. Edward III. himself became a member of the fraternity of Linen Armourers, or Merchant Taylors, and other distinguished persons followed his example. From this time they are called livery companies, "from now generally assuming a distinctive dress or livery." The origin of the Grocers' Company is thus described: "Twenty-two persons, carrying on the business of pepperers in Soper's Lane, Cheapside, agree to meet together, to a dinner, at the Abbot of Bury's, St Mary Axe, and commit the particulars of their formation into a trading society to writing. They elect after dinner two persons of the company so assembled—Roger Osekyn and Lawrence de Haliwell—as their first governors or wardens, appointing, at the same time, in conformity with the pious custom of the age, a priest or chaplain to celebrate divine offices for their souls" (Heath's "Account of the Grocers' Company," quoted in Herbert's *Twelve Great Livery Companies*, 1836, i. 43). The religious observances and the common feasts were characteristic features of those institutions. They were therefore

not merely trade unions in the current meaning of that phrase, but may rather be described as forms of industrial self-government, the basis of union being the membership of a common trade, and the authority of the society extending to the general welfare, spiritual and temporal, of its members. It must be remembered that they flourished at a time when the separate interests of master and servant had not yet been created; and, indeed, when that fundamental division of interests arose, the companies gradually lost their functions in the regulation of industry. The fact that the craftsmen were a homogeneous order will account for the wide authority claimed by their societies, and the important public powers which were conceded to them. In the regulation of trade they possessed extensive powers. They required every one carrying on the trade to join the company. In 1363, in answer to a remonstrance against the mischief caused by "the merchants called grocers who engrossed all manner of merchandize vendable, and who suddenly raised the prices of such merchandize within the realm," it was enacted "that all artificers and people of mysteries shall each choose his own mystery[1] before next Candlemas, and that, having so chosen it, he shall henceforth use no other." L. Brentano (*On Gilds*) holds that it is wrong to represent such regulations as monopolistic, inasmuch as there was no question whatever of a monopoly in that time nor until the degeneration of the craftgilds into limited corporations of capitalists. In the regulation of trade the right of search was an important instrument. The wardens of the grocers are to "assayen weights, powders, confeccions, platers, oyntments and all other things belonging to the same crafte." The goldsmiths had the assay of metals, the fishmongers the oversight of fish, the vintners of the tasting of wine, &c. The companies enforced their regulations on their members by force. Many of their ordinances looked to the domestic affairs and private conduct of the members. The grocers ordain "that no man of the fraternite take his neyghbor's house yt is of the same fraternite, or enhaunce the rent against the will of the foresaid neyghbor." Perjury is to be punished by the wardens and society with such correction as that other men of the fellowship

may be warned thereby. Members reduced to poverty by adventures on the sea, increased price of goods, borrowing and pledging, or any other misfortune, are to be assisted "out of the common money, according to his situation, if he could not do without."

Following what appears to be the natural law of their being, the companies gradually lost their industrial character. The course of decay would seem to have been the following. The capitalists gradually assumed the lead in the various societies, the richer members engrossed the power and the companies tended to become hereditary and exclusive. Persons might be members who had nothing to do with the craft, and the rise of great capitalists and the development of competition in trade made the regulation of industry by means of companies no longer possible. For an account of the "degeneration of craftgilds" a general reference may be made to Brentano, *On Gilds* (1870), and C. Gross, *The Gild Merchant* (2 vols., 1890). The usurpation of power on the part of the richer members was not always effected without opposition. Brentano refers to a pamphlet on the Clothworkers' Company, published in 1649, which asserts that "the commonalty" in the old charters meant, not the whole gild, but only the masters, wardens and assistants. Herbert records a dispute in the Goldsmiths' Company in 1529. The mode of electing officers, and the system of management generally, was challenged by three members who called themselves "artificers, poor men of the craft of goldsmiths." The company, or rather, the wardens, the assistants and livery presented a petition to the lord mayor, which was answered by the discontented craftsmen. The dispute was carried into the court of chancery and the star chamber. The artificers accused the company of subverting their grants, misappropriating the funds and changing the constitution of the society, and they complain of this being done by the usurpation of persons who "were but merchant goldsmiths, and had but little knowledge in the science." In 1531 the three complainants were expelled from the company, and then the dispute seems to have ended.

In the last stage of the companies the members have ceased to have any connexion with the trades, and in most cases their regulative functions have disappeared. The one characteristic which has clung to them throughout is that of owners of property and managers of charitable trusts. The connexion between the companies and the municipality is shortly as follows. The ordinance of Edward II. required freemen of the city to be members of one or other of the companies. By the ordinance of 49 Edw. III. (1375), the trading companies were to nominate the members of common council, and the persons so nominated alone were to attend both at common councils and at elections. An ordinance in 7 Richard II. (1383) restored the elections of common councilmen to the wards, but corporate officers and representatives in parliament were elected by a convention summoned by the lord mayor from the nominees of the companies. An act of common council in 7 Edw. IV. (1467) appointed the election of mayor, sheriffs, &c., to be in the common council, together with the masters and wardens of the companies. By 15 Edw. IV. masters and wardens were ordered to associate with themselves the honest men of their mysteries, and come in their best liveries to the elections; that is to say, the franchise was restricted to the "liverymen" of the companies. At this time the corporation exercised supreme control over the companies, and the companies were still genuine associations of the traders and householders of the city. The delegation of the franchise to the liverymen was thus, in point of fact, the selection of a superior class of householders to represent the rest. When the corporation lost its control over the companies, and the members of the companies ceased to be traders and householders, the liverymen were no longer a representative class, and some change in the system became necessary. The Reform Acts of 1832 and 1867 reformed the representation in several particulars. The liverymen of the companies, being freemen of the city, have still, however, the exclusive power of electing the lord mayor, sheriffs, chamberlain and other corporate officers.

The contributions made by the companies to the public purposes of the state and the city are interesting points in their early history. Their wealth and their representative character made them a most appropriate instrument for the enforcement of irregular taxation. The loan of £21,263, 6s. 8d. to Henry VIII. for his wars in Scotland, in 1544, is believed by Herbert to be the first instance of a pecuniary grant to the crown, but the practice rapidly gained ground. The confiscation of ecclesiastical property at the time of the Reformation affected many of the trusts of the companies; and they were compelled to make returns of their property devoted to religious uses, and to pay over the rents to the crown. In course of time the taxation of the companies became "a regular source of supply to government." The historians of the city have for the most part described these as unjust and tyrannical exactions, but, looking at the representative and municipal character of the companies, and the purposes to which their contributions were applied, we may regard them as a rough but not unfair mode of taxation. The government, when money was wanted for public works, informed the lord mayor, who apportioned the sums required among the various societies, and issued precepts for its payment. Contributions towards setting the poor to work, erecting the Royal Exchange, cleansing the city ditch, discovering new countries, furnishing military and naval armaments, for men, arms and ammunition for the defence of the city, are among what Herbert calls the sponging expedients of the government. The crown occasionally interfered in a more unjustifiable manner with the companies in the exercise of their patronage. The Stuarts made strenuous efforts to get the control of the companies. Terrified by the proceedings in the *quo warranto* case, most of the companies surrendered their charters to the crown, but such surrenders were annulled by the act of 2 William and Mary (1690) reserving the judgment in *quo warranto* against the city. The livery companies now in existence are the following:

Apothecaries.	Feltmakers.	Needlemakers.

Armourers and Brasiers.	Fishmongers.	Painters.
Bakers.	Fletchers.	Pattern Makers.
Barbers.	Founders.	Pewterers.
Basket Makers.	Framework Knitters.	Plaisterers.
Blacksmiths.	Fruiterers.	Playing Card Makers.
Bowyers.	Girdlers.	Plumbers.
Brewers.	Glass Sellers.	Poulters.
Broderers.	Glaziers.	Saddlers.
Butchers.	Glovers.	Salters.
Carmen.	Gold and Silver Wyre-drawers.	Scriveners.
Carpenters	Goldsmiths.	Shipwrights.
Clockmakers.	Grocers.	Silkthrowsters.
Clothworkers.	Gunmakers.	Skinners.
Coach and Coach-Harness Makers.	Haberdashers	Spectacle makers.
Cooks.	Horners.	Stationers.
Coopers.	Innholders.	Tallow Chandlers.
Cordwainers.	Ironmongers.	Tin Plate Workers.
Curriers.	Joiners.	Turners.
Cutlers.	Leathersellers.	Tylers and Bricklayers.
Distillers.	Loriners.	Upholders.
Drapers.	Masons.	Wax Chandlers.
Dyers.	Mercers.	Weavers.
Fanmakers.	Merchant Taylors.	Wheelwrights.
Farriers.	Musicians.	Woolmen.
Fellowship Porters.		

The following are the twelve great companies in order of civic precedence: Mercers, Grocers, Drapers, Fishmongers, Goldsmiths, Skinners, Merchant Taylors, Haberdashers, Salters, Ironmongers, Vintners, Cloth-workers. The “Irish Society” was incorporated in the 11 James I. as “the governor and assistants of the new plantation in Ulster, within the realm of Ireland.” The twelve companies contributed in equal portions the sum of £60,000 for the new scheme, by which it was intended to settle a Protestant colony in the lands forfeited by the Irish rebels. The companies divided the settlement into twelve nearly equal parts, assigning one to each, but the separate estates are still held to be under the paramount jurisdiction of the Irish Society. The charter of the society was revoked by the court of star chamber in the reign of Charles I., but a new one was granted by Charles II., under which the society still acts.

Most of the companies administer charities of large value. Many of them are governors of important schools, *e.g*. the Skinners have the Tonbridge Grammar School; the Mercers, St Paul's School; the Merchant Taylors, the school bearing their name, &c. The constitution of the livery companies usually embraces (*a*) the court, which includes the master and wardens, and is the executive and administrative body; (2) the livery or middle class, being the body from which the court is recruited; and (3) the general body of freemen, from which the livery is recruited. Some companies admit women as freemen. The freedom is obtained either by patrimony (by any person over twenty-one years of age born in lawful wedlock after the admission of his father to the freedom), by servitude (by being bound as an apprentice to a freeman of the company) or by redemption. Admission to many of the companies is subject to the payment of considerable fees. For example, in the Merchant Taylors the fees are—upon taking up the freedom, by patrimony or servitude, £1, 3s. 4d.; by redemption, £84; on admission to the livery, £80, 8s.; on election to the court of assistants, £115, 10s. At one time the position of the livery companies was a subject of much political discussion. Two parties threatened to attack them—on one side those who were anxious for extensive reforms in the municipal organization of London; on the other, those who wished to carry forward the process of inspection and revision of endowments, which had already overtaken the universities, schools and other charities. A Royal Commission was appointed in 1880 to inquire into all the livery companies, into the circumstances and dates of their foundation, the objects for which they were founded, and how far those objects were being carried into effect. A very valuable *Report and Appendix* (4 vols., 1884) was published, containing, *inter alia*, information on the constitution and powers of the governing bodies, the mode of admission of members of the companies, the mode of appointment, duties and salaries and other emoluments of the servants of the companies, the property of, or held in trust for, the companies, its value, situation and description. The companies very freely made returns to the commission, the only ones not

doing so being the Broderers, Bowyers, Distillers, Glovers, Tin-Plate Workers and Weavers. The Commission estimated the annual income of the companies to be from £750,000 to £800,000, about £200,000 of that amount being trust income, the balance corporate income.

AUTHORITIES.—In addition to the *Report* referred to above the following works may be consulted: H. T. Riley, *Memorials of London and London Life* (1868); *Chronicle of London from 1089 to 1483* (ed. by Sir N. H. Nicolas and E. Tyrrel, 1827); *Munimenta Gildhallae Londiniensis*, in Rolls Series, ed. by H. T. Riley (4 vols., 1859-1862); J. Toulmin Smith, *English Gilds* (published by Early English Text Society), with essay by L. Brentano (1870); W. Herbert, *History of the Twelve Great Livery Companies* (1837); C. Gross, *The Gild Merchant* (2 vols., 1890); W. C. Hazlitt, *The Livery Companies of the City of London* (1892), contains a précis of the Royal Commission; P. H. Ditchfield, *The City Companies of London* (1904); G. Unwin, *The Gilds and Companies of London* (1908). (T. A. I.)

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1 Properly the word should be spelled, as it was originally, "mistery;" it comes through the O. Fr. *mestier*, modern *métier*, from Lat. *ministerium*, service, employment, and meant a trade or craft, and hence the plays acted by craftsmen and members of gilds were called "mystery plays" (see DRAMA). For the word meaning a hidden or secret rite, with which this has so often been confused, see MYSTERY.

LIVIA DRUSILLA

(*c.* 55 B.C.-A.D. 29), Roman empress, was originally the wife of Tiberius Claudius Nero, by whom she had two sons, Drusus and Tiberius (afterwards emperor). But she attracted the attention of

the future emperor Augustus, who in 38 compelled her husband to divorce her and married her himself, having first got rid of his own wife Scribonia. Her two sons, at their dying father's request, were entrusted to the guardianship of Augustus, to whom she bore no children. Livia was suspected of committing various crimes to secure the throne for Tiberius, whereas Augustus naturally favoured the claims of his blood-relatives. The premature deaths of his nephew Marcellus (whom he had at first fixed upon as his successor) and of his grandsons Gaius and Lucius Caesar, the banishment of his grandson Agrippa Postumus, and even his own death, were attributed to her. But in any case Augustus's affection for his wife appears to have suffered no diminution up to the last; by his will he declared her and Tiberius (whom he had adopted in A.D. 4) his heirs; Livia inherited a third of his property; she was adopted into the Julian gens, and henceforth assumed the name of Julia Augusta. The senate also elected her chief priestess of the college founded in honour of the deified Augustus. She had now reached the summit of her ambition, and at first acted as joint-ruler with Tiberius. Tiberius, however, soon became tired of the maternal yoke; his retirement to Capreae is said to have been caused by his desire to escape from her. Livia continued to live quietly at Rome, in the full enjoyment of authority, until her death at an advanced age. Tiberius appears to have received the news with indifference, if not with satisfaction; he absented himself from the funeral, and refused to allow her apotheosis; her will was suppressed for a long time and only carried out, and the legacies paid, by Caligula.

See Tacitus, *Annals*, i. v.; Dio Cassius liii. 33, lv. 14-22, lviii. 2, lix. 2; Suetonius, *Tiberius*, 50, 51; J. Aschbach, *Livia, Gemahlin des Kaisers Augustus* (1864); V. Gardthausen, *Augustus und seine Zeit*, i. 1018 foll., ii. 631 foll.

LIVINGSTON, EDWARD (1764-1836), American jurist and statesman, was born in Clermont, Columbia county, New York, on the 26th of May 1764. He was a great-grandson of Robert Livingston, the first of the family to settle in America (see LIVINGSTON, WILLIAM, below). He graduated at Princeton in 1781, was admitted to the bar in 1785, and began to practise law in New York City, rapidly rising to distinction. In 1795-1801 he was a Republican representative in Congress, where he was one of the leaders of the opposition to Jay's treaty, introduced the resolution calling upon President Washington for all papers relating to the treaty, and at the close of Washington's administration voted with Andrew Jackson and other radicals against the address to the president. He opposed the Alien and Sedition Laws, introduced legislation on behalf of American seamen, and in 1800 attacked the president for permitting the extradition by the British government of Jonathan Robbins, who had committed murder on an English frigate, and had then escaped to South Carolina and falsely claimed to be an American citizen. In the debate on this question Livingston was opposed by John Marshall. In 1801 Livingston was appointed U.S. district-attorney for the state of New York, and while retaining that position was in the same year appointed mayor of New York City. When, in the summer of 1803, the city was visited with yellow fever, Livingston displayed courage and energy in his endeavours to prevent the spread of the disease and relieve distress. He suffered a violent attack of the fever, during which the people gave many proofs of their attachment to him. On his recovery he found his private affairs in some confusion, and he was at the same time deeply indebted to

the government for public funds which had been lost through the mismanagement or dishonesty of a confidential clerk, and for which he was responsible as district-attorney. He at once surrendered all his property, resigned his two offices in 1803, and removed early in 1804 to Louisiana. He soon acquired a large law practice in New Orleans, and in 1826 repaid the government in full, including the interest, which at that time amounted to more than the original principal.

Almost immediately upon his arrival in Louisiana, where the legal system had previously been based on Roman, French and Spanish law, and where trial by jury and other peculiarities of English common law were now first introduced, he was appointed by the legislature to prepare a provisional code of judicial procedure, which (in the form of an act passed in April 1805) was continued in force from 1805 to 1825. In 1807, after conducting a successful suit on behalf of a client's title to a part of the batture or alluvial land near New Orleans, Livingston attempted to improve part of this land (which he had received as his fee) in the Batture, Ste Marie. Great popular excitement was aroused against him; his workmen were mobbed; and Governor Claiborne, when appealed to for protection, referred the question to the Federal government. Livingston's case was damaged by President Jefferson, who believed that Livingston had favoured Burr in the presidential election of 1800, and that he had afterwards been a party to Burr's schemes. Jefferson made it impossible for Livingston to secure his title, and in 1812 published a pamphlet "for the use of counsel" in the case against Livingston, to which Livingston published a crushing reply. Livingston's final victory in the courts brought him little financial profit because of the heavy expenses of the litigation. During the war with England from 1812 to 1815 Livingston was active in rousing the mixed population of New Orleans to resistance. He used his influence to secure amnesty for Lafitte and his followers upon their offer to fight for the city, and in 1814-1815 acted as adviser and volunteer aide-de-camp to General Jackson, who was his personal friend. In 1821, by

appointment of the legislature, of which he had become a member in the preceding year, Livingston began the preparation of a new code of criminal law and procedure, afterwards known in Europe and America as the "Livingston Code." It was prepared in both French and English, as was required by the necessities of practice in Louisiana, and actually consisted of four codes—crimes and punishments, procedure, evidence in criminal cases, reform and prison discipline. Though substantially completed in 1824, when it was accidentally burned, and again in 1826, it was not printed entire until 1833. It was never adopted by the state. It was at once reprinted in England, France and Germany, attracting wide praise by its remarkable simplicity and vigour, and especially by reason of its philanthropic provisions in the code of reform and prison discipline, which noticeably influenced the penal legislation of various countries. In referring to this code, Sir Henry Maine spoke of Livingston as "the first legal genius of modern times" (*Cambridge Essays, 1856*, p. 17). The spirit of Livingston's code was remedial rather than vindictive; it provided for the abolition of capital punishment and the making of penitentiary labour not a punishment forced on the prisoner, but a matter of his choice and a reward for good behaviour, bringing with it better accommodations. His Code of Reform and Prison Discipline was adopted by Guatemala. Livingston was the leading member of a commission appointed to prepare a new civil code,[1] which for the most part the legislature adopted in 1825, and the most important chapters of which, including all those on contract, were prepared by Livingston alone.

Livingston was again a representative in Congress during 1823-1829, a senator in 1829-1831, and for two years (1831-1833) secretary of state under President Jackson. In this last position he was one of the most trusted advisers of the president, for whom he prepared a number of state papers, the most important being the famous anti-nullification proclamation of the 10th of December 1832. From 1833 to 1835 Livingston was minister plenipotentiary to France, charged with procuring the fulfilment by the

French government of the treaty negotiated by W. C. Rives in 1831, by which France had bound herself to pay an indemnity of twenty-five millions of francs for French spoliations of American shipping chiefly under the Berlin and Milan decrees, and the United States in turn agreed to pay to France 1,500,000 francs in satisfaction of French claims. Livingston's negotiations were conducted with excellent judgment, but the French Chamber of Deputies refused to make an appropriation to pay the first instalment due under the treaty in 1833, relations between the two governments became strained, and Livingston was finally instructed to close the legation and return to America. He died on the 23rd of May 1836 at Montgomery Place, Dutchess county, New York, an estate left him by his sister, to which he had removed in 1831. Livingston was twice married. His first wife, Mary McEvers, whom he married on the 10th of April 1788, died on the 13th of March 1801. In June 1805 he married Madame Louise Moreau de Lassy (d. 1860), a widow nineteen years of age, whose maiden name was Davezac de Castera, and who was a refugee in New Orleans from the revolution in Santo Domingo. She was a woman of extraordinary beauty and intellect, and is said to have greatly influenced her husband's public career.

See C. H. Hunt, *Life of Edward Livingston* (New York, 1864); Livingston's *Works* (2 vols., New York, 1873); and Louise Livingston Hunt, *Memoir of Mrs Edward Livingston* (New York, 1886).

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1 Preliminary work in the preparation of a new civil code had been done by James Brown and Moreau Lislet, who in 1808 reported a "Digest of the Civil Laws now in force in the Territory of Orleans with Alterations and Amendments adapted to the present Form of Government."

LIVINGSTON, ROBERT R. (1746-1813), American statesman, son of Robert R. Livingston (1718-1775; a justice of the New York supreme court after 1763) and brother of Edward Livingston (see above), was born in New York City, on the 27th of November 1746. He graduated at King's College, New York (now Columbia University), in 1765, was admitted to the bar in 1773, and for a short time was a law partner of John Jay. In 1773 he became recorder of New York City, but soon identified himself with the Whig or Patriot element there, and was forced to give up this position in 1775. He was a member of the second, third and fourth Provincial Congresses of New York (1775-1777), was a delegate from New York to the Continental Congress in 1775-1777 and again in 1779-1780, and was a member of the committee which drafted the Declaration of Independence. He was prevented from signing that document by his absence at the time to attend a meeting of the fourth New York Provincial Congress, which on the 10th of July became the Convention of the Representatives of the state of New York, and by which at Kingston in 1777 the first state constitution was adopted, Livingston having been a member of the committee that drafted this instrument. He was the first chancellor of the state, from 1777 to February 1801, and is best known as "Chancellor" Livingston. In this capacity he administered the oath of office to Washington at his first inauguration to the presidency, in New York, on the 30th of April 1789. Previously, from October 1781 to June 1783, he had been the first secretary of foreign affairs under the Confederation, and his European correspondence, especially with Franklin, was of the utmost value in

accomplishing peace with Great Britain. In 1788 he had been a member of the New York Convention, which ratified for that state the Federal Constitution. He became an anti-Federalist and in 1798 unsuccessfully opposed John Jay in the New York gubernatorial campaign. In 1801, having refused an appointment as secretary of the navy, he became minister to France on President Jefferson's appointment. He had refused this post when Washington offered it to him in 1794. He arrived in France in November 1801, and in 1803, in association with James Monroe, effected on behalf of his government the purchase from France of what was then known as "Louisiana," the credit for this purchase being largely his (see LOUISIANA PURCHASE). In 1804 Livingston withdrew from public life, and after a year of travel in Europe returned to New York, where he promoted various improvements in agriculture. He did much to introduce the use of gypsum as a fertilizer, and published an *Essay on Sheep* (1809). He was long interested in the problem of steam navigation; before he went to France he received from the state of New York a monopoly of steam navigation on the waters of the state and assisted in the experiments of his brother-in-law, John Stevens; in Paris he met Robert Fulton, and with him in 1802 made successful trials on the Seine of a paddle wheel steamboat; in 1803 Livingston (jointly with Robert Fulton) received a renewal of his monopoly in New York, and the first successful steam-vessel, which operated on the Hudson in 1807, was named after Livingston's home, Clermont (N.Y.). He died at Clermont on the 26th of February 1813.

Livingston and George Clinton were chosen to represent New York state in Statuary Hall, in the Capitol, at Washington, D.C.; the statue of Livingston is by E. D. Palmer.

See Frederick de Peyster, *Biographical Sketch of Robert R. Livingston* (New York, 1876); Robert K. Morton, "Robert R. Livingston: Beginnings of American Diplomacy," in *The John P. Branch Historical Papers of Randolph-Macon College*, i. 299-324, and ii. 34-46; and J. B. Moore,

"Robert R. Livingston and the Louisiana Purchase," in *Columbia University Quarterly*, v. 6 (1904), pp. 221-229.

LIVINGSTON, WILLIAM (1723-1790), American political leader, was born at Albany, New York, probably on the 30th of November 1723. He was the son of Philip Livingston (1686-1749), and grandson of Robert Livingston (1654-1725), who was born at Ancrum, Scotland, emigrated to America about 1673, and received grants (beginning in 1686) to "Livingston Manor" (a tract of land on the Hudson, comprising the greater part of what are now Dutchess and Columbia counties). This Robert Livingston, founder of the American family, became in 1675 secretary of the important Board of Indian Commissioners; he was a member of the New York Assembly in 1711-1715 and 1716-1727 and its speaker in 1718-1725, and in 1701 made the proposal that all the English colonies in America should be grouped for administrative purposes "into three distinct governments."

William Livingston graduated at Yale College in 1741, studied law in the city of New York, and was admitted to the bar in 1748. He served in the New York legislature (1759-1760), but his political influence was long exerted chiefly through pamphlets and newspaper articles. The Livingston family then led the Dissenters, who later became Whigs, and the De Lancey family represented the Anglican Tory interests. Through the columns of the *Independent Reflector*, which he established in 1752, Livingston fought the attempt of the Anglican party to bring the projected King's College (now

Columbia University) under the control of the Church of England. After the suspension of the *Reflector* in 1753, he edited in the *New York Mercury* the "Watch Tower" section (1754-1755), which became the recognized organ of the Presbyterian faction. In opposition to the efforts of the Anglicans to procure the establishment of an American episcopate, he wrote an open *Letter to the Right Reverend Father in God, John Lord, Bishop of Llandaff* (1768), and edited and in large measure wrote the "American Whig" columns in the *New York Gazette* (1768-1769). In 1772 he removed to Elizabeth, New Jersey, where after 1773 he lived on his estate known as "Liberty Hall." He represented New Jersey in the first and second Continental Congresses (1774,1775-1776), but left Philadelphia in June 1776, probably to avoid voting on the question of adopting the Declaration of Independence, which he regarded as inexpedient. He was chosen first governor of the state of New Jersey in 1776, and was regularly re-elected until his death in 1790. Loyal to American interests and devoted to General Washington, he was one of the most useful of the state executives during the War of Independence. While governor he was a frequent contributor to the *New Jersey Gazette*, and in this way he greatly aided the American cause during the war by his denunciation of the enemy and appeals to the patriotism of his countrymen. He was a delegate to the Federal Constitutional Convention of 1787, and supported the New Jersey small-state plan. In 1754 he joined with his brother, Philip Livingston, his brother-in-law, William Alexander ("Lord Stirling") and others in founding what is now known as the Society Library of New York. With the help of William Smith (1728-1793), the New York historian, William Livingston prepared a digest of the laws of New York for the period 1691-1756, which was published in two volumes (1752 and 1762). He died at Elizabeth, New Jersey, on the 25th of July 1790.

See Theodore Sedgwick, Jr., *Life of William Livingston* (New York, 1833); and E. B. Livingston, *The Livingstons of Livingston Manor* (1910).

His brother, PETER VAN BRUGH LIVINGSTON (1710-1792), was a prominent merchant and a Whig political leader in New York. He was one of the founders of the College of New Jersey (now Princeton University), was a member of the New York Council for some years before the War of Independence, a member and president of the First Provincial Congress of New York (1775), and a member of the Second Provincial Congress (1775-1776).

Another brother, PHILIP LIVINGSTON (1716-1778), was also prominent as a leader of the New York Whigs or Patriots. He was a member of the New York Assembly in 1759-1769, a delegate to the Stamp Act Congress of 1765, a member of the Continental Congress from 1774 until his death and as such a signer of the Declaration of Independence, and in 1777-1778 was a member of the first state senate.

William's son, (HENRY) BROCKHOLST LIVINGSTON (1757-1823), was an officer in the American War of Independence, and was an able lawyer and judge. From 1807 until his death he was an associate justice of the United States Supreme Court, and he wrote political pamphlets under the pen-name "Decius."

LIVINGSTONE, DAVID (1813-1873), Scottish missionary and explorer in Africa, was born on the 19th of March 1813, at the village of Blantyre Works, in Lanarkshire, Scotland. David was the second child of his parents, Neil Livingston (for so he spelled his name, as did his son for many

years) and Agnes Hunter. His parents were typical examples of all that is best among the humbler families of Scotland. At the age of ten years David left the village school for the neighbouring cotton-mill, and by strenuous efforts qualified himself at the age of twenty-three to undertake a college curriculum. He attended for two sessions the medical and the Greek classes in Anderson's College, Glasgow, and also a theological class. In September 1838 he went up to London, and was accepted by the London Missionary Society as a candidate. He took his medical degree in the Faculty of Physicians and Surgeons in Glasgow in November 1840. Livingstone had set his heart on China, and it was a great disappointment to him that the society finally decided to send him to Africa. To an exterior in these early years somewhat heavy and uncouth, he united a manner which, by universal testimony, was irresistibly winning, with a fund of genuine but simple humour and fun that would break out on the most unlikely occasions, and in after years enabled him to overcome difficulties and mellow refractory chiefs when all other methods failed.

Livingstone sailed from England on the 8th of December 1840. From Algoa Bay he made direct for Kuruman, Bechuanaland, the mission station, 700 m. north, established by Robert Moffat twenty years before, and there he arrived on the 31st of July 1841. The next two years Livingstone spent in travelling about the country to the northwards, in search of a suitable outpost for settlement. During these two years he became convinced that the success of the white missionary in a field like Africa was not to be reckoned by the tale of doubtful conversions he could send home each year—that the proper work for such men was that of pioneering, opening up and starting new ground, leaving native agents to work it out in detail. The whole of his subsequent career was a development of this idea. He selected the valley of Mabotsa, on one of the sources of the Limpopo river, 200 m. north-east of Kuruman, as his first station. Shortly after his settlement here he was attacked by a lion which crushed his left arm. The arm was imperfectly set,

and it was a source of trouble to him at times throughout his life, and was the means of identifying his body after his death. To a house, mainly built by himself at Mabotsa, Livingstone in 1844 brought home his wife, Mary Moffat, the daughter of Moffat of Kuruman. Here he laboured till 1846, when he removed to Chonuane, 40 m. farther north, the chief place of the Bakwain or Bakwena tribe under Sechele. In 1847 he again removed to Kolobeng, about 40 m. westwards, the whole tribe following their missionary. With the aid and in the company of two English sportsmen, William C. Oswell and Mungo Murray, he was able to undertake a journey to Lake Ngami, which had never yet been seen by a white man. Crossing the Kalahari Desert, of which Livingstone gave the first detailed account, they reached the lake on the 1st of August 1849. In April next year he made an attempt to reach Sebituane, who lived 200 m. beyond the lake, this time in company with his wife and children, but again got no farther than the lake, as the children were seized with fever. A year later, April 1851, Livingstone, again accompanied by his family and Oswell, set out, this time with the intention of settling among the Makololo for a period. At last he succeeded, and reached the Chobe (Kwando), a southern tributary of the Zambezi, and in the end of June reached the Zambezi itself at the town of Sesheke. Leaving the Chobe on the 13th of August the party reached Cape Town in April 1852. Livingstone may now be said to have completed the first period of his career in Africa, the period in which the work of the missionary had the greatest prominence. Henceforth he appears more in the character of an explorer, but it must be remembered that he regarded himself to the last as a pioneer missionary, whose work was to open up the country to others.

Having seen his family off to England, Livingstone left Cape Town on the 8th of June 1852, and turning north again reached Linyante, the capital of the Makololo, on the Chobe, on the 23rd of May 1853, being cordially received by Sekeletu and his people. His first object was to seek for some healthy high land in which to plant a station. Ascending the Zambezi, he,

however, found no place free from the tsetse fly, and therefore resolved to discover a route to the interior from either the west or east coast. To accompany Livingstone twenty-seven men were selected from the various tribes under Sekeletu, partly with a view to open up a trade route between their own country and the coast. The start was made from Linyante on the 11th of November 1853, and, by ascending the Liba, Lake Dilolo was reached on the 20th of February 1854. On the 4th of April the Kwango was crossed, and on the 31st of May the town of Loanda was entered, Livingstone, however, being all but dead from fever, semi-starvation and dysentery. From Loanda Livingstone sent his astronomical observations to Sir Thomas Maclear at the Cape, and an account of his journey to the Royal Geographical Society, which in May 1855 awarded him its patron's medal. Loanda was left on the 20th of September 1854, but Livingstone lingered long about the Portuguese settlements. Making a slight détour to the north to Kabango, the party reached Lake Dilolo on the 13th of June 1855. Here Livingstone made a careful study of the hydrography of the country. He "now for the first time apprehended the true form of the river systems and the continent," and the conclusions he came to have been essentially confirmed by subsequent observations. The return journey from Lake Dilolo was by the same route as that by which the party came, Linyante being reached in the beginning of September.

For Livingstone's purposes the route to the west was unavailable, and he decided to follow the Zambezi to its mouth. With a numerous following, he left Linyante on the 8th of November 1855. A fortnight afterwards he discovered the famous "Victoria" falls of the Zambezi. He had already formed a true idea of the configuration of the continent as a great hollow or basin-shaped plateau, surrounded by a ring of mountains. Livingstone reached the Portuguese settlement of Tete on the 2nd of March 1856, in a very emaciated condition. Here he left his men and proceeded to Quilimane, where he arrived on the 20th of May, thus having completed in two years

and six months one of the most remarkable and fruitful journeys on record. The results in geography and in natural science in all its departments were abundant and accurate; his observations necessitated a reconstruction of the map of Central Africa. When Livingstone began his work in Africa the map was virtually a blank from Kuruman to Timbuktu, and nothing but envy or ignorance can throw any doubt on the originality of his discoveries.

On the 12th of December he arrived in England, after an absence of sixteen years, and met everywhere the welcome of a hero. He told his story in his *Missionary Travels and Researches in South Africa* (1857) with straightforward simplicity, and with no effort after literary style, and no apparent consciousness that he had done anything extraordinary. Its publication brought what he would have considered a competency had he felt himself at liberty to settle down for life. In 1857 he severed his connexion with the London Missionary Society, with whom, however, he always remained on the best of terms, and in February 1858 he accepted the appointment of "Her Majesty's consul at Quilimane for the eastern coast and the independent districts in the interior, and commander of an expedition for exploring eastern and central Africa." The Zambezi expedition, of which Livingstone thus became commander, sailed from Liverpool in H.M.S. "Pearl" on the 10th of March 1858, and reached the mouth of the Zambezi on the 14th of May. The party, which included Dr (afterwards Sir) John Kirk and Livingstone's brother Charles, ascended the river from the Kongone mouth in a steam launch, the "Ma-Robert"; reaching Tete on the 8th of September. The remainder of the year was devoted to an examination of the river above Tete, and especially the Kebrabasa rapids. Most of the year 1859 was spent in the exploration of the river Shiré and Lake Nyasa, which was discovered in September; and during a great part of the year 1860 Livingstone was engaged in fulfilling his promise to take such of the Makololo home as cared to go. In January of next year arrived Bishop C. F.

Mackenzie and a party of missionaries sent out by the Universities Mission to establish a station on the upper Shiré.

After exploring the river Rovuma for 30 m. in his new vessel the "Pioneer," Livingstone and the missionaries proceeded up the Shiré to Chibisa's; there they found the slave trade rampant. On the 15th of July Livingstone, accompanied by several native carriers, started to show the bishop the country. Several bands of slaves whom they met were liberated, and after seeing the missionary party settled in the highlands to the south of Lake Chilwa (Shirwa) Livingstone spent from August to November in exploring Lake Nyasa. While the boat sailed up the west side of the lake to near the north end, the explorer marched along the shore. He returned more resolved than ever to do his utmost to rouse the civilized world to put down the desolating slave-trade. On the 30th of January 1862, at the Zambezi mouth, Livingstone welcomed his wife and the ladies of the mission, with whom were the sections of the "Lady Nyassa," a river steamer which Livingstone had had built at his own expense. When the mission ladies reached the mouth of the Ruo tributary of the Shiré, they were stunned to hear of the death of the bishop and one of his companions. This was a sad blow to Livingstone, seeming to have rendered all his efforts to establish a mission futile. A still greater loss to him was that of his wife at Shupanga, on the 27th of April 1862.

The "Lady Nyassa" was taken to the Rovuma. Up this river Livingstone managed to steam 156 m., but farther progress was arrested by rocks. Returning to the Zambezi in the beginning of 1863, he found that the desolation caused by the slave trade was more horrible and widespread than ever. It was clear that the Portuguese officials were themselves at the bottom of the traffic. Kirk and Charles Livingstone being compelled to return to England on account of their health, the doctor resolved once more to visit the lake, and proceeded some distance up the west side and then north-west as far as the watershed that separates the Loangwa from the rivers that run into

the lake. Meanwhile a letter was received from Earl Russell recalling the expedition by the end of the year. In the end of April 1864 Livingstone reached Zanzibar in the "Lady Nyassa," and on the 23rd of July Livingstone arrived in England. He was naturally disappointed with the comparative failure of this expedition. Still the geographical results, though not in extent to be compared to those of his first and his final expeditions, were of high importance, as were those in various departments of science, and he had unknowingly laid the foundations of the British protectorate of Nyasaland. Details will be found in his *Narrative of an Expedition to the Zambesi and its Tributaries*, published in 1865.

By Sir Roderick Murchison and his other staunch friends Livingstone was as warmly welcomed as ever. When Murchison proposed to him that he should go out again, although he seems to have had a desire to spend the remainder of his days at home, the prospect was too tempting to be rejected. He was appointed British consul to Central Africa without a salary, and government contributed only £500 to the expedition. The chief help came from private friends. During the latter part of the expedition government granted him £1000, but that, when he learned of it, was devoted to his great undertaking. The Geographical Society contributed £500. The two main objects of the expedition were the suppression of slavery by means of civilizing influences, and the ascertainment of the watershed in the region between Nyasa and Tanganyika. At first Livingstone thought the Nile problem had been all but solved by Speke, Baker and Burton, but the idea grew upon him that the Nile sources must be sought farther south, and his last journey became in the end a forlorn hope in search of the "fountains" of Herodotus. Leaving England in the middle of August 1865, via Bombay, Livingstone arrived at Zanzibar on the 28th of January 1866. He was landed at the mouth of the Rovuma on the 22nd of March, and started for the interior on the 4th of April. His company consisted of thirteen sepoys, ten Johanna men, nine African boys from Nasik school, Bombay, and four boys

from the Shiré region, besides camels, buffaloes, mules and donkeys. This imposing outfit soon melted away to four or five boys. Rounding the south end of Lake Nyasa, Livingstone struck in a north-north-west direction for the south end of Lake Tanganyika, over country much of which had not previously been explored. The Loangwa was crossed on the 15th of December 1866. On Christmas day Livingstone lost his four goats, a loss which he felt very keenly, and the medicine chest was stolen in January 1867. Fever came upon him, and for a time was his almost constant companion; this, with other serious ailments which subsequently attacked him, and which he had no medicine to counteract, told on even his iron frame. The Chambezi was crossed on the 28th of January, and the south end of Tanganyika reached on the 31st of March. Here, much to his vexation, he got into the company of Arab slave dealers (among them being Tippoo-Tib) by whom his movements were hampered; but he succeeded in reaching Lake Mweru (Nov. 1867). After visiting Lake Mofwa and the Lualaba, which he believed was the upper part of the Nile, he, on the 18th of July 1868, discovered Lake Bangweulu. Proceeding up the west coast of Tanganyika, he reached Ujiji on the 14th of March 1869, “a ruckle of bones.” Livingstone recrossed Tanganyika in July, and passed through the country of the Manyema, but baffled partly by the natives, partly by the slave hunters, and partly by his long illnesses it was not till the 29th of March 1871 that he succeeded in reaching the Lualaba, at the town of Nyangwe, where he stayed four months, vainly trying to get a canoe to take him across. It was here that a party of Arab slavers, without warning or provocation, assembled one day when the market was busiest and commenced shooting the women, hundreds being killed or drowned in trying to escape. Livingstone had “the impression that he was in hell,” but was helpless, though his “first impulse was to pistol the murderers.” The account of this scene which he sent home roused indignation in England to such a degree as to lead to determined and to a considerable extent successful efforts to get the sultan of Zanzibar to suppress the trade. In sickened disgust the weary traveller made his way

back to Ujiji, which he reached on the 13th of October. Five days after his arrival in Ujiji he was inspired with new life by the timely arrival of H. M. Stanley, the richly laden almoner of Mr Gordon Bennett, of the *New York Herald*. With Stanley Livingstone explored the north end of Tanganyika, and proved conclusively that the Rusizi runs into and not out of it. In the end of the year the two started eastward for Unyamwezi, where Stanley provided Livingstone with an ample supply of goods, and bade him farewell. Stanley left on the 15th of March 1872, and after Livingstone had waited wearily in Unyamwezi for five months, a troop of fifty-seven men and boys arrived, good and faithful fellows on the whole, selected by Stanley himself. Thus attended, he started on the 15th of August for Lake Bangweulu, proceeding along the east side of Tanganyika. His old enemy dysentery soon found him out. In January 1873 the party got among the endless spongy jungle on the east of Lake Bangweulu, Livingstone's object being to go round by the south and away west to find the "fountains." The doctor got worse and worse, and in the middle of April he had unwillingly to submit to be carried in a rude litter. On the 29th of April Chitambo's village on the Lulimala, in Ilala, on the south shore of the lake, was reached. The last entry in the journal is on the 27th of April: "Knocked up quite, and remain—recover—sent to buy milch goats. We are on the banks of the Molilamo." On the 30th of April he with difficulty wound up his watch, and early on the morning of the 1st of May the boys found "the great master," as they called him, kneeling by the side of his bed, dead. His faithful men preserved the body in the sun as well as they could, and, wrapping it carefully up, carried it and all his papers, instruments and other things across Africa to Zanzibar. It was borne to England with all honour, and on the 18th of April 1874, was deposited in Westminster Abbey. His faithfully kept journals during these seven years' wanderings were published under the title of the *Last Journals of David Livingstone in Central Africa*, in 1874, edited by his old friend the Rev. Horace Waller. In Old Chitambo's the time and place of his death are

commemorated by a permanent monument, which replaced in 1902 the tree on which his native followers had recorded the event.

In spite of his sufferings and the many compulsory delays, Livingstone's discoveries during these last years were both extensive and of prime importance as leading to a solution of African hydrography. No single African explorer has ever done so much for African geography as Livingstone during his thirty years' work. His travels covered one-third of the continent, extending from the Cape to near the equator, and from the Atlantic to the Indian Ocean. Livingstone was no hurried traveller; he did his journeying leisurely, carefully observing and recording all that was worthy of note, with rare geographical instinct and the eye of a trained scientific observer, studying the ways of the people, eating their food, living in their huts, and sympathizing with their joys and sorrows. In all the countries through which he travelled his memory is cherished by the native tribes who, almost without exception, treated Livingstone as a superior being; his treatment of them was always tender, gentle and gentlemanly. By the Arab slavers whom he opposed he was also greatly admired, and was by them styled "the very great doctor." "In the annals of exploration of the Dark Continent," wrote Stanley many years after the death of the missionary explorer, "we look in vain among other nationalities for a name such as Livingstone's. He stands pre-eminent above all; he unites in himself all the best qualities of other explorers. ... Britain ... excelled herself even when she produced the strong and perseverant Scotchman, Livingstone." But the direct gains to geography and science are perhaps not the greatest results of Livingstone's journeys. His example and his death acted like an inspiration, filling Africa with an army of explorers and missionaries, and raising in Europe so powerful a feeling against the slave trade that through him it may be considered as having received its deathblow. Personally Livingstone was a pure and tender-hearted man, full of humanity and sympathy, simple-

minded as a child. The motto of his life was the advice he gave to some school children in Scotland—"Fear God, and work hard."

See, besides his own narratives and W. G. Blaikie's *Life* (1880), the publications of the London Missionary Society from 1840, the *Journal and Proceedings of the Royal Geographical Society*, the despatches to the Foreign Office sent home by Livingstone during his last two expeditions, and Stanley's *Autobiography* (1909) and *How I Found Livingstone* (1872).

(J. S. K.)

LIVINGSTONE MOUNTAINS, a band of highlands in German East Africa, forming the eastern border of the rift-valley of Lake Nyasa, at the northern end of the lake. In parts these highlands, known also under their native name of Kinga, present rather the character of a plateau than of a true mountain range, but the latter name may be justified by the fact that they form a comparatively narrow belt of country, which falls considerably to the east as well as to the west. The northern end is well marked in 8° 50′ S. by an escarpment falling to the Ruaha valley, which is regarded as a north-eastern branch of the main rift-valley. Southwards the Livingstone range terminates in the deep valley of the Ruhuhu in 10° 30′ S., the first decided break in the highlands that is reached from the north, on the east coast of Nyasa. Geologically the range is formed on the side of the lake by a zone of gneiss running in a series of ridges and valleys generally parallel to its axis. The ridge nearest the lake (which in Mount Jamimbi or Chamembe, 9° 41′ S., rises to an absolute height of 7870 ft., or 6200 ft. above Nyasa) falls almost sheer to the water, the same steep slope being

continued beneath the surface. Towards the south the range appears to have a width of some 20 m. only, but northwards it widens out to about 40 m., though broken here by the depression, drained towards the Ruaha, of Buanyi, on the south side of which is the highest known summit of the range (9600 ft.). North and east of Buanyi, as in the eastern half of the range generally, table-topped mountains occur, composed above of horizontally bedded quartzites, sandstones and conglomerates. The uplands are generally clothed in rich grass, forest occurring principally in the hollows, while the slopes towards the lake are covered with poor scrub. Native settlements are scattered over the whole range, and German mission stations have been established at Bulongwa and Mtandala, a little north of the north end of Nyasa. The climate is here healthy, and night frosts occur in the cold season. European crops are raised with success. At the foot of the mountains on Lake Nyasa are the ports of Wiedhafen, at the mouth of the Ruhuhu, and Old Langenburg, at the north-east corner of the lake.

(E. He.)

LIVIUS ANDRONĪCUS (*c.* 284-204 B.C.), the founder of Roman epic poetry and drama. His name, in which the Greek Ἀνδρόνικος is combined with the gentile name of one of the great Roman houses, while indicative of his own position as a manumitted slave, is also significant of the influences by which Roman literature was fostered, viz. the culture of men who were either Greeks or "semi-Graeci" by birth and education, and the protection and favour bestowed upon them by the more enlightened members of the Roman aristocracy. He is supposed to have been a native of

Tarentum, and to have been brought, while still a boy, after the capture of that town in 272, as a slave to Rome. He lived in the household of a member of the gens Livia, probably M. Livius Salinator. He determined the course which Roman literature followed for more than a century after his time. The imitation of Greek comedy, tragedy and epic poetry, which produced great results in the hands of Naevius, Plautus, Ennius and their successors, received its first impulse from him. To judge, however, from the insignificant remains of his writings, and from the opinions of Cicero and Horace, he can have had no pretension either to original genius or to artistic accomplishment. His real claim to distinction was that he was the first great schoolmaster of the Roman people. We learn from Suetonius that, like Ennius after him, he obtained his living by teaching Greek and Latin; and it was probably as a school-book, rather than as a work of literary pretension, that his translation of the *Odyssey* into Latin Saturnian verse was executed. This work was still used in schools in the time of Horace (*Epp.* ii. 1., 69), and, although faultily executed, satisfied a real want by introducing the Romans to a knowledge of Greek. Such knowledge became essential to men in a high position as a means of intercourse with Greeks, while Greek literature stimulated the minds of leading Romans. Moreover, southern Italy and Sicily afforded many opportunities for witnessing representations of Greek comedies and tragedies. The Romans and Italians had an indigenous drama of their own, known by the name of *Satura*, which prepared them for the reception of the more regular Greek drama. The distinction between this *Satura* and the plays of Euripides or Menander was that it had no regular plot. This the Latin drama first received from Livius Andronicus; but it did so at the cost of its originality. In 240, the year after the end of the first Punic War, he produced at the ludi Romani a translation of a Greek play (it is uncertain whether a comedy or tragedy or both), and this representation marks the beginning of Roman literature (Livy vii. 2). Livius himself took part in his plays, and in order to spare his voice he introduced the custom of having the solos (*cantica*) sung by a boy, while he himself represented the

action of the song by dumb show. In his translation he discarded the native Saturnian metre, and adopted the iambic, trochaic and cretic metres, to which Latin more easily adapted itself than either to the hexameter or to the lyrical measures of a later time. He continued to produce plays for more than thirty years after this time. The titles of his tragedies—*Achilles*, *Aegisthus*, *Equus Trojanus*, *Hermione*, *Tereus*—are all suggestive of subjects which were treated by the later tragic poets of Rome. In the year 207, when he must have been of a great age, he was appointed to compose a hymn of thanksgiving, sung by maidens, for the victory of the Metaurus and an intercessory hymn to the Aventine Juno. As a further tribute of national recognition the "college" or "gild" of poets and actors was granted a place of meeting in the temple of Minerva on the Aventine.

See fragments in L. Müller, *Livi Andronici et Cn. Naevi Fabularum Reliquiae* (1885); also J. Wordsworth, *Fragments and Specimens of Early Latin* (1874); Mommsen, *Hist. of Rome*, bk. iii. ch. 14.

LIVNO, a town of Bosnia, situated on the eastern side of the fertile plain of Livno, at the foot of Mount Krug (6581 ft.). Pop. about 5000. The Dalmatian border is 7 m. W. Livno had a trade in grain, live-stock and silver filigree-work up to 1904, when a fire swept away more than 500 of the old Turkish houses, together with the Roman citadel. Remains prove that Livno occupies the site of a Roman settlement, the name of which is uncertain. The Roman Catholic convent of Gurici is 6 m. S.

LIVONIA, or LIVLAND (Russian, *Liflandia*), one of the three Baltic provinces of Russia, bounded W. by the Gulf of Riga, N. by Esthonia, E. by the governments of St Petersburg, Pskov and Vitebsk, and S. by Courland. A group of islands (1110 sq. m.) at the entrance of the Gulf of Riga, of which Oesel, Mohn, Runo and Paternoster are the largest, belong to this government. It covers an area of 18,160 sq. m., but of this the part of Lake Peipus which belongs to it occupies 1090. Its surface is diversified by several plateaus, those of Haanhof and of the Livonian Aa having an average elevation of 400 to 700 ft., while several summits reach 800 to 1000 ft. or more. The edges of the plateaus are gapped by deep valleys; the hilly tract between the Dvina and its tributary the Livonian Aa has received, from its picturesque narrow valleys, thick forests and numerous lakes, the name of "Livonian Switzerland." The plateau of Odenpäh, drained by tributaries of the Embach river, which flows for 93 m. from Lake Virz-yärvi into Lake Peipus, occupies an area of 2830 sq. m., and has an average elevation of 500 ft. More than a thousand lakes are scattered over Livonia, of which that of Virz-yärvi, having a surface of 106 sq. m. (115 ft. above sea-level), is the largest. Marshes and peat-bogs occupy one-tenth of the province. Of the numerous rivers, the Dvina, which flows for 90 m. along its frontier, the Pernau, Salis, Livonian Aa and Embach are navigable.

The Silurian formation which covers Esthonia, appears in the northern part of Livonia, the remainder of the province consisting of Devonian strata. The whole is overlaid with glacial deposits, sometimes 400 ft. thick. The

typical bottom moraine, with erratics from Finland, extends all over the country. Glacial furrows, striae and elongated troughs are met with everywhere, running mostly from north-west to south-east, as well as *åsar* or *eskérs*, which have the same direction. Sand-dunes cover large tracts on the shores of the Baltic. No traces of marine deposits are found higher than 100 or 150 ft. above the present sea-level. The soil is not very fertile. Forests cover about two-fifths of the surface. The climate is rather severe. The mean temperatures are 43° F. at Riga (winter 23°, summer 63°) and 40° at Yuriev. The winds are very variable; the average number of rainy and snowy days is 146 at Riga (rainfall 24.1 in.). Fogs are not uncommon.

The population of Livonia, which was 621,600 in 1816, reached 1,000,876 in 1870, and 1,295,231 in 1897, of whom 43.4% were Letts, 39.9% Ehsts, 7.6% Germans, 5.4% Russians, 2% Jews and 1.2% Poles. The estimated pop. in 1906 was 1,411,000. The Livs, who formerly extended east into the government of Vitebsk, have nearly all passed away. Their native language, of Finnish origin, is rapidly disappearing, their present language being a Lettish patois. In 1846 a grammar and dictionary of it were made with difficulty from the mouths of old people. The Ehsts, who resemble the Finns of Tavastland, have maintained their ethnic features, their customs, national traditions, songs and poetry, and their harmonious language. There is a marked revival of national feeling, favoured by “Young Esthonia.” The prevailing religion is the Lutheran (79.8%); 14.3% belong to the Orthodox Greek Church; of the Russians, however, a considerable proportion are Raskolniks (Nonconformists); the Roman Catholics amount to 2.3%, and the Jews to 2%. The Russian civil code was introduced in the Baltic provinces in 1835, and the use of Russian, instead of German, in official correspondence and in law courts was ordered in 1867, but not generally brought into practice.

Nearly all the soil belongs to the nobility, the extent of the peasants’ estates being only 15% of the entire area of the government. Serfdom was

abolished in 1819, but the peasants remained under the jurisdiction of their landlords. The class of peasant proprietors being restricted to a small number of wealthy peasants, the bulk have remained tenants at will; they are very miserable, and about one-fourth of them are continually wandering in search of work. From time to time the emigration takes the shape of a mass movement, which the government stops by forcible measures. The average size of the landed estates is 9500 to 11,000 acres, far above the general average for Russia. Agriculture has reached a high degree of perfection on the estates of the landlords. The principal crops are rye, oats, barley, flax and potatoes, with some wheat, hemp and buckwheat. Dairy-farming and gardening are on the increase. Fishing in Lake Peipus gives occupation to nearly 100,000 persons, and is also carried on in the Gulf of Riga and in the rivers. Woollen, cloth, cotton and flax mills, steam flour and saw mills, distilleries and breweries, machinery works, paper mills, furniture, tobacco, soap, candle and hardware works are among the chief industrial establishments. Livonia carries on a large export trade, especially through Riga and Pernau, in petroleum, wool, oilcake, flax, linseed, hemp, grain, timber and wooden wares; the Dvina is the chief channel for this trade.

Education stands on a much higher level than elsewhere in Russia, no less than 87% of the children receiving regular instruction. The higher educational institutions include Yuriev (Dorpat) University, Riga polytechnic and a high school for the clergy.

The government is divided into nine districts, the chief towns of which, with their populations in 1897, are: Riga, capital of the government (282,943); Arensburg, in the island of Oesel (4621); Yuriev or Dorpat (42,421); Fellin (7659); Pernau (12,856); Walk (10,139); Wenden (6327); Werro (4154); and Wolmar (5124). The capital of the government is Riga.

Coins of the time of Alexander the Great, found on the island of Oesel, show that the coasts of the Baltic were at an early period in commercial

relation with the civilized world. The chronicle of Nestor mentions as inhabitants of the Baltic coast the Chudes, the Livs, the Narova, Letgola, Semigallians and Korś. It was probably about the 9th century that the Chudes became tributary to the Varangian-Russian states. As they reacquired their independence, Yaroslav I. undertook in 1030 a campaign against them, and founded Yuriev (Dorpat). The Germans first penetrated into Livonia in the 11th century, and in 1158 several Lübeck and Visby merchants landed at the mouth of the Dvina. In 1186 the emissaries of the archbishop of Bremen began to preach Christianity among the Ehsts and Letts, and in 1201 the bishop of Livonia established his residence at Riga. In 1202 or 1204 Innocent III. recognized the order of Brothers of the Sword, the residence of its grand master being at Wenden; and the order, spreading the Christian religion by the sword among the natives, carried on from that time a series of uninterrupted wars against the Russian republics and Lithuania, as well as a struggle against the archbishop of Riga, Riga having become a centre for trade, intermediate between the Hanseatic towns and those of Novgorod, Pskov and Polotsk. The first active interference of Lithuania in the affairs of Livonia took place immediately after the great outbreak of the peasants on Oesel; Olgierd then devastated all southern Livonia. The order, having purchased the Danish part of Esthonia, in 1347, began a war against the bishop of Riga, as well as against Lithuania, Poland and Russia. The wars against those powers were terminated respectively in 1435, 1466 and 1483. About the end of the 15th century the master of the order, Plettenberg, acquired a position of great importance, and in 1527 he was recognized as a prince of the empire by Charles V. On the other hand, the authority of the bishops of Riga was soon completely destroyed (1566). The war of the order with Ivan IV. of Russia in 1558 led to a division of Livonia, its northern part, Dorpat included, being taken by Russia, and the southern part falling under the dominion of Poland. From that time (1561) Livonia formed a subject of dispute between Poland and Russia, the latter only formally abdicating its rights to the country in 1582. In 1621 it was the theatre of a war between

Poland and Sweden, and was conquered by the latter power, enjoying thus for twenty-five years a milder rule. In 1654, and again at the beginning of the 18th century, it became the theatre of war between Poland, Russia and Sweden, and was finally conquered by Russia. The official concession was confirmed by the treaty of Nystad in 1721.

See E. Seraphim, *Geschichte Liv-, Esth-, und Kurlands* (2nd ed., Revel, 1897-1904) and *Geschichte von Livland* (Gotha, 1905, &c.).

(P. A. K.; J. T. Be.)

LIVY [Titus Livius] (59 B.C.-A.D. 17), Roman historian, was born at Patavium (Padua). The ancient connexion between his native city and Rome helped to turn his attention to the study which became the work of his life. For Padua claimed, like Rome, a Trojan origin, and Livy is careful to place its founder Antenor side by side with Aeneas. A more real bond of union was found in the dangers to which both had been exposed from the assaults of the Celts (Livy x. 2), and Padua must have been drawn to Rome as the conqueror of her hereditary foes. Moreover, at the time of Livy's birth, Padua had long been in possession of the full Roman franchise, and the historian's family name may have been taken by one of his ancestors out of compliment to the great Livian gens at Rome, whose connexion with Cisalpine Gaul is well-established (Suet. *Tib.* 3), and by one of whom his family may have been enfranchized.

Livy's easy independent life at Rome, and his aristocratic leanings in politics seem to show that he was the son of well-born and opulent parents;

he was certainly well educated, being widely read in Greek literature, and a student both of rhetoric and philosophy. We have also evidence in his writings that he had prepared himself for his great work by researches into the history of his native town. His youth and early manhood, spent perhaps chiefly at Padua, were cast in stormy times, and the impression which they left upon his mind was ineffaceable. In the Civil War his personal sympathies were with Pompey and the republican party (Tac. *Ann.* iv. 34); but far more lasting in its effects was his experience of the licence, anarchy and confusion of these dark days. The rule of Augustus he seems to have accepted as a necessity, but he could not, like Horace and Virgil, welcome it as inaugurating a new and glorious era. He writes of it with despondency as a degenerate and declining age; and, instead of triumphant prophecies of world-wide rule, such as we find in Horace, Livy contents himself with pointing out the dangers which already threatened Rome, and exhorting his contemporaries to learn, in good time, the lessons which the past history of the state had to teach.

It was probably about the time of the battle of Actium that Livy established himself in Rome, and there he seems chiefly to have resided until his retirement to Padua shortly before his death. We have no evidence that he travelled much, though he must have paid at least one visit to Campania (xxxviii. 56), and he never, so far as we know, took any part in political life. Nor, though he enjoyed the personal friendship and patronage of Augustus (Tac. *Ann.* iv. 34) and stimulated the historical zeal of the future emperor Claudius (Suet. *Claud.* xli.), can we detect in him anything of the courtier. There is not in his history a trace of that rather gross adulation in which even Virgil does not disdain to indulge. His republican sympathies were freely expressed, and as freely pardoned by Augustus. We must imagine him devoted to the great task which he had set himself to perform, with a mind free from all disturbing cares, and in the enjoyment of all the facilities for study afforded by the Rome of Augustus, with its liberal encouragement of

letters, its newly-founded libraries and its brilliant literary circles. As his work went on, the fame which he had never coveted came to him in ample measure. He is said to have declared in one volume of his history that he had already won glory enough, and the younger Pliny (*Epist.* ii. 3) relates that a Spaniard came all the way from Gades merely to see him, and, this accomplished, at once returned home satisfied. The accession of Tiberius (A.D. 14) materially altered for the worse the prospects of literature in Rome, and Livy retired to Padua, where he died. He had at least one son (Quintil. x. 1. 39), who also was possibly an author (Pliny, *Nat. Hist.* i. 5. 6), and a daughter married to a certain L. Magius, a rhetorician of no great merit (Seneca, *Controv.* x. 29. 2). Nothing further is known of his personal history.

Analysis of the History.—For us the interest of Livy's life centres in the work to which the greater part of it was devoted, the history of Rome from its foundation down to the death of Drusus (9 B.C.). Its proper title was *Ab urbe condita libri* (also called *historiae* and *annales*). Various indications point to the period from 27 to 20 B.C., as that during which the first decade was written. In the first book (19. 3) the emperor is called Augustus, a title which he assumed early in 27 B.C., and in ix. 18 the omission of all reference to the restoration, in 20 B.C., of the standards taken at Carrhae seems to justify the inference that the passage was written before that date. In the epitome of book lix. there is a reference to a law of Augustus which was passed in 18 B.C. The books dealing with the civil wars must have been written during Augustus's lifetime, as they were read by him (Tac. *Ann.* iv. 34), while there is some evidence that the last part, from book cxxi. onwards, was published after his death A.D. 14.

The work begins with the landing of Aeneas in Italy, and closes with the death of Drusus, 9 B.C., though it is possible that the author intended to continue it as far as the death of Augustus. The division into decades is certainly not due to the author himself, and is first heard of at the end of the 5th century; on the other hand, the division into *libri* or *volumina* seems to

be original. That the books were grouped and possibly published in sets is rendered probable both by the prefaces which introduce new divisions of the work (vi. 1, xxi. 1, xxxi. 1) and by the description in one MS. of books cix.-cxvi. as "bellorum civilium libri octo." Such arrangement and publication in parts were, moreover, common with ancient authors, and in the case of a lengthy work almost a necessity.

Of the 142 *libri* composing the history, the first 15 carry us down to the eve of the great struggle with Carthage, a period, as Livy reckons it, of 488 years (xxxi. 1); 15 more (xvi-xxx.) cover the 63 years of the two great Punic wars. With the close of book xlv. we reach the conquest of Macedonia in 167 B.C. Book lviii. described the tribunate of Tiberius Gracchus, 133 B.C. In book lxxxix. we have the dictatorship of Sulla (81 B.C.), in ciii. Caesar's first consulship (59 B.C.), in cix.-cxvi. the civil wars to the death of Caesar (44 B.C.), in cxxiv. the defeat of Brutus and Cassius at Philippi, in cxxxiii. and cxxxiv. the battle of Actium and the accession of Augustus. The remaining eight books give the history of the first twenty years of Augustus's reign.

Of this vast work only a small portion has come down to modern times; only thirty-five books are now extant (i.-x., xxi.-xlv.), and of these xli. and xliii. are incomplete. The lost books seem to have disappeared between the 7th century and the revival of letters in the 15th—a fact sufficiently accounted for by the difficulty of transmitting so voluminous a work in times when printing was unknown, for the story that Pope Gregory I. burnt all the copies of Livy he could lay his hands on rests on no good evidence. Only one important fragment has since been recovered—the portion of book xci. discovered in the Vatican in 1772, and edited by Niebuhr in 1820. Very much no doubt of the substance of the lost books has been preserved both by such writers as Plutarch and Dio Cassius, and by epitomizers like Florus and Eutropius. But our knowledge of their contents is chiefly derived from the so-called *periochae* or epitomes, of which we have fortunately a nearly complete series, the epitomes of books cxxxvi. and cxxxvii. being the only

ones missing.[1] These epitomes have been ascribed without sufficient reason to Florus (2nd century); but, though they are probably of even later date, and are disappointingly meagre, they may be taken as giving, so far as they go, a fairly authentic description of the original. They have been expanded with great ingenuity and learning by Freinsheim in Drakenborch's edition of Livy.[2] The *Prodigio* of Julius Obsequens and the list of consuls in the *Chronica* of Cassiodorus are taken directly from Livy, and to that extent reproduce the contents of the lost books. It is probable that Obsequens, Cassiodorus and the compiler of the epitomes did not use the original work but an abridgment.

Historical Standpoint.—If we are to form a correct judgment on the merits of Livy's history, we must, above all things, bear in mind what his aim was in writing it, and this he has told us himself in the celebrated preface. He set himself the task of recording the history of the Roman people, "the first in the world," from the beginning. The task was a great one, and the fame to be won by it uncertain, yet it would be something to have made the attempt, and the labour itself would bring a welcome relief from the contemplation of present evils; for his readers, too, this record will, he says, be full of instruction; they are invited to note especially the moral lessons taught by the story of Rome, to observe how Rome rose to greatness by the simple virtues and unselfish devotion of her citizens, and how on the decay of these qualities followed degeneracy and decline.

He does not, therefore, write, as Polybius wrote, for students of history. With Polybius the greatness of Rome is a phenomenon to be critically studied and scientifically explained; the rise of Rome forms an important chapter in universal history, and must be dealt with, not as an isolated fact, but in connexion with the general march of events in the civilized world. Still less has Livy anything in common with the naïve anxiety of Dionysius of Halicarnassus to make it clear to his fellow Greeks that the irresistible

people who had mastered them was in origin, in race and in language Hellenic like themselves.

Livy writes as a Roman, to raise a monument worthy of the greatness of Rome, and to keep alive, for the guidance and the warning of Romans, the recollection alike of the virtues which had made Rome great and of the vices which had threatened her with destruction. In so writing he was in close agreement with the traditions of Roman literature, as well as with the conception of the nature and objects of history current in his time. To a large extent Roman literature grew out of pride in Rome, for, though her earliest authors took the form and often the language of their writings from Greece, it was the greatness of Rome that inspired the best of them, and it was from the annals of Rome that their themes were taken. And this is naturally true in an especial sense of the Roman historians; the long list of annalists begins at the moment when the great struggle with Carthage had for the first time brought Rome into direct connexion with the historic peoples of the ancient world, and when Romans themselves awoke to the importance of the part reserved for Rome to play in universal history. To write the annals of Rome became at once a task worthy of the best of her citizens. Though other forms of literature might be thought unbecoming to the dignity of a free-born citizen, this was never so with history. On the contrary, men of high rank and tried statesmanship were on that very account thought all the fitter to write the chronicles of the state they had served. And history in Rome never lost either its social prestige or its intimate and exclusive connexion with the fortunes of the Roman people. It was well enough for Greeks to busy themselves with the manners, institutions and deeds of the “peoples outside.” The Roman historians, from Fabius Pictor to Tacitus, cared for none of these things. This exclusive interest in Rome was doubtless encouraged by the peculiar characteristics of the history of the state. The Roman annalist had not, like the Greek, to deal with the varying fortunes and separate doings of a number of petty communities, but with the continuous life of a single city.

Nor was his attention drawn from the main lines of political history by the claims of art, literature and philosophy, for just as the tie which bound Romans together was that of citizenship, not of race or culture, so the history of Rome is that of the state, of its political constitution, its wars and conquests, its military and administrative system.

Livy's own circumstances were all such as to render these views natural to him. He began to write at a time when, after a century of disturbance, the mass of men had been contented to purchase peace at the price of liberty. The present was at least inglorious, the future doubtful, and many turned gladly to the past for consolation. This retrospective tendency was favourably regarded by the government. It was the policy of Augustus to obliterate all traces of recent revolution, and to connect the new imperial régime as closely as possible with the ancient traditions and institutions of Rome and Italy. The *Aeneid* of Virgil, the *Fasti* of Ovid, suited well with his own restoration of the ancient temples, his revival of such ancient ceremonies as the Ludi Saeculares, his efforts to check the un-Roman luxury of the day, and his jealous regard for the purity of the Roman stock. And, though we are nowhere told that Livy undertook his history at the emperor's suggestion, it is certain that Augustus read parts of it with pleasure, and even honoured the writer with his assistance and friendship.

Livy was deeply penetrated with a sense of the greatness of Rome. From first to last its majesty and high destiny are present to his mind. Aeneas is led to Italy by the Fates that he may be the founder of Rome. Romulus after his ascension declares it to be the will of heaven that Rome should be mistress of the world; and Hannibal marches into Italy, that he may "set free the world" from Roman rule. But, if this ever-present consciousness often gives dignity and elevation to his narrative, it is also responsible for some of its defects. It leads him occasionally into exaggerated language (*e.g.* xxii. 33, "nullius usquam terrarum rei cura Romanos effugiebat"), or into such mis-statements as his explanation of the course taken by the Romans in renewing

war with Carthage, that “it seemed more suitable to the dignity of the Roman people.” Often his jealousy for the honour of Rome makes him unfair and one-sided. In all her wars not only success but justice is with Rome. To the same general attitude is also due the omission by Livy of all that has no direct bearing on the fortunes of the Roman people. “I have resolved,” he says (xxxix. 48), “only to touch on foreign affairs so far as they are bound up with those of Rome.” As the result, we get from Livy very defective accounts even of the Italic peoples most closely connected with Rome. Of the past history and the internal condition of the more distant nations she encountered he tells us little or nothing, even when he found such details carefully given by Polybius.

Scarcely less strong than his interest in Rome is his interest in the moral lessons which her history seemed to him so well qualified to teach. This didactic view of history was a prevalent one in antiquity, and it was confirmed no doubt by those rhetorical studies which in Rome as in Greece formed the chief part of education, and which taught men to look on history as little more than a storehouse of illustrations and themes for declamation. But it suited also the practical bent of the Roman mind, with its comparative indifference to abstract speculation or purely scientific research. It is in the highest degree natural that Livy should have sought for the secret of the rise of Rome, not in any large historical causes, but in the moral qualities of the people themselves, and that he should have looked upon the contemplation of these as the best remedy for the vices of his own degenerate days. He dwells with delight on the unselfish patriotism of the old heroes of the republic. In those times children obeyed their parents, the gods were still sincerely worshipped, poverty was no disgrace, sceptical philosophies and foreign fashions in religion and in daily life were unknown. But this ethical interest is closely bound up with his Roman sympathies. His moral ideal is no abstract one, and the virtues he praises are those which in his view made up the truly Roman type of character. The prominence thus given to the

moral aspects of the history tends to obscure in some degree the true relations and real importance of the events narrated, but it does so in Livy to a far less extent than in some other writers. He is much too skilful an artist either to resolve his history into a mere bundle of examples, or to overload it, as Tacitus is sometimes inclined to do, with reflections and axioms. The moral he wishes to enforce is usually either conveyed by the story itself, with the aid perhaps of a single sentence of comment, or put as a speech into the mouth of one of his characters (*e.g.* xxiii. 49; the devotion of Decius, viii. 10, cf. vii. 40; and the speech of Camillus, v. 54); and what little his narrative thus loses in accuracy it gains in dignity and warmth of feeling. In his portraits of the typical Romans of the old style, such as Q. Fabius Maximus, in his descriptions of the unshaken firmness and calm courage shown by the fathers of the state in the hour of trial, Livy is at his best; and he is so largely in virtue of his genuine appreciation of character as a powerful force in the affairs of men.

This enthusiasm for Rome and for Roman virtues is, moreover, saved from degenerating into gross partiality by the genuine candour of Livy's mind and by his wide sympathies with every thing great and good. Seneca (*Suasoriae* vi. 22) and Quintilian (x. 1. 101) bear witness to his impartiality. Thus, Hasdrubal's devotion and valour at the battle on the Metaurus are described in terms of eloquent praise; and even in Hannibal, the lifelong enemy of Rome, he frankly recognizes the great qualities that balanced his faults. Nor, though his sympathies are unmistakably with the aristocratic party, does he scruple to censure the pride, cruelty and selfishness which too often marked their conduct (ii. 54; the speech of Canuleius, iv. 3; of Sextius and Licinius, vi. 36); and, though he feels acutely that the times are out of joint, and has apparently little hope of the future, he still believes in justice and goodness. He is often righteously indignant, but never satirical, and such a pessimism as that of Tacitus and Juvenal is wholly foreign to his nature.

Though he studied and even wrote on philosophy (Seneca, *Ep.* 100. 9), Livy is by no means a philosophic historian. We learn indeed from incidental notices that he inclined to Stoicism and disliked the Epicurean system. With the scepticism that despised the gods (x. 40) and denied that they meddled with the affairs of men (xliii. 13) he has no sympathy. The immortal gods are everywhere the same; they govern the world (xxxvii. 45) and reveal the future to men by signs and wonders (xliii. 13), but only a debased superstition will look for their hand in every petty incident, or abandon itself to an indiscriminate belief in the portents and miracles in which popular credulity delights. The ancient state religion of Rome, with its temples, priests and auguries, he not only reverences as an integral part of the Roman constitution, with a sympathy which grows as he studies it, but, like Varro, and in true Stoic fashion, he regards it as a valuable instrument of government (i. 19. 21), indispensable in a well-ordered community. As distinctly Stoical is the doctrine of a fate to which even the gods must yield (ix. 4), which disposes the plans of men (i. 42) and blinds their minds (v. 37), yet leaves their wills free (xxxvii. 45).

But we find no trace in Livy of any systematic application of philosophy to the facts of history. He is as innocent of the leading ideas which shaped the work of Polybius as he is of the cheap theorizing which wearies us in the pages of Dionysius. The events are graphically, if not always accurately, described; but of the larger causes at work in producing them, of their subtle action and reaction upon each other, and of the general conditions amid which the history worked itself out, he takes no thought at all. Nor has Livy much acquaintance with either the theory or the practice of politics. He exhibits, it is true, political sympathies and antipathies. He is on the whole for the nobles and against the commons; and, though the unfavourable colours in which he paints the leaders of the latter are possibly reflected from the authorities he followed, it is evident that he despised and disliked the multitude. Of monarchy he speaks with a genuine Roman hatred, and we

know that in the last days of the republic his sympathies were wholly with those who strove in vain to save it. He betrays, too, an insight into the evils which were destined finally to undermine the imposing fabric of Roman empire. The decline of the free population, the spread of slavery (vi. 12, vii. 25), the universal craving for wealth (iii. 26), the employment of foreign mercenaries (xxv. 33), the corruption of Roman race and Roman manners by mixture with aliens (xxxix. 3), are all noticed in tones of solemn warning. But his retired life had given him no wide experience of men and things. It is not surprising, therefore, to find that he fails altogether to present a clear and coherent picture of the history and working of the Roman constitution, or that his handling of intricate questions of policy is weak and inadequate.

Sources.—If from the general aim and spirit of Livy's history we pass to consider his method of workmanship, we are struck at once by the very different measure of success attained by him in the two great departments of an historian's labour. He is a consummate artist, but an unskilled and often careless investigator and critic. The materials which lay ready to his hand may be roughly classed under two heads: (1) the original evidence of monuments, inscriptions, &c., (2) the written tradition as found in the works of previous authors. It is on the second of these two kinds of evidence that Livy almost exclusively relies. Yet that even for the very early times a certain amount of original evidence still existed is proved by the use which was made of it by Dionysius, who mentions at least three important inscriptions, two dating from the regal period and one from the first years of the republic (iv. 26, iv. 58, x. 32). We know from Livy himself (iv. 20) that the breastplate dedicated by Aulus Cornelius Cossus (428 B.C.) was to be seen in his own day in the temple of Jupiter Feretrius, nor is there any reason to suppose that the *libri lintei*, quoted by Licinius Macer, were not extant when Livy wrote. For more recent times the materials were plentiful, and a rich field of research lay open to the student in the long series of laws, decrees of the senate, and official registers, reaching back, as it probably did,

The consequence of this indifference to original research and patient verification might have been less serious had the written tradition on which Livy preferred to rely been more trustworthy. But neither the materials out of which it was composed, nor the manner in which it had been put together, were such as to make it a safe guide. It was indeed represented by a long line of respectable names. The majority of the Roman annalists were men of high birth and education, with a long experience of affairs, and their defects did not arise from seclusion of life or ignorance of letters. It is rather in the conditions under which they wrote and in the rules and traditions of their craft that the causes of their shortcomings must be sought.

The Annalists.

It was not until the 6th century from the foundation of the city that historical writing began in Rome. The father of Roman history, Q. Fabius Pictor, a patrician and a senator, can scarcely have published his annals before the close of the Second Punic War, but these annals covered the whole period from the arrival of Evander in Italy down at least to the battle by Lake Trasimene (217 B.C.). Out of what materials, then, did he put together his account of the earlier history? Recent criticism has succeeded in answering this question with some degree of certainty. A careful examination of the fragments of Fabius (see H. Peter, *Historicorum Romanorum Relliquiae*, Leipzig, 1870; and C. W. Nitzsch, *Röm. Annalistik*, Berlin, 1873) reveals in the first place a marked difference between the kingly period and that which followed the establishment of the republic. The history of the former stretches back into the regions of pure mythology. It is little more than a collection of fables told with scarcely any attempt at criticism, and with no more regard to chronological sequence than was necessary to make the tale run smoothly or to fill up such gaps as that between the flight of Aeneas from Troy and the supposed year of the foundation of Rome. But from its very commencement the history of the republic wears a different aspect. The mass of floating tradition, which had come down from early days, with its tales of border raids and forays, of

valiant chiefs and deeds of patriotism, is now rudely fitted into a framework of a wholly different kind. This framework consists of short notices of important events, wars, prodigies, consecration of temples, &c., all recorded with extreme brevity, precisely dated, and couched in a somewhat archaic style. They were taken probably from one or more of the state registers, such as the annals of the pontiffs, or those kept by the aediles in the temple of Ceres. This bare official outline of the past history of his city was by Fabius filled in from the rich store of tradition that lay ready to his hand. The manner and spirit in which he effected this combination were no doubt wholly uncritical. Usually he seems to have transferred both annalistic notices and popular traditions to his pages much in the shape in which he found them. But he unquestionably gave undue prominence to the tales of the prowess and glory of the Fabii, and probably also allowed his own strong aristocratic sympathies to colour his version of the early political controversies. This fault of partiality was, according to Polybius, a conspicuous blot in Fabius's account of his own times, which was, we are told, full and in the main accurate, and, like the earlier portions, consisted of official annalistic notices, supplemented, however, not from tradition, but from his own experience and from contemporary sources. But even here Polybius charges him with favouring Rome at the expense of Carthage, and with the undue exaltation of the great head of his house, Q. Fabius Cunctator.

Nevertheless the comparative fidelity with which Fabius seems to have reproduced his materials might have made his annals the starting point of a critical history. But unfortunately intelligent criticism was exactly what they never received. It is true that in some respects a decided advance upon Fabius was made by subsequent annalists. M. Porcius Cato (234-149 B.C.) widened the scope of Roman history so as to include that of the chief Italian cities, and made the first serious attempt to settle the chronology. In his history of the Punic wars Caelius Antipater (*c.* 130 B.C.) added fresh material, drawn probably from the works of the Sicilian Greek Silenus, while Licinius Macer (70 B.C.) distinguished himself by the use he made of the ancient "linen

books." No doubt, too, the later annalists, at any rate from Caelius Antipater onwards, improved upon Fabius in treatment and style. But in more essential points we can discern no progress. One annalist after another quietly adopted the established tradition, as it had been left by his predecessors, without any serious alterations of its main outlines. Of independent research and critical analysis we find no trace, and the general agreement upon main facts is to be attributed simply to the regularity with which each writer copied the one before him. But, had the later annalists contented themselves with simply reproducing the earlier ones, we should at least have had the old tradition before us in a simple and tolerably genuine form. As it was, while they slavishly clung to its substance, they succeeded, as a rule, in destroying all traces of its original form and colouring. L. Calpurnius Piso, tribune in 149 B.C. and consul in 133 B.C., prided himself on reducing the old legends to the level of common sense, and importing into them valuable moral lessons for his own generation. By Caelius Antipater the methods of rhetoric were first applied to history, a disastrous precedent enough. He inserted speeches, enlivened his pages with chance tales, and aimed, as Cicero tells us, at not merely narrating facts but also at beautifying them. His successors carried still farther the practice of dressing up the rather bald chronicles of earlier writers with all the ornaments of rhetoric. The old traditions were altered, almost beyond the possibility of recognition, by exaggerations, interpolations and additions. Fresh incidents were inserted, new motives suggested and speeches composed in order to infuse the required life and freshness into these dry bones of history. At the same time the political bias of the writers, and the political ideas of their day were allowed, in some cases perhaps half unconsciously, to affect their representations of past events. Annalists of the Gracchan age imported into the early struggles of patricians and plebeians the economic controversies of their own day, and painted the first tribunes in the colours of the two Gracchi or of Saturninus. In the next generation they dexterously forced the venerable records of the early republic to pronounce in favour of the ascendancy of the senate, as established by Sulla. To political

bias was added family pride, for the gratification of which the archives of the great houses, the funeral panegyrics, or the imagination of the writer himself supplied an ample store of doubtful material. Pedigrees were invented, imaginary consulships and fictitious triumphs inserted, and family traditions and family honours were formally incorporated with the history of the state.

Things were not much better even where the annalists were dealing with recent or contemporary events. Here, indeed, their materials were naturally fuller and more trustworthy, and less room was left for fanciful decoration and capricious alteration of the facts. But their methods are in the main unchanged. What they found written they copied; the gaps they supplied, where personal experience failed, by imagination. No better proof of this can be given than a comparison of the annalist's version of history with that of Polybius. In the fourth and fifth decades of Livy the two appear side by side, and the contrast between them is striking. Polybius, for instance, gives the number of the slain at Cynoscephalae as 8000; the annalists raise it as high as 40,000 (Livy xxxiii. 10). In another case (xxxii. 6) Valerius Antias, the chief of sinners in this respect, inserts a decisive Roman victory over the Macedonians, in which 12,000 of the latter were slain and 2200 taken prisoner, an achievement recorded by no other authority.

Such was the written tradition on which Livy mainly relied. We have next to examine the manner in which he used it, and here we are met at the outset by the difficulty of determining with exactness what authorities he is following at any one time; for of the importance of full and accurate references he has no idea, and often for chapters together he gives us no clue at all. More often still he contents himself with such vague phrases as "they say," "the story goes," "some think," or speaks in general terms of "ancient writers" or "my authorities." Even where he mentions a writer by name, it is frequently clear that the writer named is not the one whose lead he is following at the moment, but that he is noticed incidentally as differing from Livy's guide for the time being on some point of detail (compare the

references to Piso in the first decade, i. 55, ii. 32, &c.). It is very rarely that Livy explicitly tells us whom he has selected as his chief source (*e.g.* Fabius xxii. 7; Polybius xxxiii. 10). By a careful analysis, however, of those portions of his work which admit of a comparison with the text of his acknowledged authorities (*e.g.* fourth and fifth decades, see H. Nissen, *Untersuchungen*, Berlin, 1863), and elsewhere by comparing his version with the known fragments of the various annalists, and with what we are told of their style and method of treatment, we are able to form a general idea of his plan of procedure. As to the first decade, it is generally agreed that in the first and second books, at any rate, he follows such older and simpler writers as Fabius Pictor and Calpurnius Piso (the only ones whom he there refers to by name), to whom, so far as the first book is concerned, Niebuhr (*Lectures*, p. 33) would add the poet Ennius. With the close of the second book or the opening of the third we come upon the first traces of the use of later authors. Valerius Antias[3] is first quoted in iii. 5, and signs of his handiwork are visible here and there throughout the rest of the decade (vii. 36, ix. 27, x. 3-5). In the fourth book the principal authority is apparently Licinius Macer, and for the period following the sack of Rome by the Gauls Q. Claudius Quadrigarius, whose annals began at this point in the history. We have besides a single reference (vii. 3) to the antiquarian Cincius, and two (iv. 23, x. 9) to Q. Aelius Tubero, one of the last in the list of annalists. Passing to the third decade, we find ourselves at once confronted by a question which has been long and fully discussed—the relation between Livy and Polybius. Did Livy use Polybius at all, and, if so, to what extent?

Polybius.

It is conceded on all hands that Livy in this decade makes considerable use of other authorities than Polybius (*e.g.* Fabius xxii. 7; Caelius Antipater xxi. 38, 46, 47, xxii. 31, &c.), that he only once mentions Polybius (xxx. 45), and that, if he used him, he did so to a much less extent than in the fourth and fifth decades, and in a very different manner. It is also agreed that we can detect in Livy's account of the Hannibalic war two distinct elements, derived originally, the one from a

Roman, the other from a non-Roman source. But from these generally accepted premises two opposite conclusions have been drawn. On the one hand, it is maintained (*e.g.* by Lachmann, C. Peter, H. Peter, *Hist. Rom. Relliq.*) that those parts of Livy's narrative which point to a non-Roman authority (*e.g.* Hannibal's movements prior to his invasion of Italy) are taken by Livy directly from Polybius, with occasional reference of course to other writers, and with the omission (as in the later decades) of all matters uninteresting to Livy or his Roman readers, and the addition of rhetorical touches and occasional comments. It is urged that Livy, who in the fourth and fifth decades shows himself so sensible of the great merits of Polybius, is not likely to have ignored him in the third, and that his more limited use of him in the latter case is fully accounted for by the closer connexion of the history with Rome and Roman affairs, and the comparative excellence of the available Roman authorities, and, lastly, that the points of agreement with Polybius, not only in matter but in expression, can only be explained on the theory that Livy is directly following the great Greek historian. On the other hand, it is maintained (especially by Schwegler, Nitzsch, and K. Böttcher) that the extent and nature of Livy's agreement with Polybius in this part of his work point rather to the use by both of a common original authority. It is argued that Livy's mode of using his authorities is tolerably uniform, and that his mode of using Polybius in particular is known with certainty from the later decades. Consequently the theory that he used Polybius in the third decade requires us to assume that in this one instance he departed widely, and without sufficient reason, from his usual course of procedure. Moreover, even in the passages where the agreement with Polybius is most apparent, there are so many discrepancies and divergencies in detail, and so many unaccountable omissions and additions, as to render it inconceivable that he had the text of Polybius before him. But all these are made intelligible if we suppose Livy to have been here following directly or indirectly the same original sources that were used by Polybius. The earliest of these original sources was probably Silenus, with whom may possibly be placed, for books xxi. xxii., Fabius

Pictor. The latter Livy certainly used directly for some parts of the decade. The former he almost as certainly knew only at second hand, the intermediate authority being probably Caelius Antipater. This writer, who confined himself to a history of the Second Punic War, in seven books, is expressly referred to by Livy eleven times in the third decade; and in other passages where his name is not mentioned Livy can be shown to have followed him (*e.g.* xxii. 5, 49, 50, 51, xxiv. 9). In the latter books of the decade his chief authority is possibly Valerius Antias.

In the fourth and fifth decades the question of Livy's authorities presents no great difficulties, and the conclusions arrived at by Nissen in his masterly *Untersuchungen* have met with general acceptance. These may be shortly stated as follows. In the portions of the history which deal with Greece and the East, Livy follows Polybius, and these portions are easily distinguishable from the rest by their superior clearness, accuracy and fulness. On the other hand, for the history of Italy and western Europe he falls back on Roman annalists, especially, it seems, on Claudius Quadrigarius and Valerius Antias—a most unfortunate choice—and from them too he takes the annalistic mould into which his matter is cast.

Critical method.

Livy's general method of using these authorities was certainly not such as would be deemed satisfactory in a modern historian. He is indeed free from the grosser faults of deliberate injustice and falsification, and he resists that temptation to invent, to which "the minds of authors are only too much inclined" (xxii. 7). Nor is he unconscious of the necessity for some kind of criticism. He distinguishes between rumour and the precise statements of recognized authorities (cf. xxi. 46, v. 21, vii. 6). The latter he reproduced in the main faithfully, but with a certain exercise of discretion. Where they disagreed, he calls attention to the fact, occasionally pronouncing in favour of one version rather than another (ii. 41, xxi. 46) though often on no adequate grounds, or attempting to reconcile and explain discrepancies (vi. 12, 38). Where he detects or suspects the

insertion of fabulous matter he has no scruple in saying so. Gross exaggerations, such as those in which Valerius Antias indulged, he roundly denounces, and with equal plainness of speech he condemns the family vanity which had so constantly corrupted and distorted the truth. “I suppose,” he says (viii. 40), “that the record and memorial of these matters hath been depraved and corrupted by these funeral orations of praises, ... while every house and family draweth to it the honour and renown of noble exploits, martial feats and dignities by any untruth and lie, so it be colourable.” The legendary character of the earliest traditions he frankly admits. “Such things as are reported either before or at the foundation of the city, more beautiful and set out with poets’ fables than grounded upon pure and faithful records, I mean neither to aver nor disprove” (*Praef.*); and of the whole history previous to the sack of Rome by the Gauls (390 B.C.) he writes that it was obscure “both in regard of exceeding antiquity, and also for that in those days there were very few writings and monuments, the only faithful safeguard and true remembrancers of deeds past; and, besides, whatsoever was registered in the commentaries of the priests and in other public or private records, the same for the most part, when the city was burned, perished withal.” Further than this, however, Livy’s criticism does not go. Where his written authorities are not palpably inconsistent with each other or with probability he accepts and transcribes their record without any further inquiry, nor does he ever attempt to get behind this record in order to discover the original evidence on which it rested. His acceptance in any particular case of the version given by an annalist by no means implies that he has by careful inquiry satisfied himself of its truth. At the most it only presupposes a comparison with other versions, equally second-hand, but either less generally accepted or less in harmony with his own views of the situation; and in many cases the reasons he gives for his preference of one account over another are eminently unscientific. Livy’s history, then, rests on no foundation of original research or even of careful verification. It is a compilation, and even as such it leaves much to be desired. For we cannot credit Livy with having made such a preliminary

survey of his authorities as would enable him to determine their relations to each other, and fuse their various narratives into a consistent whole. It is clear, on the contrary, that his circle of authorities for any one decade was a comparatively small one, that of these he selected one, and transcribed him with the necessary embellishments and other slight modifications until impelled by various reasons to drop him. He then, without warning, takes up another, whom he follows in the same way. The result is a curious mosaic, in which pieces of all colours and dates are found side by side, and in which even the great artistic skill displayed throughout fails to conceal the lack of internal unity. Thus many of Livy's inconsistencies are due to his having pieced together two versions, each of which gave a differently coloured account of the same event. Mommsen (*Rom. Forschungen*, ii.) has clearly shown that this is what has happened in his relation of the legal proceedings against the elder Africanus in book xxxviii.; and in the story of the first secession, as he tells it, the older version which represented it as due to political and the later which explained it by economical grievances are found side by side. Similarly a change from one authority to another leads him not unfrequently to copy from the latter statements inconsistent with those he took from the former, to forget what he has previously said, or to treat as known a fact which has not been mentioned before (cf. ii. 1, xxxiv. 6, and Weissenborn's *Introduction*, p. 37). In other cases where the same event has been placed by different annalists in different years, or where their versions of it varied, it reappears in Livy as two events. Thus the four campaigns against the Volsci (ii. 17 seq.) are, as Schwegler (*R.G.* i. 13) rightly says, simply variations of one single expedition. Other instances of such "doublettes" are the two single combats described in xxiii. 46 and xxv. 18, and the two battles at Baecula in Spain (xxvii. 18 and xxviii. 13). Without doubt, too, much of the chronological confusion observable throughout Livy is due to the fact that he follows now one now another authority, heedless of their differences on this head. Thus he vacillates between the Catonian and Varronian reckoning of the

years of the city, and between the chronologies of Polybius and the Roman annalists.

To these defects in his method must be added the fact that he does not always succeed even in accurately reproducing the authority he is for the time following. In the case of Polybius, for instance, he allows himself great freedom in omitting what strikes him as irrelevant, or tedious, or uninteresting to his Roman readers, a process in which much valuable matter disappears. In other cases his desire to give a vividness and point to what he doubtless considered the rather bald and dry style of Polybius leads him into absurdities and inaccuracies. Thus by the treaty with Antiochus (188 B.C.) it was provided that the Greek communities of Asia Minor "shall settle their mutual differences by arbitration," and so far Livy correctly transcribes Polybius, but he adds with a rhetorical flourish, "or, if both parties prefer it, by war" (xxxviii. 38). Elsewhere his blunders are apparently due to haste, or ignorance or sheer carelessness; thus, for instance, when Polybius speaks of the Aetolians assembling at their capital Thermon, Livy (xxxiii. 35) not only substitutes Thermopylae but gratuitously informs his readers that here the Pylaean assemblies were held. Thanks partly to carelessness, partly to mistranslation, he makes sad havoc (xxxv. 5 seq.) of Polybius's account of the battle of Cynoscephalae. Finally, Livy cannot be altogether acquitted on the charge of having here and there modified Polybius in the interests of Rome.

Style.—Serious as these defects in Livy's method appear if viewed in the light of modern criticism, it is probable that they were easily pardoned, if indeed they were ever discovered, by his contemporaries. For it was on the artistic rather than on the critical side of history that stress was almost universally laid in antiquity, and the thing that above all others was expected from the historian was not so much a scientific investigation and accurate exposition of the truth, as its skilful presentation in such a form as would charm and interest the reader. Tried by this standard, Livy deservedly won and held a place in the very first rank. Asinius Pollio sneered at his Patavinity, and

the emperor Caligula denounced him as verbose, but with these exceptions the opinion of antiquity was unanimous in pronouncing him a consummate literary workman. The classical purity of his style, the eloquence of his speeches, the skill with which he depicted the play of emotion, and his masterly portraiture of great men, are all in turn warmly commended, and in our own day we question if any ancient historian is either more readable or more widely read. It is true that for us his artistic treatment of history is not without its drawbacks. The more trained historical sense of modern times is continually shocked by the obvious untruth of his colouring, especially in the earlier parts of his history, by the palpable unreality of many of the speeches, and by the naïveté with which he omits everything, however important, which he thinks will weary his readers. But in spite of all this we are forced to acknowledge that, as a master of what we may perhaps call "narrative history," he has no superior in antiquity; for, inferior as he is to Thucydides, to Polybius, and even to Tacitus in philosophic power and breadth of view, he is at least their equal in the skill with which he tells his story. He is indeed the prince of chroniclers, and in this respect not unworthy to be classed even with Herodotus (Quintilian, x. 1. 101). Nor is anything more remarkable than the way in which Livy's fine taste and sense of proportion, his true poetic feeling and genuine enthusiasm, saved him from the besetting faults of the mode of treatment which he adopted. The most superficial comparison of his account of the earliest days of Rome with that given by Dionysius shows from what depths of tediousness he was preserved by these qualities. Instead of the wearisome prolixity and the misplaced pedantry which make the latter almost unreadable, we find the old tales briefly and simply told. Their primitive beauty is not marred by any attempt to force them into an historical mould, or disguised beneath an accumulation of the insipid inventions of later times. At the same time they are not treated as mere tales for children, for Livy never forgets the dignity that belongs to them as the prelude to the great epic of Rome, and as consecrated by the faith of generations. Perhaps an even stronger proof of the skill which enabled Livy to avoid dangers which were

fatal to weaker men is to be found in his speeches. We cannot indeed regard them, with the ancients, as the best part of his history, for the majority of them are obviously unhistorical, and nearly all savour somewhat too much of the rhetorical schools to be perfectly agreeable to modern taste. To appreciate them we must take them for what they are, pieces of declamation, intended either to enliven the course of the narrative, to place vividly before the reader the feelings and aims of the chief actors, or more frequently still to enforce some lesson which the author himself has at heart. The substance, no doubt, of many of them Livy took from his authorities, but their form is his own, and, in throwing into them all his own eloquence and enthusiasm, he not only acted in conformity with the established traditions of his art, but found a welcome outlet for feelings and ideas which the fall of the republic had deprived of all other means of expression. To us, therefore, they are valuable not only for their eloquence, but still more as giving us our clearest insight into Livy's own sentiments, his lofty sense of the greatness of Rome, his appreciation of Roman courage and firmness, and his reverence for the simple virtues of older times. But, freely as Livy uses this privilege of speechmaking, his correct taste keeps his rhetoric within reasonable limits. With a very few exceptions the speeches are dignified in tone, full of life and have at least a dramatic propriety, while of such incongruous and laboured absurdities as the speech which Dionysius puts into the mouth of Romulus, after the rape of the Sabine women, there are no instances in Livy.

Speeches.

But, if our estimate of the merits of his speeches is moderated by doubts as to his right to introduce them at all, no such scruples interfere with our admiration for the skill with which he has drawn the portraits of the great men who figure in his pages. We may indeed doubt whether in all cases they are drawn with perfect accuracy and impartiality, but of their life-like vigour and clearness there can be no question. With Livy this portrait-painting was a labour of love. "To all great men," says Seneca, "he gave their due ungrudgingly," but he is at his best in dealing with those who, like Q. Fabius

Maximus, “the Delayer,” were in his eyes the most perfect types of the true Roman.

The general effect of Livy’s narrative is no doubt a little spoilt by the awkward arrangement, adopted from his authorities, which obliges him to group the events by years, and thus to disturb their natural relations and continuity. As the result his history has the appearance of being rather a series of brilliant pictures loosely strung together than a coherent narrative. But it is impossible not to admire the copious variety of thought and language, and the evenly flowing style which carried him safely through the dreariest periods of his history; and still more remarkable is the dramatic power he displays when some great crisis or thrilling episode stirs his blood, such as the sack of Rome by the Gauls, the battle by the Metaurus and the death of Hasdrubal.

In style and language Livy represents the best period of Latin prose writing. He has passed far beyond the bald and meagre diction of the early chroniclers. In his hands Latin acquired a flexibility and a richness of vocabulary unknown to it before. If he writes with less finish and a less perfect rhythm than his favourite model Cicero, he excels him in the varied structure of his periods, and their adaptation to the subject-matter. It is true that here and there the “creamy richness” of his style becomes verbosity, and that he occasionally draws too freely on his inexhaustible store of epithets, metaphors and turns of speech; but these faults, which did not escape the censure even of friendly critics like Quintilian, are comparatively rare in the extant parts of his work. From the tendency to use a poetic diction in prose, which was so conspicuous a fault in the writers of the silver age, Livy is not wholly free. In his earlier books especially there are numerous phrases and sentences which have an unmistakably poetic ring, recalling sometimes Ennius and more often his contemporary Virgil. But in Livy this poetic element is kept within bounds, and serves only to give warmth and vividness to the narrative. Similarly, though the influence of rhetoric upon his language, as well as upon his general treatment, is clearly perceptible, he has not the perverted love of antithesis,

paradox and laboured word-painting which offends us in Tacitus; and, in spite of the Venetian richness of his colouring, and the copious flow of his words, he is on the whole wonderfully natural and simple.

These merits, not less than the high tone and easy grace of his narrative and the eloquence of his speeches, gave Livy a hold on Roman readers such as only Cicero and Virgil besides him ever obtained. His history formed the groundwork of nearly all that was afterwards written on the subject. Plutarch, writers on rhetoric like the elder Seneca, moralists like Valerius Maximus, went to Livy for their stock examples. Florus and Eutropius abridged him; Orosius extracted from him his proofs of the sinful blindness of the pagan world; and in every school Livy was firmly established as a text-book for the Roman youth.

Text.—The received text of the extant thirty-five books of Livy is taken from different sources, and no one of our MSS. contains them all. The MSS. of the first decade, some thirty in number, are with one exception derived, more or less directly, from a single archetype, viz., the recension made in the 4th century by the two Nicomachi, Flavianus and Dexter, and by Victorianus. This is proved in the case of the older MSS. by written subscriptions to that effect, and in the case of the rest by internal evidence. Of all these descendants of the Nicomachean recension, the oldest is the Codex Parisinus of the 10th century, and the best the Codex Mediceus or Florentinus of the 11th. An independent value attaches to the ancient palimpsest of Verona, of which the first complete account was given by Mommsen in *Abhandl. der preussischen Akad. der Wissenschaften* (1868). It contains the third, fourth, fifth and fragments of the sixth book, and, according to Mommsen, whose conclusions are accepted by Madvig (*Emend. Livianae*, 2nd ed., 1877, p. 37), it is derived, not from the Nicomachean recension, but from an older archetype common to both.

For the third decade our chief authority is the Codex Puteanus, an uncial MS. of the 5th century, now at Paris. For the fourth we have two leading MSS.

—Codex Bambergensis, 11th century, and the slightly older Codex Moguntinus, now lost and only known through the Mainz edition of 1518-1519. What remains of the fifth decade depends on the 5th century Laurishamensis or Vindobonensis from the monastery of Lorsch, edited at Basel in 1531.

A bibliography of the various editions of Livy, or of all that has been written upon him, cannot be attempted here. The following may be consulted for purposes of reference; W. Engelmann, *Scriptores Latini* (8th ed., by E. Preuss, 1882); J. E. B. Mayor, *Bibliographical Clue to Latin Literature* (1875); Teuffel-Schwabe, *History of Roman Literature* (Eng. trans.), 256, 257; M. Schanz, *Geschichte der römischen Litteratur*. ii. 1 (2nd ed., 1899). The best editions of the complete text are those of W. Weissenborn (1858-1862, containing an introductory essay on Livy's life and writings; new edition by M. Müller, 1902), and J. N. Madvig and J. L. Ussing (1863-1873). The only English translation of any merit is by Philemon Holland (1600). (H. F. P.; X.)

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1 For the fragments of an epitome discovered at Oxyrhynchus see J. S. Reid in *Classical Review* (July, 1904); E. Kornemann, *Die neue Livius-Epitome aus Oxyrhynchus*, with text and commentary (Leipzig, 1904); C. H. Moore, "The Oxyrhynchus Epitome of Livy in relation to Obsequens and Cassiodorus," in *American Journal of Philology* (1904), 241.

2 The various rumours once current of complete copies of Livy in Constantinople, Chios and elsewhere, are noticed by B. G. Niebuhr, *Lectures on the History of Rome from the first Punic War* (ed. L. Schmitz, 1844), i. 65.

3 For Livy's debt to Valerius Antias, see A. A. Howard in *Harvard Studies in Classical Philology*, xvii. (1906), pp. 161 sqq.

LIZARD (Lat. *lacerta*[1]), a name originally referred only to the small European species of four-legged reptiles, but now applied to a whole order (*Lacertilia*), which is represented by numerous species in all temperate and tropical regions. Lizards are reptiles which have a transverse external anal opening (instead of a longitudinal slit as in Crocodilians and tortoises) and which have the right and left halves of the mandibles connected by a sutural symphysis. The majority are distinguished from snakes by the possession of two pairs of limbs, of external ear-openings and movable eyelids, but since in not a few of the burrowing, snake-shaped lizards these characters give way entirely, it is well-nigh impossible to find a diagnosis which should be absolutely sufficient for the distinction between lizards and snakes. In such doubtful cases a number of characters have to be resorted to, and, while each of these may fail when taken singly, their combination decides the question. It is certain that the snakes have been evolved as a specialized branch from some Lacertilian stock, and that both "orders" are intimately related, but it is significant that it is only through the degraded members of the lizards that recent representatives of the two great groups seem to run into each other. Such critical characters are:—

	Lizards.	Snakes.
Limbs	2 pairs, 1 or 0.	0 or vestigial hind-limbs.
Ear-opening	Usually present.	Always absent.
Eyelids	Mostly movable.	No movable lids.
Tongue	Often not retractile.	Always bifid and retractile into itself.
Teeth	Pleuro- or acrodont, not anchylosed.	Acrodont, anchylosed.
Mandibles	Mostly firmly united suturally.	Never with suture, mostly ligamentous.
Columella cranii	Mostly present.	Absent.
	Mostly with bony arches across the temporal region.	No bony arches.
	Osteoderms common.	No osteoderms.

The lizards and snakes are the two dominant reptilian orders which are still on the increase in species, though certainly not in size. As a moderate estimate, the number of recent species of lizards is about 1700. As a group

they are cosmopolitan, their northern limit approaching that of the permanently frozen subsoil, while in the southern hemisphere the southern point of Patagonia forms the farthest limit. As we approach the tropics, the variety of forms and the number of individuals increase, the most specialized and developed forms, and also the most degraded, being found in the tropics. In the temperate regions they hibernate. The majority live on broken ground, with or without much vegetation; many are arboreal and many are true desert animals, while a few are more or less aquatic; one, the leguan of the Galapagos, *Amblyrhynchus*, even enters the sea. Some, like the majority of the geckos, are nocturnal. In adaptation to these varied surroundings they exhibit great variety in shape, size and structure. Most of these modifications are restricted to the skin, limbs, tail or tongue. Most lizards live on animal food, varying from tiny insects and worms to lizards, snakes, birds and mammals, while others prefer a mixed or an entirely vegetable diet. Accordingly, the teeth and the whole digestive tract are modified. But swiftness, the apparatus necessary for climbing, running and digging, the mechanism of the tongue, the muscles of the jaws (hence modifications of the cranial arches) stand also in correlation with the kind of food and with the way in which it has to be procured. Generally the teeth are conical or pointed, more rarely blunt, grooved or serrated. They are inserted either on the inner side of the margin of the jaws (*pleurodonta*) or on the edge of the bones (*acrodonta*). The tongue is generally beset with more or less scaly or velvety papillae and has always a well-marked posterior margin, while the anterior portion may or may not be more or less retractile into the posterior part.

In many lizards the muscles of the segments of the tail are so loosely connected and the vertebrae are so weak that the tail easily breaks off. The severed part retains its muscular irritability for a short time, wriggling as if it were a living creature. A lizard thus mutilated does not seem to be much affected, and the lost part is slowly reproduced. This faculty is of advantage to those lizards which lack other means of escape when pursued by some other animal, which is satisfied with capturing the detached member.

The motions of most lizards are executed with great but not enduring rapidity. With the exception of the chameleon, all drag their body over the ground, the limbs being wide apart, turned outwards and relatively to the bulk of the body generally weak. But the limbs show with regard to development great variation, and an uninterrupted transition from the most perfect condition of two pairs with five separate clawed toes to their total disappearance; yet even limbless lizards retain bony vestiges beneath the skin. The motions of these limbless lizards are similar to those of snakes, which they resemble in their elongate body.

The eggs are elliptical in shape, both poles being equal, and are covered with a shell which may be thin and leathery or hard and calcareous. The number of eggs laid is small in comparison with other reptiles, rarely exceeding a score, and some like the anolids and the geckos deposit only one or two. The parents leave the eggs to hatch where they are deposited, in sand or in mould. Many lizards, however, retain the eggs in the oviducts until the embryo is fully developed; these species then bring forth living young and are called ovo-viviparous by purists. Some lizards possess a considerable amount of intelligence; they play with each other, become very tame, and act deliberately according to circumstances. As a rule the Iguanids and Varans are as bright as the Agamas are dull. Many have the power of changing colour, a faculty which they share only with various frogs, toads and fishes. Lizards are not poisonous, with the single exception of *Heloderma*.

The Lacertilia, or lizards in the wider sense, fall easily into three natural groups: geckos (*q.v.*), chameleons (*q.v.*) and lizards.

I. Suborder, GECKONES. Pleurodont lizards with well-developed limbs; without temporal bony arches; postthoracic ribs united across the abdomen. Tongue, thick and broad, slightly nicked anteriorly. With few exceptions they have amphicoelous vertebrae, the parietal bones remain separate and they have no eyelids, with very few exceptions.

1. Family, *Geckonidae*.—Amphicoelous; parietals separate; clavicles dilated and with a perforation near the ventral end. Cosmopolitan, although mainly tropical, with about 270 species (see GECKO).

Nearly all geckos are nocturnal and the pupil contracts into a vertical slit, except in a few diurnal kinds, *e.g. Phelsuma* of islands in the Indian Ocean, and *Lygodactylus* of Africa. *Aelurosaurus* of Borneo and Australia, and *Ptenopus* of South Africa, have upper and lower movable eyelids. Whilst the skin is mostly soft on the back, with little granular tubercles, scales (except on the belly) are absent, but they are present in *Homopholis*, in *Geckolepis* of Madagascar, and most fully developed in *Teratoscincus scincus*. This peculiar little inhabitant of the steppes and desert regions of Turkestan and Persia, by rubbing the imbricating scales upon each other, produces a shrill cricket-like noise, whilst sitting at night in front of its hole in the ground. Furthermore it is so thoroughly adapted to running upon the desert sand that its digits are devoid of adhesive lamellae. The same beautiful adaptation to the surroundings exists also in *Ptenopus* (with fringed toes) and *Stenodactylus*, which are likewise deserticolous. *Aeluronyx* of Madagascar and Seychelles has cat-like retractile claws. *Naultinus elegans* of New Zealand is said to be viviparous; the others lay but one rather large egg at a time. Many species have a feeble voice which resembles a repeated click of the tongue, and their name “gecko” is supposed to be an Indian imitation of the sound.

2. Family, *Uroplatidae*.—Amphicoelous; parietals separate; but the nasal bones are fused together, and the clavicles are not dilated. Genus *Uroplates*, with a few species, *e.g. U. fimbriatus* in Madagascar.

3. Family, *Eublepharidae*.—Procoelous; parietals united; eyelids functional; clavicles expanded as in the true geckos which they resemble in other respects. The few genera and species are undoubtedly a heterogeneous assembly, as indicated by their very scattered distribution, but they all agree in their decidedly handsome colour pattern, bands of dark brown to maroon upon a light ground. *Eublepharis*, with one species each in Panama, Mexico, Texas

and California; two in India. *Coleonyx elegans* in forests of Central America and Mexico. *Psilodactylus* in West Africa.

II. Suborder, CHAMAELEONTES. Acrodont, Old World lizards, with laterally compressed body, prehensile tail and well developed limbs with the digits arranged in opposing, grasping bundles of two and three respectively. The chameleons (*q.v.*) have many structural peculiarities.

III. Suborder, LACERTAE. Procoelous vertebrae; ventral portions of the clavicles not dilated; parietal bones fused into one.

The general appearance is too misleading for the classification of the Lacertae. E. D. Cope (*Proc. Ac. Philad.*, 1864, pp. 224 et seq. and *Proc. Amer. Ass.* xix., 1871, p. 236, &c.) therefore relied upon more fundamental characters, notably the presence or absence of osteoderms, the formation of the skull, the teeth and the tongue. G. A. Boulenger (*Ann. Nat. Hist.* 5, xiv., 1884, p. 117, &c.) has further improved upon the then prevailing arrangements, and has elaborated a classification which, used by himself in the three volumes of the catalogue of lizards in the British Museum, is followed in the present article with slight alterations in the order of treatment of the families. In the following diagnoses of the families preference is given to such characters as are most easily ascertained.

The 17 “families” fall into 4 or 5 main groups. Presumably the presence of osteoderms and of complete cranial arches are more archaic than their absence, just as we conclude that limbless forms have been evolved from various groups possessed of fully developed limbs. *Zonuridae* and *Anguidae* assume a central position, with *Agamidae* and *Iguanidae* as two parallel families (not very different from each other) of highest development, one in the Old World, the other in America. *Xenosaurus* seems to be an offshoot intermediate between the *Iguanidae* and the *Anguidae*; a degraded form of latter is perhaps *Aniella* of California, whilst *Heloderma* and *Lanthanotus* are also specialized and isolated offshoots. A second group is formed by the few

American *Xantusiidae*, the numerous American *Tejidae*, and the burrowing, degraded American and African *Amphisbaenidae*. A third group comprises the cosmopolitan *Scincidae*, the African and Malagasy *Gerrhosauridae* which in various features remind us of the *Anguidae*, and the African and Eurasian *Lacertidae* which are the highest members of this group. *Anelytropidae* and perhaps also *Dibamidae* may be degraded Scincoids. The *Varanidae* stand quite alone, in many respects the highest of all lizards, with some, quite superficial, Crocodilian resemblances. Lastly there are the few *Pygopodidae* of the Australian region, with still quite obscure relationship.

Family 1. *Agamidae.*—Acrodont; tongue broad and thick, not protractile; no osteoderms. Old World.

The agamas have always two pairs of well-developed limbs. The teeth are usually differentiated into incisors, canines and molars. The skin is devoid of ossifications, but large and numerous cutaneous spines are often present, especially on the head and on the tail. The family, comprising some 200 species, with about 30 genera, shows great diversity of form; the terrestrial members are mostly flat-bodied, the arboreal more laterally compressed and often with a very long tail. Most of them are insectivorous, but a few are almost entirely vegetable feeders. They are an exclusively Old World family; they are most numerous in Australia (except New Zealand) and the Indian and Malay countries; comparatively few live in Africa (none in Madagascar) and in the countries from Asia Minor to India.

The majority of the ground-agamas, and the most common species of the plains, deserts or rocky districts of Africa and Asia, belong to the genera *Stellio* and *Agama*. Their scales are mixed with larger prominent spines, which in some species are particularly developed on the tail, and disposed in whorls. Nearly all travellers in the north of Africa mention the *Hardhón* of the Arabs (*Agama stellio*), which is extremely common, and has drawn upon itself the hatred of the Mahommedans by its habit of nodding its head, which they interpret as a mockery of their own movements whilst engaged in prayer. In

some of the Grecian islands they are still called *korkordilos*, just as they were in the time of Herodotus. *Uromastix* is one of the largest of ground-agamas, and likewise found in Africa and Asia. The body is uniformly covered with granular scales, whilst the short, strong tail is armed with powerful spines disposed in whorls. The Indian species (*U. hardwicki*) is mainly herbivorous; the African *U. acanthinurus* and *U. spinipes*, the Dab of the Arabs, take mixed food. *Phrynocephalus* is typical of the steppes and deserts of Asia. *Ceratophora* and *Lyriocephalus* scutatus, the latter remarkable for its chameleon-like appearance, are Ceylonese. *Calotes*, peculiar to Indian countries, comprises many species, *e.g. C. ophiomachus*, generally known as the "bloodsucker" on account of the red colour on the head and neck displayed during excitement. *Draco* (see DRAGON) is Indo-Malayan. *Physignathus* is known from Australia to Cochin China.

Of the Australian agamas no other genus is so numerously represented and widely distributed as *Grammatophora*, the species of which grow to a length of from 8 to 18 in. Their scales are generally rough and spinous; but otherwise they possess no strikingly distinguishing peculiarity, unless the loose skin of their throat, which is transversely folded and capable of inflation, be regarded as such. On the other hand, two other Australian agamoids have attained some celebrity by their grotesque appearance, due to the extraordinary development of their integuments. One (fig. 1) is the frilled lizard (*Chlamydosaurus kingi*), which is restricted to Queensland and the north coast, and grows to a length of 3 ft., including the long tapering tail. It is provided with a frill-like fold of the skin round the neck, which, when erected, resembles a broad collar. This lizard when startled rises with the fore-legs off the ground and squats and runs on its hind-legs. The other lizard is one which most appropriately has been called *Moloch horridus*. It is covered with large and small spine-bearing tubercules; the head is small and the tail short. It is sluggish in its movements, and so harmless that its armature and (to a casual observer) repulsive appearance are its sole means of defence. It grows only to a length of 10 in., and is not uncommon in the flats of South and West Australia.

Family 2. *Iguanidae.*—Pleurodont; tongue broad and thick, not protractile; no osteoderms. America, Madagascar and Fiji Islands.

According to the very varied habits, their external appearance varies within wide limits, there being amongst the 300 species, with 50 genera, arboreal, terrestrial, burrowing and semi-aquatic forms, and even one semi-marine kind. All have well-developed limbs. In their general structure the *Iguanidae* closely resemble the *Agamidae*, from which they differ mainly by the pleurodont dentition. Most of them are insectivorous. Some, especially *Anolis* and *Polychrus*, can change colour to a remarkable extent. The family ranges all through the neotropical region, inclusive of the Galapagos and the Antilles, into the southern and western states of North America. Remarkable cases of discontinuous distribution are *Chalarodon* and *Hoplodon* in Madagascar, and *Brachylophus fasciatus* in the Fiji Islands. *Conolophus subcristatus* and *Amblyrhynchus cristatus* inhabit the Galapagos; the former feeds upon cactus and leaves, the latter is semi-marine, diving for the algae which grow below tide-marks. For *Basiliscus* see BASILISK; IGUANA is dealt with under its own heading; allied is *Metopoceros cornutus* of Hayti. *Polychrus*, the "chameleon," and *Liolaemus* are South American; *Ctenosaura* of Central America and Mexico resembles the agamoid *Uromastix*. *Corythophanes* and *Laemanctus*, with only a few species, are rare inhabitants of the tropical forests of Central America and Mexico. *Sauromalus*, *Crotaphytus*, *Callisaurus*, *Holbrookia*, *Uma*, *Uta* are typical Sonoran genera, some ranging from Oregon through Mexico. Allied is *Sceloporus*, with about 34 species, the most characteristic genus of Mexican lizards; only 4 species live in the United States, and only 3 or 4 are found south of the Isthmus of Tehuantepec and are restricted to Central America. The majority are humivagous, while others are truly arboreal, *e.g. S. microlepidotus*, a species which, moreover, has the greatest possible altitudinal range, from the hot country of southern Oaxaca to the upper tree-line of Citlaltepetl, about 13,500 ft. elevation; many species are viviparous. *Phrynosoma*, with about a dozen species, the "horned toads" of California to Texas, and through Mexico. Some of these comical-looking little

creatures are viviparous, others deposit their eggs in the ground. They are well concealed by the colour of their upper parts, which in most cases agrees with the prevailing tone of their surroundings, mostly arid, stony or sandy localities; the large spikes on the head protect them from being swallowed by snakes. The enlarged spiny scales scattered over the back look as if it were sprinkled with the dried husks of seeds. They are entirely insectivorous, bask on the broiling hot sand and then can run fast enough; otherwise they are sluggish, dig themselves into the sand by a peculiar shuffling motion of the fringed edges of their flattened bodies, and when surprised they feign death. The statement, persistently repeated (O. P. Hay, *Proc. U.S. Nat. Mus.* xv., 1892, pp. 375-378), that some, *e.g. P. blainvillei* of California, have the power of squirting a blood-red fluid from the corner of the eye, still requires renewed investigation.

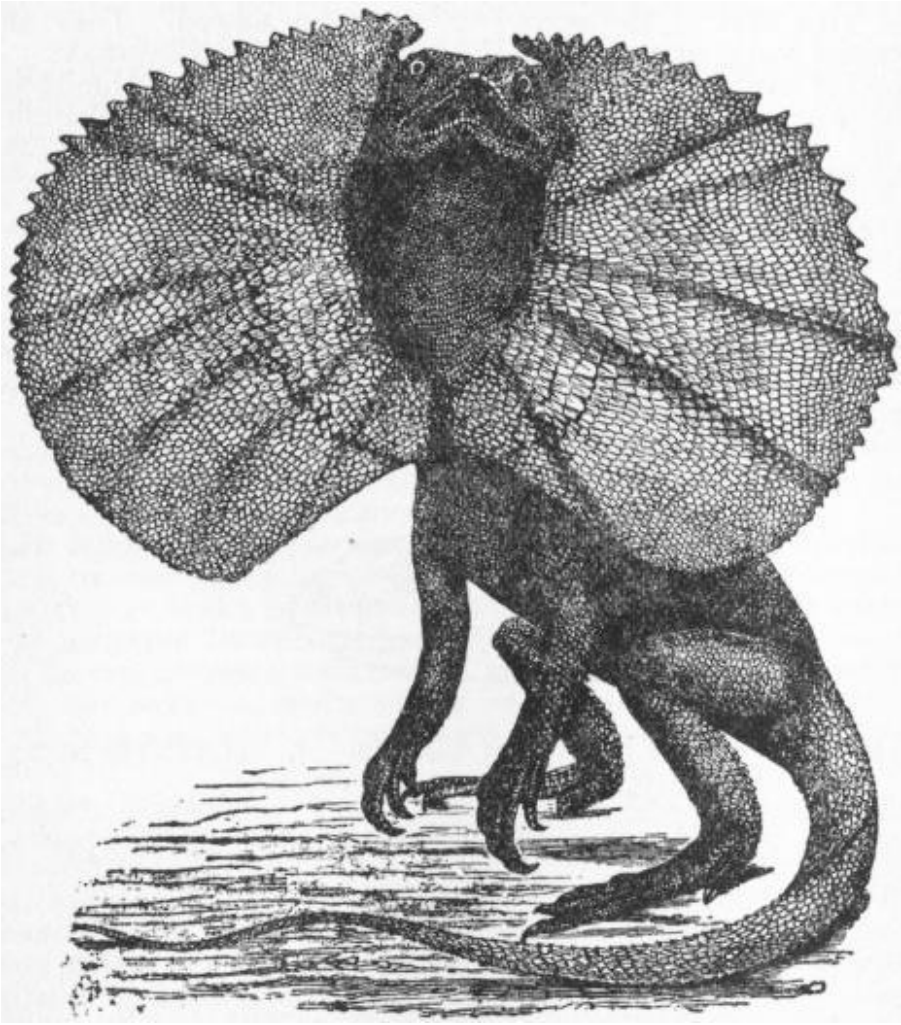

FIG. 1.—Frilled Lizard (*Chlamydosaurus kingi*).

The smallest lizards of this family belong to the genus *Anolis*, extremely numerous as regards species (more than 100) and individuals on bushes and trees of tropical America, and especially of the West Indies. They offer many points of analogy to the humming birds in their distribution, colours and even disposition. Hundreds may be seen on a bright day, disporting themselves on trees and fences, and entering houses. Like the iguanas, they (at least the males) are provided with a large, expansible dewlap at the throat, which is brilliantly coloured, and which they display on the slightest provocation. This

appendage is merely a fold of the skin, ornamental and sexual; it has no cavity in its interior, and has no communication with the mouth or with the respiratory organs; it is supported by the posterior horns of the hyoid bone, and can be erected and spread at the will of the animal. The presence of such dewlaps in lizards is always a sign of an excitable temper. Many, *e.g. A. carolinensis*, the "chameleon," can change colour to an extraordinary degree. They are much fed upon by birds and snakes, and have a fragile tail, easily reproduced. They bring forth only one large egg at a time, but probably breed several times during the season.

Family 3. *Xenosauridae.*—Pleurodont; solid teeth; anterior part of tongue slightly emarginate and retractile, and covered with flat papillae; no osteoderms. Mexico.

The only representative of this family is *Xenosaurus grandis*, recorded from the mountains of Orizaba, Cordoba and Oaxaca. The four-footed creature is less than 1 ft. in length; the body is depressed, covered above with minute granules and tubercles; a distinct fold of skin extends from the axilla to the groin, reminding of the similar fold of some *Anguidae*, to which this singular genus seems to be allied.

Family 4. *Anguidae.*—Pleurodont; teeth solid, sometimes (*Ophiosaurus*) grooved; anterior part of tongue emarginate and retractile into the posterior portion; osteoderms on the body, and especially on the head where they are roofing over the temporal fossa; entirely zoophagous and ovo-viviparous. America, Europe and India.

Gerrhonotus, 8 species, in mountainous countries, from British Columbia to Costa Rica; like *Diploglossus s. Celestus* of Mexico, the Antilles and Central America, with well-developed limbs, but with a lateral fold. *Anguis fragilis* and two species of *Ophiosaurus* are the only members of this family which are not American, and even the third species of *Ophiosaurus*, *O. ventralis*, lives in the United States. *Ophiosaurus s. Pseudopus*, the glass-snake, from

Morocco and the Balkan peninsula to Burma and Fokien; also in the U.S.A., with the limbs reduced to a pair of tiny spikes near the vent, and a lateral fold along the snake-like body. *Anguis*, with its sole species fragilis, the slow-worm or blind-worm, is devoid of a lateral fold, and the limbs are entirely absent. Europe, Algeria and western Asia.

Family 5. *Helodermatidae*, with *Heloderma* of Arizona and Mexico, and *Lanthanotus* of Borneo.—The teeth of *Heloderma* are recurved, with slightly swollen bases, loosely attached to the inner edge of the jaws; each tooth is grooved, and those of the lower jaw are in close vicinity of the series of labial glands which secrete a poison; the only instance among lizards.[2] Limbs well developed. Tongue resembling that of the *Anguidae*. The skin of the upper surface is granular, with many irregular bony tubercles which give it an ugly warty look. *H. horridum* in Mexico, and *H. suspectum*, the gila monster, in the hot and sandy lowlands of the Gila basin. The animal, which reaches a length of more than 2 ft., is blackish-brown and yellow or orange, and on the thick tail these "warning colours" are arranged in alternate rings. Small animals are probably paralyzed or killed by the bite, the poison being effective enough to produce severe symptoms even in man. The Zapotecs, who call the creature Talachini, and other tribes of Mexico have endowed it with fabulous properties and fear it more than the most poisonous snakes. *Lanthanotus corneensis*, of which only a few specimens are known, is apparently closely allied to *Heloderma*, although the teeth are not grooved, osteoderms are absent and probably also the poison glands.

Family 6. *Aniellidae.*—One genus, *Aniella*, with a few worm- or snake-shaped species in California, which seem to be degraded forms of *Anguidae*. The eyes and ears are concealed, the limbs are entirely absent, body and tail covered with soft, imbricating scales. The tongue is villose, smooth, bifid anteriorly. The few teeth are recurved, with swollen bases. The skull is much reduced. Total length of *A. pulchra* up to 8 in.

Family 7. *Zonuridae.*—Pleurodont; tongue short, villose, scarcely protractile, feebly nicked at the tip. With osteoderms at least upon the skull, where they roof in the temporal region. Africa and Madagascar.

Only 4 genera, with about 15 species. *Zonurus* of South Africa and Madagascar has the whole head, neck, back and tail covered with strong bony scales, the horny covering of which forms sharp spikes, especially on the tail. They defend themselves by jerking head and tail sidewards. *Z. giganteus* reaches 15 in. in length, and is, like the other members of the family, zoophagous. The other genera live in southern and in tropical Africa: *Pseudocordylus*, *Platysaurus* and *Chamaesaura*; the latter closely approaches the *Anguidae* by its snake-shaped body, very long tail and much reduced limbs, which in *C. macrolepis* are altogether absent.

Family 8. *Xantusiidae.*—Pleurodont; tongue very short and scaly; no osteoderms; supratemporal fossa roofed over by the cranial bones; eyes devoid of movable lids; tympanum exposed; femoral pores present; limbs and tail well developed. American.

Xantusia (so named after Xantus, a Hungarian collector), *e.g. X. vigilis* and a few other species from the desert tracts of Nevada and California to Lower California. *Lepidophyma flavomaculatum*, Central America; and *Cricosaura typica* in Cuba.

Family 9. *Tejidae.*—Teeth solid, almost acrodont; tongue long and narrow, deeply bifid, beset with papillae; no osteoderms; scales of the back very small or quite granular; limbs sometimes reduced. America.

This large, typically American family comprises more than 100 species which have been arranged in many genera. Some are entirely arboreal, dwellers in forests, while others, like *Cnemidophorus* and *Ameiva*, are strictly terrestrial, with great running powers; a few dwell below the surface and are transformed into almost limbless worm-shaped creatures. The family is essentially neotropical. Of its several dozen genera only two extend through

and beyond Central America: *Ameiva* into the eastern and western Hot-lands of Mexico, *Cnemidophorus* (monographed by H. Gadow, *Proc. Zool. Soc.*, 1906, pp. 277-375) through Mexico into the United States, where *C. sexlineatus*, the "swift," has spread over most of the Union. *Tupinambis teguixin*, the "teju" of South America and the West Indies, is the largest member of the family; it reaches a length of a yard, most of which, however, belongs to the strong, whip-like tail. *Teguixin* is taken from the Aztec *teco-ixin*, *i.e.* rock-lizard, the vernacular name of *Sceloporus torquatus* which is one of the *Iguanidae* misspelt and misapplied. The tejus frequent forests and plantations and are carnivorous, eating anything they can overpower. They in turn are much hunted for the sake of their delicate flesh. They defend themselves not only with their powerful jaws and sharp claws, but also with lashing strokes of the long tail. They also use this whip for killing snakes which they are said to eat. Their long-oval, hard-shelled eggs are deposited in the ground. They retire into self-dug burrows. *Cophias* and *Scolecosaurus* have very much reduced limbs. In the genus *Tejus* the teeth of the adult become molar-like; and in *Dracaena* they are transformed into large, oval crushers, indicating strictly herbivorous habits, while most members of the family live upon animal food.

Family 10. *Amphisbaenidae.*—The body is covered with soft skin, forming numerous rings with mere vestiges of scales. Worm-shaped, without limbs, except *Chirotes* which has short, clawed fore-limbs. Eyes and ears concealed. Tongue slightly elongated, covered with scale-like papillae and bifurcating. Tail extremely short. Acrodont or pleurodont. America, Mediterranean countries, and Africa with the exception of Madagascar.

Chirotes canaliculatus, and two other species; Pacific side of Mexico and Lower California. With five, four or three claws on the stout little digging fore-limbs. These pink, worm-like creatures live in sandy, moist localities, burrowing little tunnels and never appearing on the surface. *Amphisbaena* (*q.v.*). *Rhinëura* of Florida, and also known from the Oligocene of South

Dakota; *Lepidosternum* of South America; and *Anops* in America and Africa; *Blanus cinereus*, Mediterranean countries. *Trogonophis*, *Pachycalamus* and *Agamodon* of Africa are all acrodont; the other genera are pleurodont. In all about a dozen genera, with some 60, mostly tropical species.

Family 11. *Scincidae.*—Pleurodont. Tongue scaly, feebly nicked in front. Osteoderms on the head and body. Limbs often reduced. Cosmopolitan. The temporal region is covered over, as in the *Lacertidae* and *Anguidae*, with strongly developed dermal ossifications. Similar osteoderms underlie the scales of the body and tail. Femoral pores are absent.

All the skinks seem to be viviparous, and they prefer dry, sandy ground, in which they burrow and move quickly about in search of their animal food. This partly subterranean life is correlated with the frequent reduction of the limbs which, in closely allied forms, show every stage from fully developed, five-clawed limbs to complete absence. Some have functional fore-limbs but mere vestiges of hind-limbs; in others this condition is reversed. In some deserticolous kinds *e.g. Ablepharus*, the lower eyelid is transformed into a transparent cover which is fused with the rim of the reduced upper lid. The same applies to the limbless little *Ophiopsiseps nasutus* of Australia. This large family contains about 400 species, with numerous genera; the greatest diversity in numbers and forms occurs in the tropical parts of the Old World, especially in the Australian region, inclusive of many of the Pacific islands. New Zealand has at least 6 species of *Lygosoma*. America, notably South America, has comparatively very few skinks.

The skink, which has given the name to the whole family, is a small lizard (*Scincus officinalis*) of 6 or 8 in. in length, common in arid districts of North Africa and Syria. A peculiarly wedge-shaped snout, and toes provided with strong fringes, enable this animal to burrow rapidly in and under the sand of the desert. In former times large quantities of it were imported in a dry state into Europe for officinal purposes, the drug having the reputation of being efficacious in diseases of the skin and lungs; and even now it may be found in

apothecaries' shops in the south of Europe, country people regarding it as a powerful aphrodisiac for cattle.

Mabouia, with many species, in the whole of Africa, southern Asia and in tropical America. *M. (Euprepes) vittata*, the "poisson de sable" of Algeria, is semi-aquatic. *Chalcides s. Seps*, of the Mediterranean countries and south-western Asia, has a transparent disk on the lower eyelid which is movable; limbs very short or reduced to mere vestiges. *Lygosoma* circumtropical; *Eumeces*, also with many small species, in America, Africa and Asia. *Cyclodus s. Tiliqua* of Australia, Tasmania and Malay Islands, has stout lateral teeth with rounded-off crowns; *C. gigas* of the Moluccas and of New Guinea is the largest member of the family, reaching a length of nearly 2 ft.; the limbs are well developed, as in *Trachysaurus rugosus* of Australia, which is easily recognized by the large and rough scales and the short, broad, stump-like tail.

Family 12. *Anelytropidae.*—An artificial assembly of a few degraded Scincoids. The worm-shaped body is devoid of osteoderms. The tongue is short, covered with imbricating papillae and slightly nicked anteriorly. Teeth pleurodont. *Anelytropsis papillosus*, of which only three specimens are known, from the humus of forests in the state of Vera Cruz. Eyes concealed. *Typhlosaurus* and *Feylinia* in tropical Africa and Madagascar.

Family 13. *Dibamidae.—Dibamus novae-Guineae* of New Guinea, the Moluccas, Celebes and the Nicobar Islands. Tongue arrow-shaped, covered with curved papillae. The vermiform body is covered with cycloid imbricating scales, devoid of osteoderms. Limbs and even their arches are absent, excepting a pair of flaps which represent the hind-limbs in the males.

Family 14. *Gerrhosauridae.*—Pleurodont. Tongue long, with papillae, like that of the *Lacertidae* but only feebly nicked anteriorly. Osteoderms on the head and body, roofing over the temporal region. Femoral pores present, also mostly a lateral fold. Limbs sometimes reduced to small stumps. Tail long and

brittle. The few genera and species of this family are restricted to Africa, south of the Sahara and Madagascar.

Gerrhosaurus, with lateral fold and complete limbs; *Tetradactylus* also with a fold, but with very variable limbs; *Condylosaurus*; all in Africa. *Zonosaurus* and *Tracheloptychus* in Madagascar.

Family 15. *Lacertidae.*—Pleurodont. Tongue long and bifid, with papillae or folds, with osteoderms on the head but not on the body. Limbs always well developed. Palaearctic and palaeotropical with the exception of Madagascar; not in the Australian region.

The *Lacertidae* or true lizards comprise about 20 genera, with some 100 species, most abundant in Africa; their northern limit coincides fairly with that of the permanently frozen subsoil. They all are terrestrial and zoophagous. The long, pointed tail is brittle.

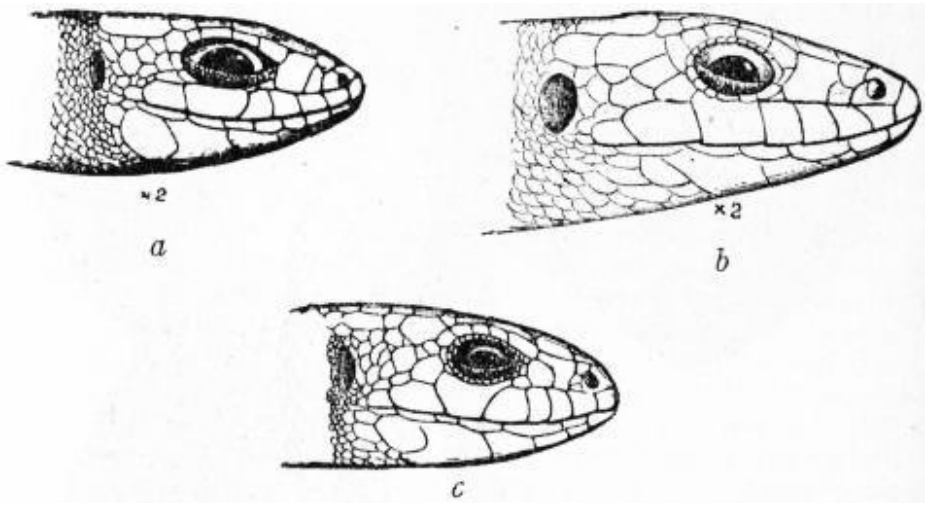

FIG. 2.—Heads of British Lizards. *a*, *Lacerta vivipara*; *b*, *L. agilis*; *c*, *L. viridis*.

Most of the European lizards with four well developed limbs belong to the genus *Lacerta*. Only three species occur in Great Britain (see fig. 2). The

common lizard (*Lacerta vivipara*) frequents heaths and banks in England and Scotland, and is locally met with also in Ireland; it is viviparous. Much scarcer is the second species, the sand-lizard (*Lacerta agilis*), which is confined to some localities in the south of England, the New Forest and its vicinity; it does not appear to attain on English soil the same size as on the continent of Europe where it abounds, growing sometimes to a length of 9 in. Singularly, a snake (*Coronella laevis*), also common on the continent, and feeding principally on this lizard, has followed it across the British Channel, apparently existing in those localities only in which the sand-lizard has settled. This lizard is oviparous. The males differ by their brighter green ground colour from the females, which are brown, spotted with black. The third British species, the green lizard (*Lacerta viridis*), does not occur in England proper; it has found a congenial home in the island of Guernsey, but is there much less developed as regards size and beauty than on the continent. This species is larger than the two preceding; it is green, with minute blackish spots. In Germany and France one other species only (*Lacerta muralis*) appears; but in the south of Europe the species of *Lacerta* are much more numerous, the largest and finest, being *L. ocellata*, which grows to a length of 18 or 20 in., and is brilliantly green, ornamented with blue eye-like spots on the sides. Even the small island-rocks of the Mediterranean, sometimes only a few hundred yards in diameter, are occupied by peculiar races of lizards, which have attracted much attention from the fact that they have assumed under such isolated conditions a more or less dark, almost black, coloration. *L. muralis*, with its numerous varieties, has been monographed by G. A. Boulenger, *Trans. Zool. Soc.* xvii. (1905), pp. 351-422, pl. 22-29.

Other genera are *Psammodromus* and *Acanthodactylus* in south-western Europe and northern Africa. *Cabrita* in India, with transparent lower eyelids. *Ophiops*, likewise with transparent but united lids, from North Africa to India.

Family 16. *Varanidae.*—Pleurodont. Tongue very long, smooth and bifid. Osteoderms absent. Limbs always well developed. Old World.

This family contains only one genus, *Varanus*, with nearly 30 species, in Africa, Arabia and southern Asia, and Australia, but not in Madagascar. The generic term is derived from the Arabic *Ouaran*, which means lizard. Owing to a ridiculous muddle, this Arabic word has been taken to mean "warning" lizard, hence the Latin *Monitor*, one of the many synonyms of this genus, now often used as the vernacular. Many of the "monitors" are semi-aquatic, *e.g. V. niloticus*, and these have a laterally compressed tail; others inhabit dry sandy districts, *e.g. V. scincus*, the *ouaran el ard* of North Africa; others prefer wooded localities. *V. salvator* is the largest species, reaching a length of 7 ft.; it ranges from Nepal and southern China to Cape York; a smaller species, common in New Guinea and Australia, is *V. gouldi*. They all are predaceous, powerful creatures, with a partiality for eggs. Their own eggs are laid in hollow trees, or buried in the sand. The young are prettily spotted with white and black ocelli, but the coloration of the adult is mostly very plain.

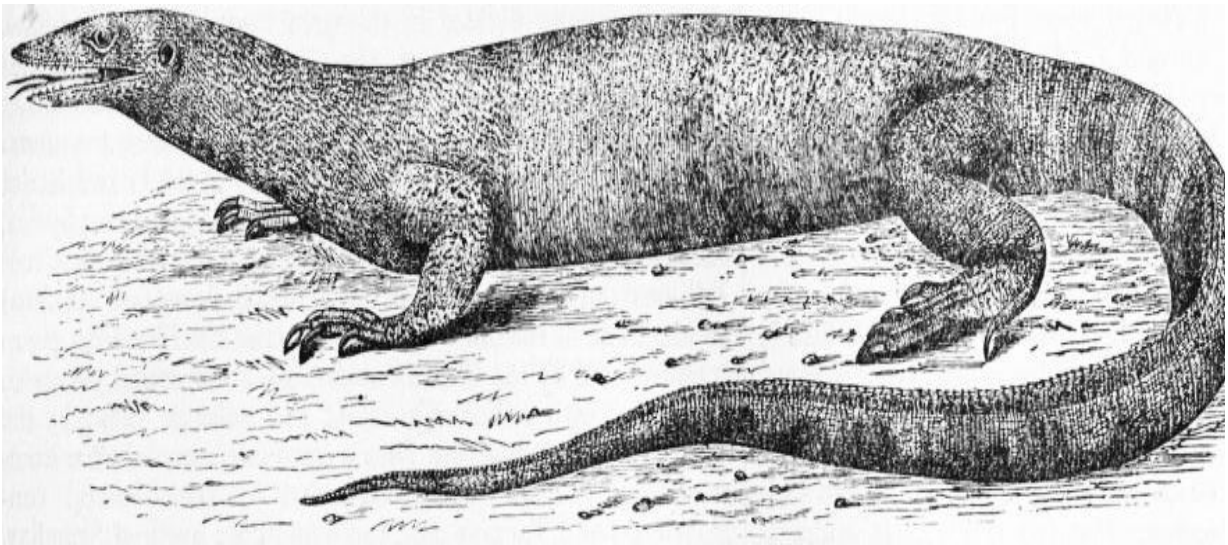

FIG. 3.—Monitor of the Nile (*Varanus niloticus*).

The following families are much degraded in conformity with their, in most cases, subterranean life. They are of doubtful relationships and contain each

but a few species.

Family 17. *Pygopodidae.*—Pleurodont, snake-shaped, covered with roundish, imbricating scales. Tail long and brittle. Fore-limbs absent; hind-limbs transformed into a pair of scale-covered flaps. Tongue slightly forked. Eyes functional but devoid of movable lids. Australia, Tasmania and New Guinea.

Pygopus, *e.g. P. lepidopus*, about 2 ft. long, two-thirds belonging to the tail, distributed over the whole of Australia.

Lialis burtoni, of similar size and distribution, has the hind-limbs reduced to very small, narrow appendages. The members of this family seem to lead a snake-like life, not subterranean, and some are said to eat other lizards. *L. jicari*, from the Fly river, has a very snake-like appearance, with a long, pointed snout like certain tree-snakes, but with an easily visible ear-opening; their eyelids are reduced to a ring which is composed of two or three rows of small scales.

(H. F. G.)

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1 For the etymology of this word, see CROCODILE.

2 For anatomical detail and experiments, see R. W. Shufeldt, *P. Z. S.* (1890), p. 178; G. A. Boulenger, *ibid.* (1891), p. 109, and C. Stewart, *ibid.* (1891), p. 119.

LIZARD POINT,

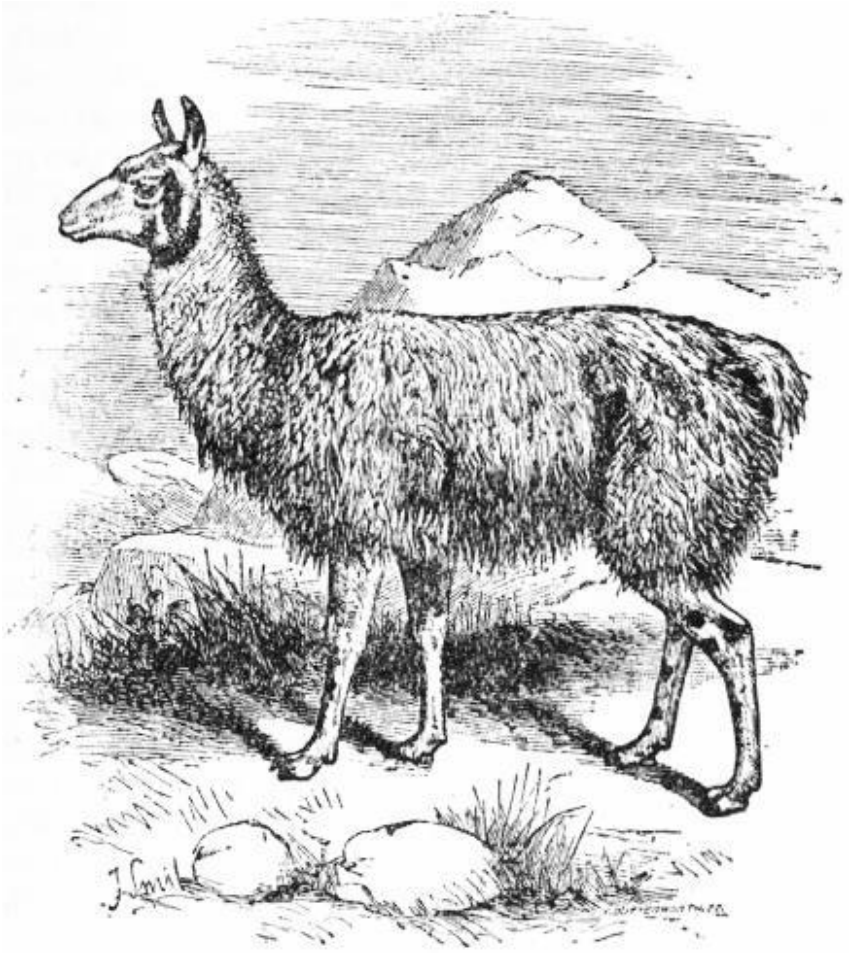
or THE LIZARD, the southernmost point of Great Britain, in Cornwall, England, in 49° 57′ 30″ N., 5° 12′ W. It is generally the first British land sighted by ships bound up the English Channel, and there are

two lighthouses on it. The cliff scenery is magnificent, and attracts many visitors. The coast is fretted into several small bays, such as Housel and, most famous of all, Kynance Cove; caves pierce the cliffs at many points, and bold isolated rocks fringe the shore. The coloured veining of the serpentine rock is a remarkable feature. The Lion's Den is a chasm formed by the falling in of a sea-cave in 1847; the Stags is a dangerous reef stretching southward from the point, and at Asparagus Island, Kynance Cove, is a natural funnel in which the air is compressed by the waves and causes a violent ejection of foam. The principal village is Lizard Town, 10½ m. from Helston, the nearest railway station.

LJUNGGREN, GUSTAF HÅKAN JORDAN (1823-1905), Swedish man of letters, was born at Lund on the 6th of March 1823. He was educated at Lund university, where he was professor of German (1850-1859), of aesthetics (1859-1889) and rector (1875-1885). He had been a member of the Swedish Academy for twenty years at the time of his death in September 1905. His most important work, *Svenska vitterhetens häfder efter Gustav III.'s död* (5 vols., Lund., 1873-1895), is a comprehensive study of Swedish literature in the 19th century. His other works include: *Framställning af de förnämste estetiska systemerna* (an exposition of the principal system of aesthetics; 2 vols., 1856-1860); *Svenska dramat intill slutet af 17 århundradet* (a history of the Swedish drama down to the end of the 17th century, Lund, 1864); an edition (1864) of the *Epistlar* of Bellman and Fredman, and a history of the Swedish Academy in the year of its centenary (1886).

His scattered writings were collected as *Smärre Skrifter* (3 vols., 1872-1881).

LLAMA, the Spanish modification of the Peruvian name of the larger of the two domesticated members of the camel-tribe indigenous to South America. The llama (*Lama huanacus glama*) is a domesticated derivative of the wild guanaco, which has been bred as a beast of burden. Chiefly found in southern Peru, it generally attains a larger size than the guanaco, and is usually white or spotted with brown or black, and sometimes altogether black. The following account by Augustin de Zarate was given in 1544:



Llama.

“In places where there is no snow, the natives want water, and to supply this they fill the skins of sheep with water and make other living sheep carry them, for, it must be remarked, these sheep of Peru are large enough to serve as beasts of burden. They can carry about one hundred pounds or more, and the Spaniards used to ride them, and they would go four or five leagues a day. When they are weary they lie down upon the ground, and as there are no means of making them get up, either by beating or assisting them, the load must of necessity be taken off. When there is a man on one of them, if the beast is tired and urged to go on, he turns his head round, and discharges his saliva, which has an unpleasant odour, into the rider’s face. These animals are

of great use and profit to their masters, for their wool is very good and fine, particularly that of the species called pacas, which have very long fleeces; and the expense of their food is trifling, as a handful of maize suffices them, and they can go four or five days without water. Their flesh is as good as that of the fat sheep of Castile. There are now public shambles for the sale of their flesh in all parts of Peru, which was not the case when the Spaniards came first; for when one Indian had killed a sheep his neighbours came and took what they wanted, and then another Indian killed a sheep in his turn."

The disagreeable habit of spitting is common to all the group.

In a wide sense the term "llama" is used to designate all the South American *Camelidae*. (See TYLOPODA.)

LLANBERIS, a town of Carnarvonshire, N. Wales, 8½ m. E. by S. of Carnarvon, by a branch of the London & North-Western railway. Pop. (1901) 3015. It is finely situated in a valley near the foot of Snowdon. The valley has two lakes, Llyn Peris and Llyn Padarn, of over 1 m. and 2 m. long respectively, about ¼ m. apart. From Padarn rises the Seint, called Rothell in its upper part. Dolbadarn Castle is a circular tower near the foot of Peris lake. Dolbadarn means the "Padarn meadow." Several Welsh churches are dedicated to Padarn. In the castle Owen Goch (Owen the Red) was imprisoned from 1254 to 1277, by the last Llewelyn, whose brother Dafydd held it for some time against Edward I. During the time of Owen Glendower (*temp.* Henry IV. and Henry V.), the castle often changed hands. Near is Ceunantmawr waterfall. The Vaenol slate quarries are here, and hence is the

easiest ascent of Snowdon, with a railway to the summit. From the road over the fine Llanberis pass towards Capel Curig, a turn to the right leads to Beddgelert, through Nant Gwynnant ("white" or "happy valley," or "stream"), where Pembroke and Ieuan ap Robert (for the Lancastrians) had many skirmishes in the time of Edward IV. Gwynnant Lake is about 1 m. long, by ¼ m. broad, and below it is the smaller Llyn Dinas.

LLANDAFF, a city of Glamorganshire, Wales, on the Taff Vale railway, 149 m. from London. Pop. (1901) 5777. It is almost entirely within the parliamentary borough of Cardiff. It is nobly situated on the heights which slope towards the southern bank of the Taff. Formerly the see of Llandaff was looked upon as the oldest in the kingdom; but its origin is obscure, although the first two bishops, St Dubricius and St Teilo, certainly flourished during the latter half of the 6th century. By the 12th century, when Urban was bishop, the see had acquired great wealth (as may be seen from the *Book of Llandaff*, a collection of its records and land-grants compiled probably by Geoffrey of Monmouth), but after the reign of Henry VIII. Llandaff, largely through the alienations of its bishops and the depredations of the canons, became impoverished, and its cathedral was left for more than a century to decay. In the 18th century a new church, in debased Italian style, was planted amid the ruins. This was demolished and replaced (1844-1869) by the present restored cathedral, due chiefly to the energy of Dean Williams. The oldest remaining portion is the chancel arch, belonging to the Norman cathedral built by Bishop Urban and opened in 1120. Jasper Tudor, uncle of Henry VII., was the architect of the north-west tower, portions of which remain. The cathedral is

also the parish church. The palace or castle built by Urban was destroyed, according to tradition, by Owen Glendower in 1404, and only a gateway with flanking towers and some fragments of wall remain. After this, Mathern near Chepstow became the episcopal residence until about 1690, when it fell into decay, leaving the diocese without a residence until Llandaff Court was acquired during Bishop Ollivant's tenure of the see (1849-1882). For over 120 years the bishops had been non-resident. The ancient stone cross on the green (restored in 1897) is said to mark the spot on which Archbishop Baldwin, and his chaplain Giraldus Cambrensis, preached the Crusade in 1187. Money bequeathed by Thomas Howell, a merchant, who died in Spain in 1540, maintains an intermediate school for girls, managed by the Drapers' Company, Howell's trustees. There is an Anglican theological college, removed to Llandaff from Aberdare in 1907. The city is almost joined to Cardiff, owing to the expansion of that town.

Llandaff Court, already mentioned, was the ancient mansion of the Mathew family, from which Henry Matthews, 1st Viscount Llandaff (b. 1826), was descended. Another branch of this family formerly held the earldom of Llandaff in the Irish peerage. Henry Matthews, a barrister and Conservative M.P., whose father was a judge in Ceylon, was home secretary 1886-1892, and was created viscount in 1895.

LLANDEILO GROUP, in geology, the middle subdivision of the British Ordovician rocks. It was first described and named by Sir. R. I. Murchison from the neighbourhood of Llandeilo in Carmarthenshire. In the

type area it consists of a series of slaty rocks, shales, calcareous flagstones and sandstones; the calcareous middle portion is sometimes termed the “Llandeilo limestone”; and in the upper portion volcanic rocks are intercalated. A remarkable feature in the history of the Llandeilo rocks in Britain, more especially in North Wales and Cumberland, was the outbreak of volcanic action; vast piles of Llandeilo lava and ashes form such hills as Cader Idris, and the Arenigs in Wales, and Helvellyn and Scafell in Westmorland and Cumberland. The series is also found at Builth and in Pembrokeshire. The average thickness in Wales is about 2000 ft. The group is usually divided in this area into three subdivisions. In the Corndon district of Shropshire the *Middleton Series* represents the Llandeilo group; it includes, in descending order, the Rorrington black shales, the *Meadowtown limestones* and flags, and the western grits and shales. In the Lake District the great *volcanic series of Borrowdale*, green slates and porphyries, 8000 to 9000 ft. in thickness, lies on this horizon; and in the Cross Fell area the *Milburn beds* of the Skiddaw slates (see ARENIG) appear to be of the same age. In Scotland the Llandeilo group is represented by the *Glenkiln shales*, black shales and yellowish mudstones with radiolarian cherts and volcanic tuffs; by the *Barr Series*, including the Benan conglomerates, Stinchar limestone and Kirkland sandstones; and by the Glenapp conglomerates and Tappins mudstones and grits south of Stinchar. Graptolitic shales, similar to those of southern Scotland, are traceable into the north-east of Ireland.

The fossils of the Llandeilo group include numerous graptolites, *Coenograptus gracilis* being taken as the zonal fossil of the upper portion, *Didymograptus Murchisoni* of the lower. Other forms are *Climacograptus Scharenbergi* and *Diplograptus foliaceus*. Many trilobites are found in these rocks, *e.g. Ogygia Buchi*, *Asaphus tyrannus*, *Calymene cambrensis*, *Cheirurus Sedgwickii*. Among the brachiopods are *Crania*, *Leptaena*, *Lingula*, *Strophomena*; *Cardiola* and *Modiolopsis* occur among the Pelecypods; *Euomphalus*, *Bellerophon*, *Murchisonia* among the Gasteropods; *Conularia* and *Hyolithes* among the Pteropods; the Cephalopods are represented by

Orthoceras and *Cyrtoceras*. The green roofing slates and plumbago (graphite) of the Lake District are obtained from this group of rocks, (see ORDOVICIAN).

LLANDILO, or LLANDEILO FAWR, a market town and urban district of Carmarthenshire, Wales, picturesquely situated above the right bank of the river Towy. Pop. (1901) 1721. Llandilo is a station on the Mid-Wales section of the London & North-Western railway, and a terminus of the Llandilo-Llanelly branch line of the Great Western. The large parish church of St Teilo has a low embattled Perpendicular tower. Adjoining the town is the beautiful park of Lord Dynevor, which contains the ruined keep of Dinefawr Castle and the residence of the Rices (Lords Dynevor), erected early in the 17th century but modernized in 1858. Some of the loveliest scenery of South Wales lies within reach of Llandilo, which stands nearly in the centre of the Vale of Towy.

The name of Llandilo implies the town's early foundation by St Teilo, the great Celtic missionary of the 6th century, the friend of St David and reputed founder of the see of Llandaff. The historical interest of the place centres in its proximity to the castle of Dinefawr, now commonly called Dynevor, which was originally erected by Rhodri Mawr or his son Cadell about the year 876 on the steep wooded slopes overhanging the Towy. From Prince Cadell's days to the death of the Lord Rhys, last reigning prince of South Wales, in 1196, Dinefawr continued to be the recognized abode of South Welsh royalty. The castle ruins remain in the possession of the Rices, Lords Dynevor, heirs and descendants of Prince Cadell. At one period residence and park became known as New-town, a name now obsolete. Some personal relics of the

celebrated Sir Rhys ap Thomas, K.G. (1451-1527), are preserved in the modern house. Dinefawr Castle and its estates were granted away by Henry VIII. on the execution for high treason of Sir Rhys's grandson, Rhys ap Griffith, but were restored to the family under Queen Mary.

LLANDOVERY (*Llan-ym-ddyffri*), a market town and ancient municipal borough of Carmarthenshire, Wales, situated amid hills near the left bank of the Towy. Pop. (1901) 1809. Llandovery is a station on the Mid-Wales section of the London & North-Western railway. The old-fashioned town lies in the parish of Llandingat, and contains the two churches of Llandingat and Llanfair-ar-y-bryn. The slight remains of the castle stand on a hillock above the river Brân. The public school was founded here by Sir Thomas Phillips in 1847.

The place probably owes its Celtic name of Llan-ym-ddyffri (the church amid the waters) to the proximity of Llandingat church to the streams of the Towy, Brân and Gwydderig. On account of its commanding position at the head of the fertile vale of Towy, Llandovery was a strategic site of some importance in the middle ages. The castle erected here by the Normans early in the 12th century frequently changed owners during the course of the Anglo-Welsh wars before 1282. In 1485 the borough of Llandovery, or Llanymtheverye, was incorporated by a charter from Richard III., and this king's privileges were subsequently confirmed by Henry VIII. in 1521, and by Elizabeth in 1590, the Tudor queen's original charter being still extant and in the possession of the corporation, which is officially styled "the bailiff and

burgesses of the borough of Llanymtheverye, otherwise Llandovery." The bailiff likewise holds the office of recorder, but has neither duties nor emoluments. In the 17th century the vicarage of Llandingat was held by the celebrated Welsh poet and preacher, Rhys Prichard, commonly called "the vicar of Llandovery" (d. 1644). In the middle of the 19th century William Rees of Tonn published at Llandovery many important works dealing with early Welsh history and archaeology.

LLANDOVERY GROUP, in geology, the lowest division of the Silurian (Upper Silurian) in Britain. C. Lapworth in 1879 proposed the name *Valentian* (from the ancient north British province of Valentia) for this group. It includes in the type area the Tarannon Shales 1000-1500 ft., Upper Llandovery and May Hill Sandstone 800 ft., Lower Llandovery, 600-1500 ft.

The *Lower Llandovery* rocks consist of conglomerates, sandstones and slaty beds. At Llandovery they rest unconformably upon Ordovician rocks (Bala), but in many other places no unconformity is traceable. These rocks occur with a narrow crop in Pembrokeshire, which curves round through Llandovery, and in the Rhyader district they attain a considerable thickness. Northwards they thin out towards Bala Lake. They occur also in Cardiganshire and Carmarthenshire in many places where they have not been clearly separated from the associated Ordovician rocks.

There is a change in the fauna on leaving the Ordovician and entering the Llandovery. Among the graptolites the Diplograptidae begin to be replaced by the Monograptidae. Characteristic graptolite zones, in descending order, are:

—*Monograptus gregarius*, *Diplograptusvesiculosus*, *D. acuminatus*. Common trilobites are:—*Acidaspis*, *Encrinurus*, *Phacops*, *Proëtus*; among the brachiopods are *Orthis elegantula*, *O. testudinaria*, *Meristella crassa* and *Pentamerus* (*Stricklandinia*) *lens* (*Pentamerus* is so characteristic that the Llandovery rocks are frequently described as the "Pentamerus beds").

The *Upper Llandovery*, including the May Hill Sandstone of May Hill, Gloucestershire, is an arenaceous series generally conglomeratic at the base, with local lenticular developments of shelly limestone (Norbury, Hollies and Pentamerus limestones). It occurs with a narrow outcrop in Carmarthenshire at the base of the Silurian, disappearing beneath the Old Red Sandstone westward to reappear in Pembrokeshire; north-eastward the outcrop extends to the Longmynd, which the conglomerate wraps round. As it is followed along the crop it is found to rest unconformably upon the Lower Llandovery, Caradoc, Llandeilo, Cambrian and pre-Cambrian rocks. The fossils include the trilobites *Phacops caudata*, *Encrinurus punctatus*, *Calymene Blumenbachii*; the brachiopods *Pentamerus oblongus*, *Orthis calligramma*, *Atrypa reticularis*; the corals *Favosites*, *Lindostroemia*, &c.; and the zonal graptolites *Rastrites maximus* and *Monograptus spinigerus* and others (*Monograptus Sedgwicki*, *M. Clingani*, *M. proteus*, *Diplograptus Hughesii*).

The *Tarannon shales*, grey and blue slates, designated by A. Sedgwick the "paste rock," is traceable from Conway into Carmarthenshire; in Cardiganshire, besides the slaty facies, gritty beds make their appearance; and in the neighbourhood of Builth soft dark shales. The group is poor in fossils with the exception of graptolites; of these *Cyrtograptus grayae* and *Monograptus exiguus* are zonal forms. The Tarannon group is represented by the Rhyader Pale Shales in Radnorshire; by the Browgill beds, with *Monograptus crispus* and *M. turriculatus*, in the Lake district; in the Moffat Silurian belt in south Scotland by a thick development, including the Hawick rocks and Ardwell beds, and the Queensberry group or Gala (Grieston shales, Buckholm grits and Abbotsford flags); in the Girvan area, by the Drumyork

flags, Bargany group and Penkill group; and in Ireland by the Treveshilly shales of Strangford Lough, and the shales of Salterstown, Co. Louth.

The Upper and Lower Llandovery rocks are represented in descending order by the Pale shales, Graptolite shales, Grey slates and Corwen grit of Merionethshire and Denbighshire. In the Rhyader district the Caban group (Gafalt beds, shales and grits and Caban conglomerate), and the Gwastaden group (Gigrin mudstones, Ddol shales, Dyffryn flags, Cerig Gwynion grits) lie on this horizon; at Builth also there is a series of grits and shales. In the Lake district the lower part of the Stockdale shales (Skelgill beds) is of Llandovery age. In south Scotland in the central and southern belt of Silurian rocks, which extends across the country from Luce Bay to St Abb's Head, the Birkhill shales, a highly crumpled series of graptolitic beds, represent the Llandovery horizon. In the Girvan area to the north their place is taken by the Camregan, Shaugh Hill and Mullock Hill groups. In Ireland the Llandovery rocks are represented by the Anascaul slates of the Dingle promontory, by the Owenduff and Gowlaun grits, Co. Galway, by the Upper Pomeroy beds, by the Uggool and Ballaghaderin beds, Co. Mayo, and by rocks of this age in Coalpit Bay and Slieve Felim Mountains.

Economic deposits in Llandovery rocks include slate pencils (Teesdale), building stone, flag-stone, road metal and lime. Lead ore occurs in Wales. (See SILURIAN.)

(J. A. H.)

LLANDRINDOD, or LLANDRINDOD WELLS, a market town, urban district and health-resort of Radnorshire, Wales, situated in a lofty and

exposed district near the river Ithon, a tributary of the Wye. Pop. (1901) 1827. Llandrindod is a station on the Mid-Wales section of the London & North-Western railway. The town annually receives thousands of visitors, and lies within easy reach of the beautiful Wye Valley and the wild district of Radnor Forest. The saline, sulphur and chalybeate springs of Llandrindod have long been famous. According to a treatise published by a German physician, Dr Wessel Linden, in 1754, the saline springs at Ffynon-llwyn-y-gog ("the well in the cuckoos' grove") in the present parish of Llandrindod had acquired more than a local reputation as early as the year 1696. In the 18th century both saline and sulphur springs were largely patronized by numbers of visitors, and about 1749 a Mr Grosvenor built a hydropathic establishment near the old church, on a site now covered by a farm-house known as Llandrindod Hall.

LLANDUDNO, a seaside resort in the Arfon parliamentary division of Carnarvonshire, North Wales, in a detached portion of the county east of the Conwy, on a strip of sandy soil terminating in the massive limestone of Great Orme's Head. Pop. of urban district (1901) 9279. The town is reached by the London & North-Western railway, and lies 227 m. N.W. of London. A village in 1850, Llandudno is to-day one of the most flourishing watering-places in North Wales. Sheltered by the Great Orme on the N.W. and by the Little Orme on the E., it faces a wide bay of the Irish Sea, and is backed by low sandhills. A Marine Drive encircles the Great Orme. The Little Orme has caverns and abounds in sea birds and rare plants. Close to the town are the Gloddaeth woods, open to visitors. On the Great Orme are old circular buildings, an ancient fortress, a "rocking-stone" (*crŷd Tudno*) and the 7th-

century church of St Tudno, restored in 1885. Druidical and other British antiquities are numerous in the district. At Deganwy, or Diganwy, 2 m. from Llandudno, is a castle, Dinas Gonwy (Conwy fort), known to English historians as Gannoc, dating from the 11th or (according to the Welsh) earlier than the 9th century.

LLANELLY, a market town, urban district, and seaport of Carmarthenshire, Wales, situated on the north shore of the broad estuary of the river Loughor (Llwchwr), known as Burry river, which forms an inlet of Carmarthen Bay. Pop. (1901) 25,617. Llanelly is a station on the South Wales section of the Great Western railway. The town is wholly of modern appearance. The mother-church of St Elliw, or Elli (whence the town derives its name) has been practically rebuilt (1906), but it retains its 13th-century tower and other ancient features of the original fabric. Its situation on a broad estuary and its central position with regard to a neighbourhood rich in coal, iron and limestone, have combined to make Llanelly one of the many important industrial towns of South Wales. Anthracite and steam-coal from the collieries of the coast and along the Loughor Valley are exported from the extensive docks; and there are also large works for the smelting of copper and the manufacture of tin plates.

Llanelly, though an ancient parish and a borough by prescription under a portreeve and burgesses in the old lordship of Kidwelly, remained insignificant until the industrial development in South Wales during the 19th century. In 1810 the combined population of Llanelly, with its four subsidiary

hamlets of Berwick, Glyn, Hencoed and Westowe, only amounted to 2972; in 1840 the inhabitants of the borough hamlet alone had risen to 4173. Llanelly is now the most populous town in Wales outside the confines of Glamorganshire. In 1832 Llanelly was added as a contributory borough to the Carmarthen parliamentary district.

LLANES, a seaport of northern Spain, in the province of Oviedo, on the river Carrocedo and the Bay of Biscay. Pop. (1900) 18,684. The streets are mostly narrow and irregular, and contain some curious old houses. The principal buildings are a fine Gothic church and an old Augustinian monastery, which has been converted into a school and meteorological station. In summer the fine climate, scenery and sea-bathing attract many visitors. Llanes is a second-class port for light-draught vessels; but the entrance is narrow, and rather difficult in rough weather. The trade is chiefly in agricultural produce, timber, butter and fish.

LLANGOLLEN, a picturesque market-town and summer resort of Denbighshire, N. Wales, in the Dee (*Dyfrdwy*) valley, on a branch of the Great

Western Railway, 9 m. S.W. of Wrexham, 202½ m. from London by rail. Pop. of urban district (1901) 3303. The Dee is here crossed by a 14th-century bridge of four arches, “one of the seven wonders of Wales,” built by John Trevor, afterwards bishop of St Asaph (*Llanelwy*). The Anglican church of St Collen, Norman and Early English, has a monument in the churchyard to the “Ladies of Llangollen,” Lady Eleanor Butler and Hon. Sarah Ponsonby, of Plas Newydd, (1778 to 1829 and 1831 respectively). The house is now a museum. Castell Dinas Brân (the castle of the town of Brân; the mountain stream below is also called Brân), the ruins of a fortress on a high conical hill about 1 m. from the town, is supposedly British, of unknown date. “An old ruynous thinge,” as the Elizabethan poet Churchyard calls it even in the 16th century, it was inhabited, apparently, about 1390, by Myfanwy Fechan of the Tudor Trevor family and beloved by the bard Howel ab Einion Llygliw, whose ode to her is still extant. Valle Crucis Abbey (*Llan Egwest*) is a Cistercian ruin at the foot of Bronfawr hill, some 2 m. N.W. of Llangollen, founded about 1200 by Madoc ab Gruffydd Maelor, lord of Dinas Brân and grandson of Owen Gwynedd, prince of Wales. Llan Egwest, dissolved in 1535, was given by James I. to Lord Edward Wootton. In the meadow adjoining, still called Llwyn y Groes (“grove of the cross”), is “Eliseg’s Pillar.” Eliseg was father of Brochmael, prince of Powys, and his grandson, Concen or Congen, appears to have erected the pillar, which is now broken, with an illegible inscription; the modern inscription dates only from 1779. At Llangollen are linen and woollen manufactures, and near are collieries, lime and iron works. Brewing, malting and slate-quarrying are also carried on. Within the parish, an aqueduct carries the Ellesmere canal across the Dee.

LLANQUIHUE (pron. *lan-kè-wa*), a province of southern Chile bordering on the northern shores of the Gulf and Straits of Chacao, and extending from the Pacific to the Argentine frontier. The province of Valdivia lies N. and is separated from it in part by the Bueno river. Pop. (1895) 78,315. Area 45,515 sq. m. It is a region of forests, rivers and lakes, and the greater part is mountainous. The rainfall is excessive, the average at Puerto Montt being 104 in. a year, and the temperature is singularly uniform, the average for the summer being 58½°, of the winter 47½°, and of the year 53° F. There are several large lakes in the eastern part of the province—Puyehue, on the northern frontier, Rupanco, Llanquihue and Todos los Santos. Lake Llanquihue is the largest body of fresh water in Chile, having an extreme length from N. to S., or from Octai to Varas, of about 33 m., and extreme breadth of nearly the same. There is a regular steamship service on the lake between Octai and Varas, and its western shores are well settled. The volcanoes of Calbuco and Osorno rise from near its eastern shores, the latter to a height of 7382 ft. The outlet of the lake is through Maullin river, the lower course of which is navigable. The other large rivers of the province are the Bueno, which receives the waters of Lakes Puyehue and Rupanco, and the Puelo, which has its rise in a lake of the same name in the Argentine territory of Chubut. A short tortuous river of this vicinity, called the Petrohue, affords an outlet for the picturesque lake of Todos los Santos, and enters the Reloncavi Inlet near the Puelo. The southern coast of the province is indented by a number of inlets and bays affording good fishing, but the mouths of the rivers flowing into the Pacific are more or less obstructed by sand-bars. Apart

from the lumber industry, which is the most important, the productions of Llanquihue include wheat, barley, potatoes and cattle. The white population is composed in great part of Germans, who have turned large areas of forest lands in the northern districts into productive wheat fields. The capital is Puerto Montt, on a nearly land-locked bay called the Reloncavi, designed to be the southern terminus of the longitudinal railway from Tacna, a distance of 2152 m. An important town in the northern part of the province is Osorno, on the Rahue river, which is chiefly inhabited by Germans. It exports wheat and other farm produce, leather, lumber and beer.

LLANTRISANT, a small town and a contributory parliamentary borough of Glamorganshire, Wales, picturesquely situated with a southern aspect, commanding a fine view of the vale of Glamorgan, in a pass on the mountain range which separates that vale from the valley of the Taff. The population of the parish in 1901 was 10,091 and of the contributory borough 2057. A branch of the Taff Vale railway running from Pontypridd to Cowbridge and Aberthaw has a station, Cross Inn, ½ m. below the town, while nearly 2 m. farther south it passes (near the village of Pontyclun) through Llantrisant station on the Great Western railway main line, which is 156¼ m. by rail from London and 11 m. N.W. from Cardiff. The castle, which according to G. T. Clark was “second only to Cardiff in military importance,” dates from the reign of Henry III. or Edward I. Of the original building nothing remains, and of a later building only a tall and slender fragment. It was the head of the lordship of Miskin, a great part of which was in the hands of native owners, until the last of them, Howel ap Meredith, was expelled by

Richard de Clare (1229-1262). Since then it has always been in the hands of the lord of Glamorgan. It was in the near neighbourhood of the town that Edward II. was captured in 1327. In 1426 the then lord of Glamorgan, Richard, 5th earl of Warwick, granted to the residents a charter confirming grants made by his predecessors in 1346, 1397 and 1424. The corporation was abolished in 1883, and its property (including 284 acres of common land) is administered by a town trust under a scheme of the charity commissioners. The "freemen" of the borough, however, still hold a court leet in the town-hall. The market formerly held here has been discontinued, but there are four annual fairs. The church was dedicated to three saints (Illtyd, Gwyno and Tyfodwg), whence the name Llantrisant. Originally a Norman building, most of the present fabric belongs to the 15th century. There are numerous chapels. Welsh is still the predominant language. Oliver Cromwell's forbears were natives of this parish, as also was Sir Leoline Jenkins, secretary of state under Charles II. There are tinplate works at Pontyclun and numerous collieries in the district.

LLANTWIT MAJOR (Welsh *Llan-Illtyd-Fawr*), a small market town in the southern parliamentary division of Glamorganshire, South Wales, about 1 m. from the Bristol Channel, with a station on the Barry railway, 5 m. S. of Cowbridge. Pop. (1901) 1113. About 1 m. N.N.W. of the town there were discovered in 1888 the remains of a large Roman villa within a square enclosure of about 8 acres, which has been identified as part of the site of a Roman settlement mentioned in Welsh writings as Caer Wrgan. The building seemed to have been the scene of a massacre, possibly the work of Irish

pirates in the 5th century, as some forty-three human skeletons and the remains of three horses were found within its enclosure. Etymological reasoning have led some to suggest that the Roman station of Bovium was at Boverton, 1 m. E. of the town, but it is more likely to have been at Ewenny (2 m. S.E. of Bridgend) or perhaps at Cowbridge. On the sea coast are two camps, one known as Castle Ditches, commanding the entrance to the creek of Colhugh, once the port of Llantwit. In the time of Henry I. a small colony of Flemings settled in the district. The town and church derive their name from St Illtyd or Iltutus, styled the "knight," a native of Brittany and a great-nephew of Germanus of Auxerre. Having come under the influence of St Cadoc, abbot of Llancarvan, 6 m. E.N.E. of Llantwit, Illtyd established at the latter place, about A.D. 520, a monastic college which became famous as a seat of learning. He attracted a number of scholars to him, especially from Brittany, including Samson, archbishop of Dol, Maglorius (Samson's successor) and Paul de Leon, while his Welsh students included David, the patron saint of Wales, Gildas the historian, Paulinus and Teilo. The college continued to flourish for several centuries, sending forth a large number of missionaries until, early in the 12th century, its revenues were appropriated to the abbey of Tewkesbury by Fitzhamon, the first Norman lord of Glamorgan. A school seems, however, to have lingered on in the place until it lost all its emoluments in the reign of Henry VIII. The present church of St Illtyd is the result of a sequence of churches which have sprung from a pre-Norman edifice, almost entirely rebuilt and greatly extended in the 13th century and again partially rebuilt late in the 14th century. It consists of an "eastern" church which (according to Professor Freeman) belonged probably to the monks, and is the only part now used for worship, a western one used as a parochial church before the dissolution, but now disused, and still farther west of this a chantry with sacristan's house, now in ruins. The western church consists of the nave of a once cruciform building, while in continuation of it was built the eastern church, consisting of chancel, nave (of great height and width but very short), aisles and an embattled western tower built over the

junction of the two naves. A partial restoration was made in 1888, and a careful and more complete one in 1900-1905. In the church and churchyard are preserved some early monumental remains of the British church, dating from the 9th century, and some possibly from an earlier date. They include two cross-shafts and one cross with inscriptions in debased Latin (one being to the memory of St Illtyd) and two cylindrical pillars, most of them being decorated with interlaced work. There are some good specimens of domestic architecture of the 17th century. The town is situated in a fertile district and the inhabitants depend almost entirely on agriculture. Its weekly market is mainly resorted to for its stock sales. St Donats castle, 2 m. to the west, was for nearly seven centuries the home of the Stradling family.

As to the Roman remains, see the *Athenaeum* for October 20 (1888), and the *Antiquary* for August (1892). As to the church, see the *Archaeologia Cambrensis*, 3rd ser. iv. 31 (an article by Professor Freeman), 5th ser., v. 409 and xvii. 129, and 6th ser., iii. 56; A. C. Fryer, *Llantwit-Major: a Fifth Century University* (1893).

(D. Ll. T.)

LLANWRTYD WELLS, an urban district of Breconshire, south Wales, with a station on the central Wales section of the London & North Western railway, 231 m. from London. It is situated in the midst of wild mountain scenery on the river Irfon, a right-bank tributary of the Wye. The place is chiefly noted for its sulphur and chalybeate springs, the former being the strongest of the kind in Wales. The medicinal properties of the sulphur water were discovered, or perhaps rediscovered, in 1732 by a famous Welsh

writer, the Rev. Theophilus Evans, then vicar of Llangammarch (to which living Llanwrtyd was a chapelry till 1871). Saline water is obtained daily in the season from Builth Wells. The Irfon is celebrated as a trout-stream. Out of the civil parish, which has an area of 10,785 acres and had in 1901 a population of 854, there was formed in 1907 the urban district, comprising 1611 acres, and with an estimated population at the date of formation of 812. Welsh is the predominant language of the district.

Four miles lower down the Irfon valley, at the junction of the Cammarch and Irfon, and with a station on the London & North Western railway, is the village of Llangammarch, noted for its barium springs. The ancient parish of Llangammarch consists of the townships of Penbuallt and Treflis, the wells being in the former, which comprises 11,152 acres and had in 1901 a population of only 433. John Penry, the Puritan martyr, was born at Cefn-brith in this parish. Charles Wesley's wife, Sarah Gwynne, was of Garth, an old residence just outside the parish.

LLEWELYN, the name of two Welsh princes.

Llewelyn I., Ab Iorwerth (d. 1240), prince of North Wales, was born after the expulsion of his father, Iorwerth, from the principality. In 1194, while still a youth, Llewelyn recovered the paternal inheritance. In 1201 he was the greatest prince in Wales. At first he was a friend of King John, whose illegitimate daughter, Joanna, he took to wife (1201); but the alliance soon fell through, and in 1211 John reduced Llewelyn to submission. In the next year Llewelyn recovered all his losses in North Wales. In 1215 he took

Shrewsbury. His rising had been encouraged by the pope, by France, and by the English barons. His rights were secured by special clauses in Magna Carta. But he never desisted from his wars with the Marchers of South Wales, and in the early years of Henry III. he was several times attacked by English armies. In 1239 he was struck with paralysis and retired from the active work of government in favour of his son David. He retired into a Cistercian monastery.

See the lists of English chronicles for the reigns of John and Henry III.; also the Welsh chronicle *Brut y Tywysogion* (ed. Rolls Series); O. M. Edwards, *History of Wales* (1901); T. F. Tout in the *Political History of England*, iii. (1905).

Llewelyn II., Ab Gruffydd (d. 1282), prince of North Wales, succeeded his uncle David in 1246, but was compelled by Henry III. to confine himself to Snowdon and Anglesey. In 1254 Henry granted Prince Edward the royal lands in Wales. The steady encroachment of royal officers on Llewelyn's land began immediately, and in 1256 Llewelyn declared war. The Barons' War engaged all the forces of England, and he was able to make himself lord of south and north Wales. Llewelyn also assisted the barons. By the treaty of Shrewsbury (1265) he was recognized as overlord of Wales; and in return Simon de Montfort was supplied with Welsh troops for his last campaign. Llewelyn refused to do homage to Edward I., who therefore attacked him in 1276. He was besieged in the Snowdon mountains till hunger made him surrender, and conclude the humiliating treaty of Conway (1277). He was released, but in 1282 he revolted again, and was killed in a skirmish with the Mortimers, near Builth in central Wales.

See C. Bémont, *Simon de Montfort* (Paris, 1884); T. F. Tout in the *Political History of England*, iii. (1905); J. E. Morris in *The Welsh Wars of Edward I.* (1901).

LLORENTE, JUAN ANTONIO (1756-1823), Spanish historian, was born on the 30th of March 1756 at Rincon de Soto in Aragon. He studied at the university of Saragossa, and, having been ordained priest, became vicar-general to the bishop of Calahorra in 1782. In 1785 he became commissary of the Holy Office at Logroño, and in 1789 its general secretary at Madrid. In the crisis of 1808 Llorente identified himself with the Bonapartists, and was engaged for a few years in superintending the execution of the decree for the suppression of the monastic orders, and in examining the archives of the Inquisition. On the return of King Ferdinand VII. to Spain in 1814 he withdrew to France, where he published his great work, *Historia critica de la inquisicion de España* (Paris, 1815-1817). Translated into English, French, German, Dutch and Italian, it attracted much attention in Europe, and involved its author in considerable persecution, which, on the publication of his *Portraits politiques des papes* in 1822, culminated in a peremptory order to quit France. He died at Madrid on the 5th of February 1823. Both the personal character and the literary accuracy of Llorente have been assailed, but although he was not an exact historian there is no doubt that he made an honest use of documents relating to the Inquisition which are no longer extant.

The English translation of the *Historia* (London, 1826) is abridged. Llorente also wrote *Memorias para la historia de la revolucion española* (Paris, 1814-1816), translated into French (Paris, 1815-1819); *Noticias historicas sobre las tres provincias vacongadas* (Madrid, 1806-1808); an autobiography, *Noticia biografica* (Paris, 1818), and other works.

LLOYD, EDWARD (1845-), English tenor vocalist, was born in London on the 7th of March 1845, his father, Richard Lloyd, being vicar choralist at Westminster Abbey. From 1852 to 1860 he sang in the abbey choir, and was thoroughly trained in music, eventually becoming solo tenor at the Chapel Royal. He began singing at concerts in 1867, and in 1871 appeared at the Gloucester Musical Festival. His fine evenly-produced voice and pure style at once brought him into notice, and he gradually took the place of Sims Reeves as the leading English tenor of the day, his singing of classical music, and especially of Handel, being particularly admired. At the Handel Festivals after 1888 he was the principal tenor, and even in the vast auditorium at the Crystal Palace he triumphed over acoustic difficulties. In 1888, 1890 and 1892 he paid successful visits to the United States; but by degrees he appeared less frequently in public, and in 1900 he formally retired from the platform.

LLOYD, WILLIAM (1627-1717), English divine, successively bishop of St Asaph, of Lichfield and Coventry, and of Worcester, was born at Tilehurst, Berkshire, in 1627, and was educated at Oriel and Jesus Colleges, Oxford. He graduated M.A. in 1646. In 1663 he was prebendary of Ripon, in

1667 prebendary of Salisbury, in 1668 archdeacon of Merioneth, in 1672 dean of Bangor and prebendary of St Paul's, London, in 1680 bishop of St Asaph, in 1689 lord-almoner, in 1692 bishop of Lichfield and Coventry, and in 1699 bishop of Worcester. Lloyd was an indefatigable opponent of the Roman Catholic tendencies of James II., and was one of the seven bishops who for refusing to have the Declaration of Indulgence read in his diocese was charged with publishing a seditious libel against the king and acquitted (1688). He engaged Gilbert Burnet to write *The History of the Reformation of the Church of England* and provided him with much material. He was a good scholar and a keen student of biblical apocalyptic literature and himself "prophesied" to Queen Anne, Robert Harley, earl of Oxford, William Whiston, and John Evelyn the diarist. Lloyd was a stanch supporter of the revolution. His chief publication was *An Historical Account of Church Government as it was in Great Britain and Ireland when they first received the Christian Religion* (London, 1684, reprinted Oxford, 1842). He died at Hartlebury castle on the 30th of August 1717.

LLOYD, WILLIAM WATKISS (1813-1893), English man of letters, was born at Homerton, Middlesex, on the 11th of March 1813. He received his early education at Newcastle-under-Lyme grammar school, and at the age of fifteen entered a family business in London, with which he was connected for thirty-five years. He devoted his leisure to the study of art, architecture, archaeology, Shakespeare, classical and modern languages and literature. He died in London on the 22nd of December 1893. The work by which he is best known is *The Age of Pericles* (1875), characterized by

soundness of scholarship, great learning, and a thorough appreciation of the period with which it deals, but rendered unattractive by a difficult and at times obscure style. He wrote also: *Xanthian Marbles* (1845); *Critical Essays upon Shakespeare's Plays* (1875); *Christianity in the Cartoons* [of Raphael] (1865), which excited considerable attention from the manner in which theological questions were discussed; *The History of Sicily to the Athenian War* (1872); *Panics and their Panaceas* (1869); an edition of *Much Ado about Nothing*, "now first published in fully recovered metrical form" (1884; the author held that all the plays were originally written in blank verse). A number of manuscripts still remain unpublished, the most important of which have been bequeathed to the British Museum, amongst them being: *A Further History of Greece*; *The Century of Michael Angelo*; *The Neo-Platonists*.

See Memoir by Sophia Beale prefixed to Lloyd's (posthumously published) *Elijah Fenton: his Poetry and Friends* (1894), containing a list of published and unpublished works.

LLOYD GEORGE, DAVID (1863-), British statesman, was born at Manchester on the 17th of January 1863. His father, William George, a Welshman of yeoman stock, had left Pembrokeshire for London at an early age and became a school teacher there, and afterwards in Liverpool and Haverfordwest, and then headmaster of an elementary school at Pwllheli, Carnarvonshire, where he married the daughter of David Lloyd, a neighbouring Baptist minister. Soon afterwards William George became headmaster of an elementary school in Manchester, but after the birth of his

eldest son David his health failed, and he gave up his post and took a small farm near Haverfordwest. Two years later he died, leaving his widow in poor circumstances; a second child, another son, was posthumously born. Mrs George's brother, Richard Lloyd, a shoemaker at Llanystumdwy, and pastor of the Campbellite Baptists there, now became her chief support; it was from him that young David obtained his earliest views of practical and political life, and also the means of starting, at the age of fourteen, on the career of a solicitor.

Having passed his law preliminary, he was articled to a firm in Portmadoc, and in 1884 obtained his final qualifications. In 1888 he married Margaret, daughter of Richard Owen of Criccieth. From the first he managed to combine his solicitor's work with politics, becoming secretary of the South Carnarvonshire Anti-tithe League; and his local reputation was made by a successful fight, carried to the High Court, in defence of the right of Nonconformists to burial in the parish churchyard. In the first county council elections for Carnarvonshire he played a strenuous part on the Radical side, and was chosen an alderman; and in 1890, at a by-election for Carnarvon Boroughs, he was returned to parliament by a majority of 18 over a strong Conservative opponent. He held his seat successfully at the contests in 1892, 1895 and 1900, his reputation as a champion of Welsh nationalism, Welsh nonconformity and extreme Radicalism becoming thoroughly established both in parliament and in the country. In the House of Commons he was one of the most prominent guerrilla fighters, conspicuous for his audacity and pungency of utterance, and his capacity for obstruction while the Conservatives were in office. During the South African crisis of 1899-1902 he was specially vehement in opposition to Mr Chamberlain, and took the "pro-Boer" side so bitterly that he was mobbed in Birmingham during the 1900 election when he attempted to address a meeting at the Town Hall. But he was again returned for Carnarvon Boroughs; and in the ensuing parliament he came still more to the front by his resistance to the Education Act of 1902.

As the leader of the Welsh party, and one of the most dashing parliamentarians on the Radical side, his appointment to office when Sir H. Campbell-Bannerman became premier at the end of 1905 was generally expected; but his elevation direct to the cabinet as president of the Board of Trade was somewhat of a surprise. The responsibilities of administration have, however, often converted a political free-lance into a steady-going official, and the Unionist press did its best to encourage such a tendency by continual praise of the departmental action of the new minister. His settlement of the railway dispute in 1906 was universally applauded; and the bills he introduced and passed for reorganizing the port of London, dealing with Merchant Shipping, and enforcing the working in England of patents granted there, and so increasing the employment of British labour, were greeted with satisfaction by the tariff-reformers, who congratulated themselves that a Radical free-trader should thus throw over the policy of *laisser faire*. The president of the Board of Trade was the chief success of the ministry, and when Mr Asquith became premier in 1908 and promoted Mr Lloyd George to the chancellorship of the exchequer, the appointment was well received even in the City of London. For that year the budget was already settled, and it was introduced by Mr Asquith himself, the ex-chancellor; but Mr Lloyd George earned golden opinions, both at the Treasury and in parliament, by his industry and his handling of the Finance Bill, especially important for its inclusion of Old Age Pensions, in the later stages.

It was not till the time came nearer for the introduction of the budget for 1909-1910 that opinion in financial circles showed the change which was afterwards to become so marked. A considerable deficit, of about £16,000,000, was in prospect, and the chancellor of the exchequer aroused misgivings by alluding in a speech to the difficulty he had in deciding what "hen roost" to "rob." The government had been losing ground in the country, and Mr Lloyd George and Mr Winston Churchill were conspicuously in alliance in advocating the use of the budget for introducing drastic reforms in regard to licensing and land, which the resistance of the House of Lords

prevented the Radical party from effecting by ordinary legislation. The well-established doctrine that the House of Lords could not amend, though it might reject, a money-bill, coupled with the fact that it never had gone so far as to reject a budget, was relied on by the extremists as dictating the obvious party tactics; and before the year 1909 opened, the possibility of the Lords being driven to compel a dissolution by standing on their extreme rights as regards the financial provision for the year was already canvassed in political circles, though it was hardly credited that the government would precipitate a constitutional crisis of such magnitude. When Mr Lloyd George, on the 29th of April, introduced his budget, its revolutionary character, however, created widespread dismay in the City and among the propertied classes. In a very lengthy speech, which had to be interrupted for half an hour while he recovered his voice, he ended by describing it as a "war budget" against poverty, which he hoped, in the result, would become "as remote to the people of this country as the wolves which once infested its forests." Some of the original proposals, which were much criticized, were subsequently dropped, including the permanent diversion of the Old Sinking Fund to a National Development Fund (created by a separate bill), and a tax on "ungotten minerals," for which was substituted a tax on mineral rights. But the main features of the budget were adhered to, and eventually passed the House of Commons on the 4th of November, in spite of the persistent opposition of the scanty Unionist minority. Apart from certain non-contentious provisions, such as a tax on motorcars, the main features of the measure were large increases in the spirit and tobacco duties, license duties, estate, legacy and succession duties, and income tax, and an elaborate and novel system of duties on land-values ("increment duty," "reversion duty," "undeveloped land duty"), depending on the setting up of arrangements for valuation of a highly complicated kind. The discussions on the budget entirely monopolized public attention for the year, and while the measure was defended by Mr Lloyd George in parliament with much suavity, and by Mr Asquith, Sir Edward Grey and Mr Haldane outside the House of Commons with tact and moderation, the

feelings of its opponents were exasperated by a series of inflammatory public speeches at Limehouse and elsewhere from the chancellor of the exchequer, who took these opportunities to rouse the passions of the working-classes against the landed classes and the peers. When the Finance Bill went up to the House of Lords, Lord Lansdowne gave notice that on the second reading he would move "that this House is not justified in giving its consent to this bill until it has been submitted to the judgment of the country," and on the last day of November this motion was carried by an overwhelming majority of peers. The government passed a solemn resolution of protest in the House of Commons and appealed to the country; and the general election of January 1910 took place amid unexampled excitement. The Unionists gained a hundred seats over their previous numbers, but the constitutional issue undoubtedly helped the government to win a victory, depending indeed solely on the votes of the Labour members and Irish Nationalists, which a year before had seemed improbable.

Events had now made Mr Lloyd George and his financial policy the centre of the Liberal party programme; but party tactics for the moment prevented the ministry, who remained in office, from simply sending the budget up again to the Lords and allowing them to pass it. There was no majority in the Commons for the budget as such, since the Irish Nationalists only supported it as an engine for destroying the veto of the Lords and thus preparing the way for Irish Home Rule. Instead, therefore, of proceeding with the budget, the government allowed the financial year to end without one, and brought forward resolutions for curtailing the powers of the Lords, on which, if rejected by them, another appeal could be made to the people (see PARLIAMENT). Hardly, however, had the battle been arrayed when the King's death in May upset all calculations. An immediate continuance of hostilities between the two Houses was impossible. A truce was called, and a conference arranged between four leaders from each side—Mr Lloyd George being one—to consider whether compromise on the constitutional question was not feasible. The budget for 1909-10 went quietly through, and before the August

adjournment the chancellor introduced his budget for 1910-11, discussion being postponed till the autumn. It imposed no new taxation, and left matters precisely as they were.

(H. Ch.)

LLOYD'S, an association of merchants, shipowners, underwriters, and ship and insurance brokers, having its headquarters in a suite of rooms in the north-east corner of the Royal Exchange, London. Originally a mere gathering of merchants for business or gossip in a coffee-house kept by one Edward Lloyd in Tower Street, London, the earliest notice of which occurs in the *London Gazette* of the 18th of February 1688, this institution has gradually become one of the greatest organizations in the world in connexion with commerce. The establishment existed in Tower Street up to 1692, in which year it was removed by the proprietor to Lombard Street, in the centre of that portion of the city most frequented by merchants of the highest class. Shortly after this event Mr Lloyd established a weekly newspaper furnishing commercial and shipping news, in those days an undertaking of no small difficulty. This paper took the name of *Lloyd's News*, and, though its life was not long, it was the precursor of the now ubiquitous *Lloyd's List*, the oldest existing paper, the *London Gazette* excepted. In Lombard Street the business transacted at Lloyd's coffee-house steadily grew, but it does not appear that throughout the greater part of the 18th century the merchants and underwriters frequenting the rooms were bound together by any rules, or acted under any organization. By and by, however, the increase of marine insurance business made a change of system and improved accommodation necessary, and after finding a temporary resting-place in Pope's Head Alley, the underwriters and

brokers settled in the Royal Exchange in March 1774. One of the first improvements in the mode of effecting marine insurance was the introduction of a printed form of policy. Hitherto various forms had been in use; and, to avoid numerous disputes the committee of Lloyd's proposed a general form, which was adopted by the members on the 12th of January 1779, and remains in use, with a few slight alterations, to this day. The two most important events in the history of Lloyd's during the 19th century were the reorganization of the association in 1811, and the passing of an act in 1871 granting to Lloyd's all the rights and privileges of a corporation sanctioned by parliament. According to this act of incorporation, the three main objects for which the society exists are—first, the carrying out of the business of marine insurance; secondly, the protection of the interests of the members of the association; and thirdly, the collection, publication and diffusion of intelligence and information with respect to shipping. In the promotion of the last-named object an intelligence department has been developed which for wideness of range and efficient working has no parallel among private enterprises. By Lloyd's Signal Station Act 1888, powers were conferred on Lloyd's to establish signal stations with telegraphic communications, and by the Derelict Vessels (Report) Act 1896, masters of British ships are required to give notice to Lloyd's agents of derelict vessels, which information is published by Lloyd's.

The rooms at Lloyd's are available only to subscribers and members. The former pay an annual subscription of five guineas without entrance fee, but have no voice in the management of the institution. The latter consist of non-underwriting members, who pay an entrance fee of twelve guineas, and of underwriting members who pay a fee of £100. Underwriting members are also required to deposit securities to the value of £5000 to £10,000, according to circumstances, as a guarantee for their engagements. The management of the establishment is delegated by the members to certain of their number selected as a "committee for managing the affairs of Lloyd's." With this body lies the appointment of all the officials and agents of the institution, the daily routine

of duty being entrusted to a secretary and a large staff of clerks and other assistants. The mode employed in effecting an insurance at Lloyd's is simple. The business is done entirely by brokers, who write upon a slip of paper the name of the ship and shipmaster, the nature of the voyage, the subject to be insured, and the amount at which it is valued. If the risk is accepted, each underwriter subscribes his name and the amount he agrees to take or underwrite, the insurance being effected as soon as the total value is made up.

See F. Martin, *History of Lloyd's and of Marine Insurance in Great Britain* (1876).

LLWYD, EDWARD (1660-1709), British naturalist and antiquary, was born in Cardiganshire in 1660. He was educated at Jesus College, Oxford, but did not graduate; he received the degree of M.A. however in 1701. In 1690, after serving for six years as assistant, he succeeded R. Plot as keeper of the Ashmolean museum, a position which he retained until 1709. In 1699 he published *Lithophylacii Britannici Ichnographia*, in which he described and figured various fossils, personally collected or received from his friends, and these were arranged in cabinets in the museum. They were obtained from many parts of England, but mostly from the neighbourhood of Oxford. A second edition was prepared by Llwyd, but not published until 1760. He issued in 1707 the first volume of *Archaeologia Britannica* (afterwards discontinued). He was elected F.R.S. in 1708. He died at Oxford on the 30th of June 1709.

LOACH. The fish known as loaches (*Cobitinae*) form a very distinct subfamily of the *Cyprinidae*, and are even regarded by some authors as constituting a family. Characters: Barbels, three to six pairs; pharyngeal teeth in one row, in moderate number; anterior part of the air-bladder divided into a right and left chamber, separated by a constriction, and enclosed in a bony capsule, the posterior part free or absent. They are more or less elongate in form, often eel-shaped, and naked or covered with minute scales. Most of the species are small, the largest known measuring 12 (the European *Misgurnus fossilis*), 13 (the Chinese *Botia variegata*), or 14 in. (the Central Asian *Nemachilus siluroides*). They mostly live in small streams and ponds, and many are mountain forms. They are almost entirely confined to Europe and Asia, but one species (*Nemachilus abyssinicus*) has recently been discovered in Abyssinia. About 120 species are known, mostly from Central and South-Eastern Asia. Only two species occur in Great Britain: the common *Nemachilus barbatulus* and the rarer and more local *Cobitis taenia*. The latter extends across Europe and Asia to Japan. Many of these fishes delight in the mud at the bottom of ponds, in which they move like eels. In some cases the branchial respiration appears to be insufficient, and the intestinal tract acts as an accessory breathing organ. The air-bladder may be so reduced as to lose its hydrostatic function and become subservient to a sensory organ, its outer exposed surface being connected with the skin by a meatus between the bands of muscle, and conveying the thermo-barometrical impressions to the auditory nerves. Loaches are known in some parts of Germany as “Wetterfisch.”

LOAD; LODE. The O.E. *lád*, from which both these words are derived, meant “way,” “journey,” “conveyance,” and is cognate with Ger. *Leite*. The Teutonic root is also seen in the O. Teut. *laidjan*, Ger. *leiten*, from which comes “to lead.” The meanings of the word have been influenced by a supposed connexion with “lade,” O.E. *hladan*, a word common to many old branches of Teutonic languages in the sense of “to place,” but used in English principally of the placing of cargo in a ship, hence “bill of lading,” and of emptying liquor or fluid out of one vessel into another; it is from the word in this sense that is derived “ladle,” a large spoon or cup-like pan with a long handle. The two words, though etymologically one, have been differentiated in meaning, the influence of the connexion with “lade” being more marked in “load” than in “lode,” a vein of metal ore, in which the original meaning of “way” is clearly marked. A “load” was originally a “carriage,” and its Latin equivalent in the *Promptorium Parvulorum* is *vectura*. From that it passed to that which is laid on an animal or vehicle, and so, as an amount usually carried, the word was used of a specific quantity of anything, a unit of weight, varying with the locality and the commodity. A “load” of wheat = 40 bushels, of hay = 36 trusses. Other meanings of “load” are: in electricity, the power which an engine or dynamo has to furnish; and in engineering, the weight to be supported by a structure, the “permanent load” being the weight of the structure itself, the “external load” that of anything which may be placed upon it.

LOAF, properly the mass of bread made at one baking, hence the smaller portions into which the bread is divided for retailing. These are of uniform size (see BAKING) and are named according to shape ("tin loaf," "cottage loaf," &c.), weight ("quartern loaf," &c.), or quality of flour ("brown loaf," &c.). "Loaf," O.E. *hláf*, is a word common to Teutonic languages; cf. Ger. *Laib*, or *Leib*, Dan. *lev*, Goth, *hlaifs*; similar words with the same meaning are found in Russian, Finnish and Lettish, but these may have been adapted from Teutonic. The ultimate origin is unknown, and it is uncertain whether "bread" (*q.v.*) or "loaf" is the earlier in usage. The O.E. *hláf* is seen in "Lammas" and in "lord," *i.e. hlaford* for *hlafweard*, the loaf-keeper, or "bread-warder"; cf. the O.E. word for a household servant *hláf-æta*, loaf-eater. The Late Lat. *companio*, one who shares, *panis*, bread, Eng. "companion," was probably an adaptation of the Goth, *gahlaiba*, O.H. Ger. *gileipo*, messmate, comrade. The word "loaf" is also used in sugar manufacture, and is applied to sugar shaped in a mass like a cone, a "sugar-loaf," and to the small knobs into which refined sugar is cut, or "loaf-sugar."

The etymology of the verb "to loaf," *i.e.* to idle, lounge about, and the substantive "loafer," an idler, a lazy vagabond, has been much discussed. R. H. Dana (*Two Years before the Mast*, 1840) called the word "a newly invented Yankee word." J. R. Lowell (*Biglow Papers*, 2nd series, Introd.) explains it as German in origin, and connects it with *laufen*, to run, and states that the dialectical form *lofen* is used in the sense of "saunter up and

down." This explanation has been generally accepted. The *New English Dictionary* rejects it, however, and states that *laufen* is not used in this sense, but points out that the German *Landläufer*, the English obsolete word "landlouper," or "landloper," one who wanders about the country, a vagrant or vagabond, has a resemblance in meaning. J. S. Farmer and W. E. Henley's *Dictionary of Slang and its Analogues* gives as French synonyms of "loafer," *chevalier de la loupe* and *loupeur*.

LOAM (O.E. *lám*; the word appears in Dut. *leem* and Ger. *Lehm*; the ultimate origin is the root *lai-*, meaning "to be sticky," which is seen in the cognate "lime," Lat. *limus*, mud, clay), a fertile soil composed of a mixture of sand, clay, and decomposed vegetable matter, the quantity of sand being sufficient to prevent the clay massing together. The word is also used of a mixture of sand, clay and straw, used for making casting-moulds and bricks, and for plastering walls, &c. (see SOIL).

LOAN (adapted from the Scandinavian form of a word common to Teutonic languages, cf. Swed. *lån*, Icel. *lán*, Dut. *leen*; the O.E. *laén*

appears in “lend,” the ultimate source is seen in the root of Gr. λείπειν and Lat. *linquere*, to leave), that which is lent; a sum of money or something of value lent for a specific or indefinite period when it or its equivalent is to be repaid or returned, usually at a specified rate of interest (see USURY and MONEY-LENDING). For public loans see FINANCE, NATIONAL DEBT, and the various sections on finance under the names of the various countries.

LOANDA (*São Paulo de Loanda*), a seaport of West Africa, capital of the Portuguese province of Angola, situated in 8° 48′ S., 13° 7′ E., on a bay between the rivers Bango and Kwanza. The bay, protected from the surf by a long narrow island of sand, is backed by a low sandy cliff which at its southern end sweeps out with a sharp curve and terminates in a bold point crowned by Fort San Miguel. The depth of water at the entrance to the bay is 20 fathoms or more. The bay has silted up considerably, but there is a good anchorage about 1½ m. from the shore in 7 to 14 fathoms, besides cranage accommodation and a floating dock. Vessels discharge into lighters, and are rarely delayed on account of the weather. A part of the town lies on the foreshore, but the more important buildings—the government offices, the governor’s residence, the palace of the bishop of Angola, and the hospital—are situated on higher ground. Most of the European houses are large stone buildings of one storey with red tile roofs. Loanda possesses a meteorological observatory, public garden, tramways, gas-works, statues to Salvador Correia de Sá, who wrested Angola from the Dutch, and to Pedro

Alexandrino, a former governor, and is the starting-point of the railway to Ambaca and Malanje.

Loanda was founded in 1576, and except between 1640 and 1648, when it was occupied by the Dutch, has always been in Portuguese possession. It was for over two centuries the chief centre of the slave trade between Portuguese West Africa and Brazil. During that time the traffic of the port was of no small account, and after a period of great depression consequent on the suppression of that trade, more legitimate commerce was developed. There is a regular service of steamers between the port and Lisbon, Liverpool and Hamburg. The town has some 15,000 inhabitants, including a larger European population than any other place on the west coast of Africa. It is connected by submarine cables with Europe and South Africa. Fully half the imports and export trade of Angola (*q.v.*) passes through Loanda.

LOANGO, a region on the west coast of Africa, extending from the mouth of the Congo river in 6° S. northwards through about two degrees. At one time included in the "kingdom of Congo" (see ANGOLA, *History*), Loango became independent about the close of the 16th century, and was still of considerable importance in the middle of the 18th century. Buali, the capital, was situated on the banks of a small river not far from the port of Loango, where were several European "factories." The country afterwards became divided into a large number of petty states, while Portugal and France exercised an intermittent sovereignty over the coast. Here the slave

trade was longer maintained than anywhere else on the West African seaboard; since its extirpation, palm oil and india-rubber have been the main objects of commerce. The Loango coast is now divided between French Congo and the Portuguese district of Kabinda (see those articles). The natives, mainly members of the Ba-Kongo group of Bantu negroes, and often called Ba-Fiot, are in general well-built, strongly dolichocephalous and very thick of skull, the skin of various shades of warm brown with the faintest suggestion of purple. Baldness is unknown, and many of the men wear beards. Physical deformity is extremely rare. In religious beliefs and in the use of fetishes they resemble the negroes of Upper Guinea.

LOBACHEVSKIY, NICOLAS IVANOVICH (1793-1856), Russian mathematician, was born at Makariev, Nizhniy-Novgorod, on the 2nd of November (N.S.) 1793. His father died about 1800, and his mother, who was left in poor circumstances, removed to Kazan with her three sons. In 1807 Nicolas, the second boy, entered as a student in the University of Kazan, then recently established. Five years later, having completed the curriculum, he began to take part in the teaching, becoming assistant professor in 1814 and extraordinary professor two years afterwards. In 1823 he succeeded to the ordinary professorship of mathematics, and retained the chair until about 1846, when he seems to have fallen into official disfavour. At that time his connexion with the university to which he had devoted his life practically came to an end, except that in 1855, at the celebration of his jubilee, he brought it as a last

tribute his *Pangéométrie*, in which he summarized the results of his geometrical studies. This work was translated into German by H. Liebmann in 1902. He died at Kazan on the 24th of February (N.S.) 1856. Lobachevskiy was one of the first thinkers to apply a critical treatment to the fundamental axioms of geometry, and he thus became a pioneer of the modern geometries which deal with space other than as treated by Euclid. His first contribution to non-Euclidian geometry is believed to have been given in a lecture at Kazan in 1826, but the subject is treated in many of his subsequent memoirs, among which may be mentioned the *Geometrische Untersuchungen zur Theorie der Parallellinien* (Berlin, 1840, and a new edition in 1887), and the *Pangéométrie* already referred to, which in the subtitle is described as a précis of geometry founded on a general and rigorous theory of parallels. (See GEOMETRY, § *Non-Euclidean*, and GEOMETRY, § *Axioms of*.) In addition to his geometrical studies, he made various contributions to other branches of mathematical science, among them being an elaborate treatise on algebra (Kazan, 1834). Besides being a geometer of power and originality, Lobachevskiy was an excellent man of business. Under his administration the University of Kazan prospered as it had never done before; and he not only organized the teaching staff to a high degree of efficiency, but arranged and enriched its library, furnished instruments for its observatory, collected specimens for its museums and provided it with proper buildings. In order to be able to supervise the erection of the last, he studied architecture, with such effect, it is said, that he was able to carry out the plans at a cost considerably below the original estimates.

See F. Engel, *N. I. Lobatchewsky* (Leipzig, 1899).

LOBANOV-ROSTOVSKI, ALEXIS BORISOVICH, Prince (1824-1896), Russian statesman, was born on the 30th of December 1824, and educated, like Prince Gorchakov and so many other eminent Russians, at the lyceum of Tsarskoe Selo. At the age of twenty he entered the diplomatic service, and became minister at Constantinople in 1859. In 1863 a regrettable incident in his private life made him retire temporarily from the public service, but four years later he re-entered it and served for ten years as *adlatus* to the minister of the interior. At the close of the Russo-Turkish war in 1878 he was selected by the emperor to fill the post of ambassador at Constantinople, and for more than a year he carried out with great ability the policy of his government, which aimed at re-establishing tranquillity in the Eastern Question, after the disturbances produced by the reckless action of his predecessor, Count Ignatiev. In 1879 he was transferred to London, and in 1882 to Vienna; and in March 1895 he was appointed minister of foreign affairs in succession to M. de Giers. In this position he displayed much of the caution of his predecessor, but adopted a more energetic policy in European affairs generally and especially in the Balkan Peninsula. At the time of his appointment the attitude of the Russian government towards the Slav nationalities had been for several years one of extreme reserve, and he had seemed as ambassador to sympathize with this attitude. But as soon as he became minister of foreign affairs, Russian influence in the Balkan Peninsula suddenly revived. Servia received financial assistance; a large

consignment of arms was sent openly from St Petersburg to the prince of Montenegro; Prince Ferdinand of Bulgaria became ostensibly reconciled with the Russian emperor, and his son Boris was received into the Eastern Orthodox Church; the Russian embassy at Constantinople tried to bring about a reconciliation between the Bulgarian exarch and the oecumenical patriarch; Bulgarians and Servians professed, at the bidding of Russia, to lay aside their mutual hostility. All this seemed to foreshadow the creation of a Balkan confederation hostile to Turkey, and the sultan had reason to feel alarmed. In reality Prince Lobanov was merely trying to establish a strong Russian hegemony among these nationalities, and he had not the slightest intention of provoking a new crisis in the Eastern Question so long as the general European situation did not afford Russia a convenient opportunity for solving it in her own interest without serious intervention from other powers. Meanwhile he considered that the integrity and independence of the Ottoman empire must be maintained so far as these other powers were concerned. Accordingly, when Lord Salisbury proposed energetic action to protect the Armenians, the cabinet of St Petersburg suddenly assumed the rôle of protector of the sultan and vetoed the proposal. At the same time efforts were made to weaken the Triple Alliance, the principal instrument employed being the *entente* with France, which Prince Lobanov helped to convert into a formal alliance between the two powers. In the Far East he was not less active, and became the protector of China in the same sense as he had shown himself the protector of Turkey. Japan was compelled to give up her conquests on the Chinese mainland, so as not to interfere with the future action of Russia in Manchuria, and the financial and other schemes for increasing Russian influence in that part of the world were vigorously supported. All this activity, though combined with a haughty tone towards foreign governments and diplomatists, did not produce much general apprehension, probably because there was a widespread conviction that he desired to maintain peace, and that his great

ability and strength of character would enable him to control the dangerous forces which he boldly set in motion. However this may be, before he had time to mature his schemes, and when he had been the director of Russian policy for only eighteen months, he died suddenly of heart disease when travelling with the emperor on the 30th of August 1896. Personally Prince Lobanov was a *grand seigneur* of the Russian type, proud of being descended from the independent princes of Rostov, and at the same time an amiable man of wide culture, deeply versed in Russian history and genealogy, and perhaps the first authority of his time in all that related to the reign of the emperor Paul.

(D. M. W.)

LÖBAU, a town of Germany, in the kingdom of Saxony, on the Löbau water, 12 m. S.E. of the town of Bautzen, on the Dresden-Görlitz railway. Pop. (1905) 10,683. There is a spa, König Albert-Bad, largely frequented during the summer season. The town has agricultural implement, pianoforte, sugar, machine-building and button works, and trade in grain, yarn, linen and stockings. Other industries are spinning, weaving, dyeing, bleaching and brewing.

Löbau is first mentioned as a town in 1221; it received civic rights early in the 14th century and, in 1346, became one of the six allied towns of Lusatia. It suffered severely during the Hussite war and was deprived of its rights in 1547.

See Bergmann, *Geschichte der Oberlausitzer Sechsstadt Löbau* (Bischofswerda, 1896); and Kretschmer, *Die Stadl Löbau* (Chemnitz, 1904).

LOBBY, a corridor or passage, also any apartment serving as an ante-room, waiting room or entrance hall in a building. The Med. Lat. *lobia*, *laubia* or *lobium*, from which the word was directly adapted, was used in the sense of a cloister, gallery or covered place for walking attached to a house, as defined by Du Cange (*Gloss. Med. et Inf. Lat.*, s.v. *Lobia*), *porticus operta ad spatiandum idonea, aedibus adjuncta*. The French form of *lobia* was *loge*, cf. Ital. *loggia*, and this gave the Eng. "lodge," which is thus a doublet of "lobby." The ultimate derivation is given under LODGE. Other familiar uses of the term "lobby" are its application (1) to the entrance hall of a parliament house, and (2) to the two corridors known as "division-lobbies," into which the members of the House of Commons and other legislative bodies pass on a division, their votes being recorded according to which "lobby," "aye" or "no," they enter. The entrance lobby to a legislative building is open to the public, and thus is a convenient place for interviews between members and their constituents or with representatives of public bodies, associations and interests, and the press. The influence and pressure thus brought to bear upon members of legislative bodies has given rise to the use of "to lobby," "lobbying," "lobbyist," &c., with this special significance. The practice, though not

unknown in the British parliament, is most prevalent in the United States of America, where the use of the term first arose (see below).

LOBBYING, in America, a general term used to designate the efforts of persons who are not members of a legislative body to influence the course of legislation. In addition to the large number of American private bills which are constantly being introduced in Congress and the various state legislatures, there are many general measures, such as proposed changes in the tariff or in the railway or banking laws, which seriously affect special interests. The people who are most intimately concerned naturally have a right to appear before the legislature or its representative, the committee in charge of the bill, and present their side of the case. Lobbying in this sense is legitimate, and may almost be regarded as a necessity. Unfortunately, however, all lobbying is not of this innocent character. The great industrial corporations, insurance companies, and railway and traction monopolies which have developed in comparatively recent years are constantly in need of legislative favours; they are also compelled to protect themselves against legislation which is unreasonably severe, and against what are known in the slang of politics as *strikes* or *hold-ups*.[1] In order that these objects may be accomplished there are kept at Washington and at the various state capitals paid agents whose influence is so well recognized that they are popularly called “the third house.” Methods of the most reprehensible kind have often been employed by them.

Attempts have been made to remedy the evil by constitutional prohibition, by statute law and by the action of the governor of the state supported by public opinion. Improper lobbying has been declared a felony in California, Georgia, Utah, Tennessee, Oregon, Montana and Arizona, and the constitutions of practically all of the states impose restrictions upon the enactment of special and private legislation. The Massachusetts anti-lobbying act of 1890, which has served as a model for the legislation of Maryland (1900), Wisconsin (1905) and a few of the other states, is based upon the publicity principle. Counsel and other legislative agents must register with the sergeant-at-arms giving the names and addresses of their employers and the date, term and character of their employment. In 1907 alone laws regulating lobbying were passed in nine states—Alabama, Connecticut, Florida, Idaho, Missouri, Nebraska, North Dakota, South Dakota and Texas.

See James Bryce, *American Commonwealth* (New York, ed. 1889), i. 673-678; Paul S. Reinsch, *American Legislatures and Legislative Methods* (New York, 1907), chaps. viii., ix.; Margaret A. Schaffner, "Lobbying," in *Wisconsin Comparative Legislation Bulletins*, No. 2; and G. M. Gregory, *The Corrupt Use of Money in Politics and Laws for its Prevention* (Madison, Wis., 1893).

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1 Bills introduced for purposes of blackmail.

LOBE, any round projecting part, specifically the lower part of the external ear, one of the parts into which the liver is divided, also one of several parts of the brain, divided by marked fissures (see LIVER and BRAIN). The Greek λοβός, from which "lobe" is derived, was applied to the lobe of the ear and of the liver, and to the pod of a leguminous plant.

LOBECK, CHRISTIAN AUGUST (1781-1860), German classical scholar, was born at Naumburg on the 5th of June 1781. After having studied at Jena and Leipzig, he settled at Wittenberg in 1802 as privat-docent, and in 1810 was appointed to a professorship in the university. Four years later, he accepted the chair of rhetoric and ancient literature at Königsberg, which he occupied till within two years of his death (25th of August 1860). His literary activities were devoted to the history of Greek religion and to the Greek language and literature. His greatest work, *Aglaophamus* (1829), is still valuable to students. In this he maintains, against the views put forward by G. F. Creuzer in his *Symbolik* (1810-1823), that the religion of the Greek mysteries (especially those of Eleusis) did not essentially differ from the national religion; that it was not esoteric; that the priests as such neither taught nor possessed any higher knowledge of God; that the Oriental elements were a later importation. His edition of the *Ajax* of Sophocles (1809) had gained him the reputation of a sound scholar and critic; his Phrynichus (1820) and *Paralipomena grammaticae graecae* (1837) exhibit the widest acquaintance with Greek

literature. He had little sympathy with comparative philology, holding that it needed a lifetime to acquire a thorough knowledge of a single language.

See the article by L. Friedländer in *Allgemeine deutsche Biographie*; C. Bursian's *Geschichte der klassischen Philologie in Deutschland* (1883); Lehrs, *Populäre Aufsätze aus dem Altertum* (2nd ed., Leipzig, 1875); Ludwich, *Ausgewählte Briefe von und an Chr. Aug. Lobeck und K. Lehrs* (1894); also J. E. Sandys, *History of Classical Scholarship*, i. (1908), 103.

LOBEIRA, JOÃO (*c.* 1233-1285), a Portuguese troubadour of the time of King Alphonso III., who is supposed to have been the first to reduce into prose the story of *Amadis de Gaula* (*q.v.*). D. Carolina Michaelis de Vasconcellos, in her masterly edition of the *Cancioneiro de Ajuda* (Halle, 1904, vol. i. pp. 523-524), gives some biographical notes on João Lobeira, who is represented in the Colocci Brancuti *Canzoniere* (Halle, 1880) by five poems (Nos. 230-235). In number 230, João Lobeira uses the same *ritournelle* that Oriana sings in *Amadis de Gaula*, and this has led to his being generally considered by modern supporters of the Portuguese case to have been the author of the romance, in preference to Vasco de Lobeira, to whom the prose original was formerly ascribed. The folklorist A. Thomas Pires (in his *Vasco de Lobeira*, Elvas, 1905), following the old tradition, would identify the novelist with a man of that name who flourished in Elvas at the close of the 14th and beginning of the 15th century, but the

documents he publishes contain no reference to this Lobeira being a man of letters.

LOBELIA, the typical genus of the tribe *Lobelieae*, of the order Campanulaceae, named after Matthias de Lobel, a native of Lille, botanist and physician to James I. It numbers about two hundred species, natives of nearly all the temperate and warmer regions of the world, excepting central and eastern Europe as well as western Asia. They are annual or perennial herbs or under-shrubs, rarely shrubby; remarkable arborescent forms are the tree-lobelias found at high elevations on the mountains of tropical Africa. Two species are British, *L. Dortmanna* (named by Linnaeus after Dortmann, a Dutch druggist), which occurs in gravelly mountain lakes; and *L. urens*, which is only found on heaths, &c., in Dorset and Cornwall. The genus is distinguished from *Campanula* by the irregular corona and completely united anthers, and by the excessive acridity of the milky juice. The species earliest described and figured appears to be *L. cardinalis*, under the name *Trachelium americanum sive cardinalis planta*, “the rich crimson cardinal’s flower”; Parkinson (*Paradisus*, 1629, p. 357) says, “it groweth neere the riuer of Canada, where the French plantation in America is seated.” It is a native of the eastern United States. This and several other species are in cultivation as ornamental garden plants, *e.g.* the dwarf blue *L. Erinus*, from the Cape, which, with its numerous varieties, forms a familiar bedding plant. *L. splendens* and *L. fulgens*, growing from 1 to 2 ft. high, from Mexico, have scarlet flowers; *L. Tupa*, a Chilean perennial 6 to 8 ft.

high, has reddish or scarlet flowers; *L. tenuior* with blue flowers is a recent acquisition to the greenhouse section, while *L. amaena*, from North America, as well as *L. syphilitica* and its hybrids, from Virginia, have also blue flowers. The last-named was introduced in 1665. The hybrids raised by crossing *cardinalis*, *fulgens*, *splendens* and *syphilitica*, constitute a fine group of fairly hardy and showy garden plants. Queen Victoria is a well-known variety, but there are now many others.

The *Lobelia* is familiar in gardens under two very different forms, that of the dwarf-tufted plants used for summer bedding, and that of the tall showy perennials. Of the former the best type is *L. Erinus*, growing from 4 to 6 in. high, with many slender stems, bearing through a long period a profusion of small but bright blue two-lipped flowers. The variety *speciosa* offers the best strain of the dwarf lobelias; but the varieties are being constantly superseded by new sorts. A good variety will reproduce itself sufficiently true from seed for ordinary flower borders, but to secure exact uniformity it is necessary to propagate from cuttings.

The herbaceous lobelias, of which *L. fulgens* may be taken as the type, may be called hardy except in so far as they suffer from damp in winter; they throw up a series of short rosette-like suckers round the base of the old flowering stem, and these sometimes, despite all the care taken of them, rot off during winter. The roots should either be taken up in autumn, and planted closely side by side in boxes of dry earth or ashes, these being set for the time they are dormant either in a cold frame or in any airy place in the greenhouse; or they may be left in the ground, in which case a brick or two should be put beside the plants, some coal ashes being first placed round them, and slates to protect the plants being laid over the bricks, one end resting on the earth beyond. About February they should be placed in a warm pit, and after a few days shaken out and the suckers parted, and potted singly into small pots of light rich earth. After being kept in the

forcing pit until well established, they should be moved to a more airy greenhouse pit, and eventually to a cold frame preparatory to planting out. In the more favoured parts of the United Kingdom it is unnecessary to go to this trouble, as the plants are perfectly hardy; even in the suburbs of London they live for several years without protection except in very severe winters. They should have a loamy soil, well enriched with manure; and require copious waterings when they start into free growth. They may be raised from seeds, which, being very fine, require to be sown carefully; but they do not flower usually till the second year unless they are sown very early in heat.

The species *Lobelia inflata*, the "Indian tobacco" of North America, is used in medicine, the entire herb, dried and in flower, being employed. The species derives its specific name from its characteristic inflated capsules. It is somewhat irritant to the nostrils, and is possessed of a burning, acrid taste. The chief constituent is a volatile liquid alkaloid (cf. nicotine) named lobeline, which occurs to the extent of about 30 %. This is a very pungent body, with a tobacco-like odour. It occurs in combination with lobelic acid and forms solid crystalline salts. The single preparation of this plant in the British Pharmacopeia is the *Tinctura Lobeliae Ethereae*, composed of five parts of spirits of ether to one of lobelia. The dose is 5 to 15 minims. The ether is employed in order to add to the efficacy of the drug in asthma, but a simple alcoholic tincture would be really preferable.

Lobelia has certain pharmacological resemblances to tobacco. It has no action upon the unbroken skin, but may be absorbed by it under suitable conditions. Taken internally in small doses, *e.g.* 5 minims of the tincture, it stimulates the peristaltic movements of the coecum and colon. In large doses it is a powerful gastrointestinal irritant, closely resembling tobacco, and causing giddiness, headache, nausea, vomiting, purging and extreme prostration, with clammy sweats and faltering rapid pulse. Its action on the

circulation is very decided. The cardiac terminals of the vagus nerves are paralysed, the pulse being thus accelerated by loss of the normal inhibitory influence, and the blood-vessels being relaxed owing to paresis of the vasomotor centre. The blood-pressure thus falls very markedly. The respiratory centre is similarly depressed, death ensuing from this action. Lobelia is thus a typical respiratory poison. In less than toxic doses the motor terminals of the vagi in the bronchi and bronchioles are paralysed, thus causing relaxation of the bronchial muscles. It is doubtful whether lobelia affects the cerebrum directly. It is excreted by the kidneys and the skin, both of which it stimulates in its passage. In general terms the drug may be said to stimulate non-striped muscular fibres in small, and paralyse them in toxic doses.

Five minims of the tincture may be usefully prescribed to be taken night and morning in chronic constipation due to inertia of the lower part of the alimentary canal. In spasmodic (neurotic) asthma, and also in bronchitis accompanied by asthmatic spasm of the bronchioles, the tincture may be given in comparatively large doses (*e.g.* one drachm) every fifteen minutes until nausea is produced. Thereafter, whether successful or not in relieving the spasm, the administration of the drug must be stopped.

LOBENSTEIN, a town of Germany, in the principality of Reuss, on the Lemnitz, situated in a pleasant and fertile country, 25 m. N.W. from Hof by railway. Pop. (1905) 2990. The town, grouped round a rock, upon which stand the ruins of the old castle, is exceedingly picturesque. It

contains a spacious parish church, a palace, until 1824 the residence of the princes of Reuss-Lobenstein-Elersdorf, and a hydropathic establishment. The manufactures include dyeing, brewing and cigar-making.

See Zedler and Schott, *Führer durch Lobenstein und Umgebung* (2nd ed., Lobenstein, 1903).

LOBO, FRANCISCO RODRIGUES

(?1575-?1627), Portuguese bucolic writer, a lineal descendant in the family of letters of Bernardim Ribeiro and Christovam Falcão. All we know of his life is that he was born of rich and noble parents at Leiria, and lived at ease in its picturesque neighbourhood, reading philosophy and poetry and writing of shepherds and shepherdesses by the rivers Liz and Lena. He studied at the university of Coimbra and took the degree of licentiate about 1600. He visited Lisbon from time to time, and tradition has it that he died by drowning on his way thither as he was descending the Tagus from Santarem. Though his first book, a little volume of verses (Romances) published in 1596, and his last, a rhymed welcome to King Philip III., published in 1623, are written in Spanish, he composed his eclogues and prose pastorals entirely in Portuguese, and thereby did a rare service to his country at a time when, owing to the Spanish domination, Castilian was the language preferred by polite society and by men of letters. His *Primavera*, a book that may be compared to the *Diana* of Jorge de Montemôr (Montemayor), appeared in 1601, its second part, the *Pastor Peregrino*, in

1608, and its third, the *Desenganado*, in 1614. The dullness of these lengthy collections of episodes without plan, thread or ideas, is relieved by charming and ingenious pastoral songs named *serranilhas*. His eclogues in endecasyllables are an echo of those of Camoens, but like his other verses they are inferior to his *redondilhas*, which show the traditional fount of his inspiration. In his *Corte na Aldeia* (1619), a man of letters, a young nobleman, a student and an old man of easy means, beguile the winter evenings at Cintra by a series of philosophic and literary discussions in dialogue which may still be read with pleasure. Lobo is also the author of an insipid epic in twenty cantos in *ottava rima* on the Constable D. Nuno Alvares Pereira, the hero of the war of independence against Spain at the end of the 14th century. The characteristics of his prose style are harmony, purity and elegance, and he ranks as one of Portugal's leading writers. A disciple of the Italian school, his verses are yet free from imitations of classical models, his descriptions of natural scenery are unsurpassed in the Portuguese language, and generally his writings strike a true note and show a sincerity that was rare at the time. Their popularity may be seen by the fact that the *Primavera* went through seven editions in the 17th century and nine in all, a large number for so limited a market as that of Portugal, while six editions exist of the *Pastor Peregrino* and four of the epic poem. An edition of his collected works was published in one volume in Lisbon in 1723, and another in four volumes, but less complete, appeared there in 1774.

See Costa e Silva, *Ensaio biographico critico*, v. 5-112, for a critical examination of Lobo's writings; also Bouterwek's *History of Portuguese Literature*.

(E. Pr.)

LOBO, JERONIMO (1593-1678), Jesuit missionary, was born in Lisbon, and entered the Order of Jesus at the age of sixteen. In 1621 he was ordered as a missionary to India, and in 1622 he arrived at Goa. With the intention of proceeding to Abyssinia, whose Negus (emperor) Segued had been converted to Roman Catholicism by Pedro Paez, he left India in 1624. He disembarked on the coast of Mombasa, and attempted to reach his destination through the Galla country, but was forced to return. In 1625 he set out again, accompanied by Mendez, the patriarch of Ethiopia, and eight missionaries. The party landed on the coast of the Red Sea, and Lobo settled in Abyssinia as superintendent of the missions in Tigré. He remained there until death deprived the Catholics of their protector, the emperor Segued. Forced by persecution to leave the kingdom, in 1634 Lobo and his companions fell into the hands of the Turks at Massawa, who sent him to India to procure a ransom for his imprisoned fellow-missionaries. In this he was successful, but could not induce the Portuguese viceroy to send an armament against Abyssinia. Intent upon accomplishing this cherished project, he embarked for Portugal, and after he had been shipwrecked on the coast of Natal, and captured by pirates, arrived at Lisbon. Neither at this city, however, nor at Madrid and Rome, was any countenance given to Lobo's plan. He accordingly returned to India in 1640, and was elected rector, and afterwards provincial, of the Jesuits at Goa. After some years he returned to his native city, and died there on the 29th of January 1678.

Lobo wrote an account of his travels in Portuguese, which appears never to have been printed, but is deposited in the monastery of St Roque, Lisbon. Balthazar Telles made large use of the information therein in his *Historia geral da Ethiopia a Alta* (Coimbra, 1660), often erroneously attributed to Lobo (see Machado's *Bibliotheca Lusitana*). Lobo's own narrative was translated from a MS. copy into French in 1728 by the Abbé Joachim le Grand, under the title of *Voyage historique d'Abissinie*. In 1669 a translation by Sir Peter Wyche of several passages from a MS. account of Lobo's travels was published by the Royal Society (translated in M. Thévenot's *Relation des voyages* in 1673). An English abridgment of Le Grand's edition by Dr Johnson was published in 1735 (reprinted 1789). In a *Mémoire justificatif en réhabilitation des pères Pierre Paez et Jérôme Lobo*, Dr C. T. Beke maintains against Bruce the accuracy of Lobo's statements as to the source of the Abai branch of the Nile. See A. de Backer, *Bibliothèque de la Compagnie de Jésus* (ed. C. Sommervogel, iv., 1893).

LOBSTER (O.E. *lopustre*, *lopystre*, a corruption of Lat. *locusta*, lobster or other marine shell-fish; also a locust), an edible crustacean found on the coasts of the North Atlantic and Mediterranean. The name is sometimes loosely applied to any of the larger Crustacea of the order Macrura, especially to such as are used for food.

The true lobsters, forming the family *Homaridae*, are distinguished from the other Macrura by having the first three pairs of legs terminating in

chelae or pincers. The first pair are large and massive and are composed of six segments, while the remaining legs are each composed of seven segments. The sternum of the last thoracic somite is immovably united with the preceding. This last character, together with some peculiarities of the branchial system, distinguish the lobsters from the freshwater crayfishes. The common lobster (*Homarus gammarus* or *vulgaris*) is found on the European coasts from Norway to the Mediterranean. The American lobster (*Homarus americanus*), which should perhaps be ranked as a variety rather than as a distinct species, is found on the Atlantic coast of North America from Labrador to Cape Hatteras. A third species, found at the Cape of Good Hope, is of small size and of no economic importance.

Both in Europe and in America the lobster is the object of an important fishery. It lives in shallow water, in rocky places, and is usually captured in traps known as lobster-pots, or creels, made of wickerwork or of hoops covered with netting, and having funnel-shaped openings permitting entrance but preventing escape. These traps are baited with pieces of fish, preferably stale, and are sunk on ground frequented by lobsters, the place of each being marked by a buoy. In Europe the lobsters are generally sent to market in the fresh state, but in America, especially in the northern New England states and in the maritime provinces of Canada, the canning of lobsters is an important industry. The European lobster rarely reaches 10 pounds in weight, though individuals of 14 pounds have been found, and in America there are authentic records of lobsters weighing 20 to 23 pounds.

The effects of over-fishing have become apparent, especially in America, rather in the reduced average size of the lobsters caught than in any diminution of the total yield. The imposition of a close time to protect the spawning lobsters has been often tried, but as the female carries the spawn attached to her body for nearly twelve months after spawning it is impossible to give any effective protection by this means. The prohibition

of the capture of females carrying spawn, or, as it is termed, “in berry,” is difficult to enforce. A minimum size, below which it is illegal to sell lobsters, is fixed by law in most lobster-fishing districts, but the value of the protection so given has also been questioned.

The Norway lobster (*Nephrops norvegicus*) is found, like the common lobster, from Norway to the Mediterranean. It is a smaller species, with long and slender claws and is of an orange colour, often beautifully marked with red and blue. It is found in deeper water and is generally captured by trawling. It is a curious and unexplained fact that nearly all the individuals so captured are males. It is less esteemed for food than the common species. In London it is sold under the name of “Dublin prawn.”

The rock lobster, spiny lobster, or sea-crawfish (*Palinurus vulgaris*) belongs to the family *Palinuridae*, distinguished from the *Homaridae* by the fact that the first legs are not provided with chelae or pincers, and that all the legs possess only six segments. The antennae are very long and thick. It is found on the southern and western coasts of the British, Islands and extends to the Mediterranean. It is highly esteemed for the table, especially in France, where it goes by the name of *Langouste*. Other species of the same family are used for food in various parts of the world, especially on the Pacific coast of North America and in Australia and New Zealand.

In Melbourne and Sydney the name of “Murray lobster” is given to a large species of crayfish (*Astacopsis spinifer*, formerly known as *Astacus*, or *Potamobius serratus*) which is much used for food.

(W. T. Ca.)

LOCAL GOVERNMENT, a phrase specially adopted in English usage for the decentralized or deconcentrated administration, within a state or national and central government, of local affairs by local authorities. It is restricted not only in respect of area but also in respect of the character and extent of the duties assigned to them. It is not to be confused with local self-government in the wider sense in which the words are sometimes employed, *e.g.* for the granting by the crown of self-government to a colony; the expression, in a general way, may mean this, but "local government" as technically used in England refers more narrowly to the system of county or municipal administration, and English usage transfers it to denote the similar institutions in other countries. The growth and persistence of this kind of subordinate government is due practically to the need of relieving the central authority in the state, and to experience of the failure of a completely centralized bureaucracy. The degree to which local government is adopted varies considerably in different countries, and those which are the best examples of it in modern times—the United Kingdom, the United States, France and Germany—differ very much in their local institutions, partly through historical, partly through temperamental, causes. A certain shifting of ideas from time to time, as to what is local and what is central, is inevitable, and the same view is not possible in countries of different configuration, history or political system. The history and present state of the local government in the various countries are dealt with in the separate articles on them (ENGLAND,

GERMANY, &c.), in the sections dealing with government and administration, or political institutions.

The best recent comparative study of local government is Percy Ashley's *Local and Central Government* (Murray, 1906), an admirable account of the evolution and working of the systems in England, France, Prussia and United States. Other important works, in addition to general works on constitutional law, are J. A. Fairlie's *Municipal Administration*, Shaw's *Municipal Government in Continental Europe*, Redlich and Hirst's *Local Government in England*, Mr and Mrs Sidney Webb's elaborate historical inquiry into English local government (1906), and for Germany, Bornhak's *Geschichte des preussischen Verwaltungsrechts*.

LOCAL GOVERNMENT BOARD,

a department of the administration of the United Kingdom, constituted in 1871. It is the successor of the General Board of Health, established in 1848 pursuant to the Public Health Act of that year. The General Board of Health continued in existence until 1854, when it was reconstituted. Its existence under its new constitution was originally limited to one year, but was extended from year to year until 1858, when it was allowed to expire, its powers under the various acts for the prevention of diseases being transferred to the privy council, while those which related to the control of local authorities passed to the secretary of state for the home department, to whose department the staff of officers and clerks belonging to the board was transferred. This state

of affairs continued until 1871, when the Local Government Board was created by the Local Government Board Act 1871. It consists of the lord president of the council, the five principal secretaries of state, the lord privy seal, the chancellor of the exchequer and a president appointed by the sovereign. The board itself seldom meets, and the duties of the department are discharged by the president assisted by a parliamentary and a permanent secretary and a permanent staff. The president and one of the secretaries usually have seats in parliament, and the president is generally a member of the cabinet. The salary of the president, formerly £2000, was raised in 1910 to £5000 a year. The board has all the powers of the secretary of state under the Public Health Act 1848, and the numerous subsequent acts relating to sanitary matters and the government of sanitary districts; together with all the powers and duties of the privy council under the acts relating to the prevention of epidemic disease and to vaccination. The powers and duties of the board have been largely added to by legislation since its creation; it may be said that the board exercises a general supervision over the numerous authorities to whom local government has been entrusted (see ENGLAND: *Local Government*). A committee presided over by Lord Jersey in 1904 inquired into the constitution and duties of the board, but made no recommendation as to any change therein. It recommended, however, an increase in the salaries of the president and of the parliamentary and permanent secretaries.

LOCARNO (Ger. *Luggarus*), a small town of Italian appearance in the Swiss canton of Tessin or Ticino, of which till 1881 it was one of the three capitals (the others being Bellinzona, *q.v.*, and Lugano, *q.v.*). It is built at the north or Swiss end of the Lago Maggiore, not far from the point at which the Maggia enters that lake, and is by rail 14 m. S.W. of Bellinzona. Its height above the sea-level is only 682 ft., so that it is said to be the lowest spot in Switzerland. In 1900 its population was 3603, mainly Italian-speaking and Romanists. It was taken from the Milanese in 1512 by the Swiss who ruled it till 1798, when it became part of the canton of Lugano in the Helvetic Republic, and in 1803 part of that of Tessin or Ticino, then first erected. In 1555 a number of Protestant inhabitants were expelled for religious reasons, and going to Zürich founded the silk industry there. Above Locarno is the romantically situated sanctuary of the Madonna del Sasso (now rendered easily accessible by a funicular railway) that commands a glorious view over the lake and the surrounding country.

(W. A. B. C.)

LOCH, HENRY BROUGHAM LOCH, 1ST BARON (1827-1900), British colonial administrator, son of James Loch, M.P., of Drylaw, Midlothian, was born on the 23rd of May 1827. He entered the navy, but at the end of two years quitted it for the East India Company's military service, and in 1842 obtained a commission in the Bengal Light Cavalry. In the Sikh war in 1845 he was given an appointment on the staff of Sir Hugh Gough, and served throughout the Sutlej campaign. In 1852 he

became second in command of Skinner's Horse. At the outbreak of the Crimean war in 1854, Loch severed his connexion with India, and obtained leave to raise a body of irregular Bulgarian cavalry, which he commanded throughout the war. In 1857 he was appointed attaché to Lord Elgin's mission to the East, was present at the taking of Canton, and in 1858 brought home the treaty of Yedo. In April 1860 he again accompanied Lord Elgin to China, as secretary of the new embassy sent to secure the execution by China of her treaty engagements. The embassy was backed up by an allied Anglo-French force. With Harry S. Parkes he negotiated the surrender of the Taku forts. During the advance on Peking Loch was chosen with Parkes to complete the preliminary negotiations for peace at Tungchow. They were accompanied by a small party of officers and Sikhs. It having been discovered that the Chinese were planning a treacherous attack on the British force, Loch rode back and warned the outposts. He then returned to Parkes and his party under a flag of truce hoping to secure their safety. They were all, however, made prisoners and taken to Peking, where the majority died from torture or disease. Parkes and Loch, after enduring irons and all the horrors of a Chinese prison, were afterwards more leniently treated. After three weeks' time the negotiations for their release were successful, but they had only been liberated ten minutes when orders were received from the Chinese emperor, then a fugitive in Mongolia, for their immediate execution. Loch never entirely recovered his health after this experience in a Chinese dungeon. Returning home he was made C.B., and for a while was private secretary to Sir George Grey, then at the Home Office. In 1863 he was appointed lieutenant-governor of the Isle of Man. During his governorship the House of Keys was transformed into an elective assembly, the first line of railway was opened, and the influx of tourists began to bring fresh prosperity to the island. In 1882 Loch, who had become K.C.B. in 1880, accepted a commissionership of woods and forests, and two years later was made governor of Victoria, where he won the esteem of all

classes. In June 1889 he succeeded Sir Hercules Robinson as governor of Cape Colony and high commissioner of South Africa.

As high commissioner his duties called for the exercise of great judgment and firmness. The Boers were at the same time striving to frustrate Cecil Rhodes's schemes of northern expansion and planning to occupy Mashonaland, to secure control of Swaziland and Zululand and to acquire the adjacent lands up to the ocean. Loch firmly supported Rhodes, and, by informing President Kruger that troops would be sent to prevent any invasion of territory under British protection, he effectually crushed the "Banyailand trek" across the Limpopo (1890-91). Loch, however, with the approval of the imperial government, concluded in July-August 1890 a convention with President Kruger respecting Swaziland, by which, while the Boers withdrew all claims to territory north of the Transvaal, they were granted an outlet to the sea at Kosi Bay on condition that the republic entered the South African Customs Union. This convention was concluded after negotiations conducted with President Kruger by J. H. Hofmeyr on behalf of the high commissioner, and was made at a time when the British and Bond parties in Cape Colony were working in harmony. The Transvaal did not, however, fulfil the necessary condition, and in view of the increasingly hostile attitude of the Pretoria administration to Great Britain Loch became a strong advocate of the annexation by Britain of the territory east of Swaziland, through which the Boer railway to the sea would have passed. He at length induced the British government to adopt his view and on the 15th of March 1895 it was announced that these territories (Amatongaland, &c.), would be annexed by Britain, an announcement received by Mr Kruger "with the greatest astonishment and regret." Meantime Loch had been forced to intervene in another matter. When the commandeering difficulty of 1894 had roused the Uitlanders in the Transvaal to a dangerous pitch of excitement, he travelled to Pretoria to use his personal influence with President Kruger, and obtained the withdrawal

of the obnoxious commandeering regulations. In the following year he entered a strong protest against the new Transvaal franchise law. Meanwhile, however, the general situation in South Africa was assuming year by year a more threatening aspect. Cecil Rhodes, then prime minister of Cape Colony, was strongly in favour of a more energetic policy than was supported by the Imperial government, and at the end of March 1895 the high commissioner, finding himself, it is believed, out of touch with his ministers, returned home a few months before the expiry of his term of office. In the same year he was raised to the peerage. When the Anglo-Boer war broke out in 1899 Loch took a leading part in raising and equipping a body of mounted men, named after him "Loch's Horse." He died in London on the 20th of June 1900, and was succeeded as 2nd baron by his son Edward (b. 1873).

LOCHABER, a district of southern Inverness-shire, Scotland, bounded W. by Loch Linnhe, the river and loch Lochy, N. by the Corryarrick range and adjoining hills, N.E. and E. by the district of Badenoch, S.E. by the district of Rannoch and S. by the river and loch Leven. It measures 32 m. from N.E. to S.W. and 25 m. from E. to W., and is remarkable for wild and romantic scenery, Ben Nevis being the chief mountain. The district has given its name to a celebrated type of axe, consisting of a long shaft with a blade like a scythe and a large hook behind it, which, according to Sir Walter Scott, was introduced into the Highlands and Ireland from Scandinavia. It was the weapon of the old City Guard of

Edinburgh. The pathetic song of “Lochaber no more” was written by Allan Ramsay.

LOCHES, a town in France, capital of an arrondissement in the department of Indre-et-Loire, 29 m. S.E. of Tours by rail, on the left bank of the Indre. Pop. (1906) 3751. The town, one of the most picturesque in central France, lies at the foot of the rocky eminence on which stands the castle of the Anjou family, surrounded by an outer wall 1¼ m. in circumference, and consisting of the old collegiate church of St Ours, the royal lodge and the donjon. The church of St Ours dates from the 10th to the 12th centuries; among its distinguishing features are the huge stone pyramids surmounting the nave and the beautiful carving of the west door. The royal lodge, built by Charles VII. and used as the subprefecture, contains the tomb of Agnes Sorel and the oratory of Anne of Brittany. The donjon includes, besides the ruined keep (12th century), the Martelet, celebrated as the prison of Lodovico Sforza, duke of Milan, who died there in 1508, and the Tour Ronde, built by Louis XI. and containing the famous iron cages in which state prisoners, including—according to a story now discredited—their inventor Cardinal Balue, were confined. Loches has an hôtel-de-ville and several houses of the Renaissance period. It has a tribunal of first instance, a communal college and a training college. Liqueur-distilling and tanning are carried on together with trade in farm-produce, wine, wood and live-stock.

On the right bank of the Loire, opposite the town and practically its suburb, is the village of Beaulieu-lès-Loches, once the seat of a barony. Besides the parish church of St Laurent, a beautiful specimen of 12th-century architecture, it contains the remains of the great abbey church of the Holy Sepulchre founded in the 11th century by Fulk Nerra, count of Anjou, who is buried in the chancel. This chancel, which with one of the older transepts now constitutes the church, dates from the 15th century. The Romanesque nave is in ruins, but of the two towers one survives intact; it is square, crowned with an octagonal steeple of stone, and is one of the finest extant monuments of Romanesque architecture.

Loches (the Roman *Leucae*) grew up round a monastery founded about 500 by St Ours and belonged to the counts of Anjou from 886 till 1205. In the latter year it was seized from King John of England by Philip Augustus, and from the middle of the 13th century till after the time of Charles IX. the castle was a residence of the kings of France.

LOCHGELLY, a police burgh of Fifeshire, Scotland, 7½ m. N.E. of Dunfermline by the North British railway. Pop. (1901) 5472. The town is modern and owes its prosperity to the iron-works and collieries in its immediate vicinity. Loch Gelly, from which the town takes its name, situated ½ m. S.E., measures ½ m. in length by ¾ m. in breadth, contains some trout and pike, and has on its west banks Lochgelly House, a seat of the earl of Minto. The Romans are said to have had a station at Loch Ore in

the parish of Ballingry, 2¼ m. N. by W., which was drained about the end of the 18th century and then cultivated. To the N.E. rises the hill of Benarty (1131 ft.). Hallyards, about 2 m. S.E. of Lochgelly, is a ruined house that once belonged to Sir William Kirkaldy of Grange, who held Edinburgh Castle for Queen Mary. Here James V. was received after his defeat at Solway Moss in 1542, and here a few Jacobites used to meet in 1715.

LOCHGILPHEAD, a municipal and police burgh of Argyllshire, Scotland, at the head of Loch Gilp, a small arm on the western side of Loch Fyne. Pop. (1901) 1313. The herring-fishery is the chief industry, but there is some weaving of woollens and, in summer, a considerable influx of visitors. Ardrishaig (pop. 1285), a seaport on the west of the mouth of Loch Gilp, is the east terminus of the Crinan Canal. It is the place of transhipment from the large Glasgow passenger steamers to the small craft built for the navigation of the canal. It is an important harbour in connexion with the Loch Fyne herring-fishery, and there is also a distillery. During the summer there is a coach service to Ford at the lower end of Loch Awe.

LOCHMABEN, a royal and police burgh of Dumfriesshire, Scotland, 8 m. N.E. of Dumfries, with a station on the Caledonian railway company's branch from Dumfries to Locherbie. Pop. (1901) 1328. It is delightfully situated, there being eight lakes in the immediate neighbourhood, while the river Annan, and the Waters of Ae, Kinnel and Dryfe are in the vicinity. The town hall is a handsome edifice with clock tower. At the south end of Castle Loch, the chief lake, stand the ruins, a mere shell, of Lochmaben Castle, dating from the 13th century, where local tradition declares that Robert Bruce was born—an honour which is also claimed, however, for Turnberry Castle on the coast of Ayrshire. In the parish church is a bell said to have been presented to King Robert by the pope after reconciliation with him. A statue of the king stands in front of the town hall. Whether it were his birthplace or not, the associations of Bruce with Lochmaben were intimate. He exempted his followers in the district from feudal service and their descendants—the "kindly tenants of Lochmaben"—were confirmed in their tenure by the court of session in 1824. The Castle Loch is the only fresh water in Scotland, and possibly in the British Isles, where the vendace (*coregonus vandesius*) occurs. This fish, which is believed to be growing scarcer, is alleged on doubtful authority to have been introduced by Queen Mary. It is captured by the sweep-net in August, and is esteemed as a delicacy. The lakes adjoining the town afford the inhabitants exceptional advantages for the game of curling. There was once a team of Lochmaben Curlers entirely composed of shoemakers (souters) who held their own against all comers, and their prowess added the phrase "to souter" to the vocabulary of the sport, the word indicating a match in which the winners scored "game" to their opponents' "love." Lochmaben unites with Annan, Dumfries, Kirkcudbright and Sanquhar (the Dumfries burghs) in returning one member to parliament.

LOCK, MATTHIAS, English 18th-century furniture designer and cabinet-maker. The dates of his birth and death are unknown; but he was a disciple of Chippendale, and subsequently of the Adams, and was possibly in partnership with Henry Copeland (*q.v.*). During the greater part of his life he belonged to that flamboyant school which derived its inspiration from Louis XV. models; but when he fell under the influence of Robert Adam he absorbed his manner so completely that it is often difficult to distinguish between them, just as it is sometimes easy to confound Lock's work with the weaker efforts of Chippendale. Thus from being extravagantly rococo he progressed to a simple ordered classicism. His published designs are not equal to his original drawings, many of which are preserved in the Victoria and Albert Museum, South Kensington, while the pieces themselves are often bolder and more solid than is suggested by the author's representations of them. He was a clever craftsman and holds a distinct place among the minor furniture designers of the second half of the 18th century.

Among his works, some of which were issued in conjunction with Copeland, are: *A New Drawing Book of Ornaments* (n. d.); *A New Book of Ornaments* (1768); *A New Book of Pier Frames, Ovals, Girandoles, Tables, &c.* (1769); and *A New Book of Foliage* (1769).

LOCK (from the O. Eng. *loc.*; the word appears, in different forms, in many Teutonic languages, but with such various meanings as “hole,” Ger. *Loch*, “lid,” Swed. *lock*, &c.; probably the original was a root meaning “to enclose”), a fastening, particularly one which consists of a bolt held in a certain position by one or more movable parts which require to be placed in definite positions by the aid of a key or of a secret arrangement of letters, figures or signs, before the bolt can be moved. It is with such fastenings that the present article chiefly deals.

The word is also used, in the original sense of an enclosure or barrier, for a length of water in a river or canal, or at the entrance of a dock, enclosed at both ends by gates, the “lock-gates,” and fitted with sluices, to enable vessels to be raised from a lower to a higher level or vice versa (see CANAL and DOCK). In guns and rifles the lock is the mechanism which effects the firing of the charge; it thus appears in the names of old types of weapons, such as wheel-lock, match-lock, flint-lock (see ARMS AND ARMOUR, § *Firearms*; also GUN and RIFLE). Lock (Ger. *Locke*) in the sense of a curl or tuft of hair, the separate groups in which the hair naturally grows, may be, in ultimate origin, connected with the root of the main word. Lockjaw is the popular name of the disease known as tetanus (*q.v.*). The name “Lock Hospital” is frequently used in English for a hospital for patients suffering from venereal diseases. According to the *New English Dictionary* there was in Southwark as early as 1453 a leper-hospital, known as the Lock Lazar House, which later was used for the treatment of venereal diseases. The

name appears to have become used in the present sense as early as the end of the 17th century. Lock hospitals were established in London in 1745-1747 and in Dublin in 1754-1755.

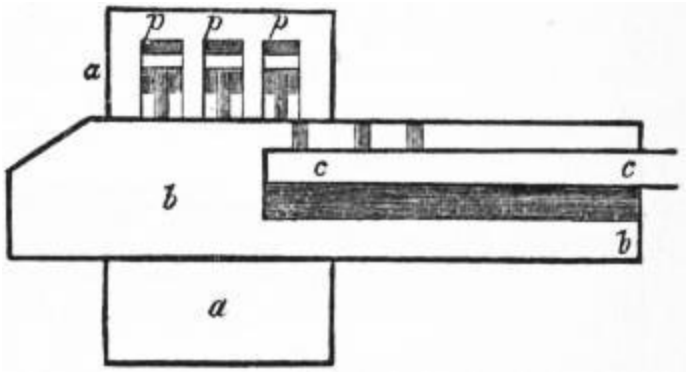

FIG. 1.

The forms in which locks are manufactured, such as padlock, rim-lock, mortise-lock, one-sided or two-sided, &c., are necessarily extremely numerous; and the variations in the details of construction of any one of these forms are still more numerous, so that it is impossible to do more here than describe the main types which have been or are in common use. Probably the earliest locks were of Chinese origin. Specimens of these still extant are quite as secure as any locks manufactured in Europe up to the 18th century, but it is impossible to ascertain the date of their manufacture. With the exception, in all probability, of these Chinese examples, the earliest lock of which the construction is known is the Egyptian, which was used four thousand years ago. In fig. 1, *aa* is the body of the lock, *bb* the bolt and *cc* the key. The three pins *p, p, p* drop into three holes in the bolt when it is pushed in, and so hold it fast; and they are raised again by putting in the key through the large hole in the bolt and raising it a little, so that the pins in the key push the locking pins up out of the way of the bolt. It was evidently to locks and keys of this nature that the prophet alluded: “And the key of the house of David will I lay upon his shoulder” (Isaiah xxii. 22), the word *muftah* used in this passage being the common word for key to this day.

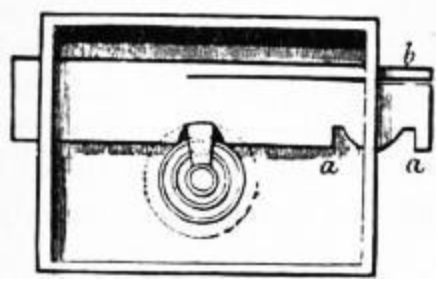

FIG. 2.

FIG. 3.

In the 18th century the European lock was nothing better than a mere bolt, held in its place, either shut or open, by a spring *b* (fig. 2), which pressed it down, and so held it at either one end or the other of the convex notch *aa*; and the only impediment to opening it was the wards which the key had to pass before it could turn in the keyhole. But it was always possible to find the shape of the wards by merely putting in a blank key covered with wax, and pressing it against them; and when this had been done it was unnecessary to cut out the key into the complicated form of the wards (such as fig. 3), because no part of that key does any work except the edge *bc* farthest from the pipe *a*; and so a key of the form fig. 4 would do just as well. Thus a small collection of skeleton keys, as they are called, of a few different patterns, was all the stock in trade that a lock-picker required.

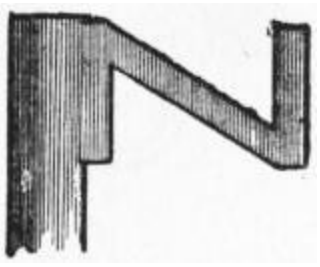

FIG. 4.

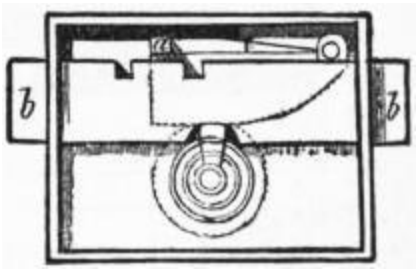

FIG. 5.

The common single-tumbler lock (fig. 5) requires two operations instead of one to open it. The tumbler *at* turns on a pivot at *t*, and has a square pin at *a*, which drops into a notch in the bolt *bb*, when it is either quite open or quite shut, and the tumbler must be lifted by the key before the bolt can be moved again. The tumbler offered little resistance to picking, as the height to which it might be lifted was not limited and the bolt would operate provided only that this height was sufficient; the improvement which formed the foundation of the modern key lock was the substitution of what is known as the "lever" for the tumbler, the difference being that the lever must be lifted to *exactly* the right height to allow the bolt to pass. This improvement, together with the obvious one of using more than one lever, was introduced in 1778 by Robert Barron, and is illustrated in figs. 6 and 7. Unless the square pin *a* (fig. 6) is lifted by the key to the proper height and no higher, the bolt cannot move. Fig. 8 illustrates the key of such a lock with four levers, the different distances between the centre of the key barrel and the edge of the bit being adapted to lift the levers to the respective heights required. This lock differs from the modern lever lock only in the fact that Barron made his gating in the bolt and carried stumps on his levers, instead of having the main stump riveted into the bolt and the gatings in the levers as is the modern practice.

Lever locks.

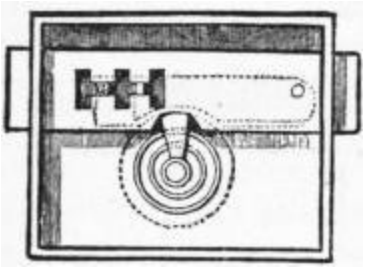

FIG. 6.

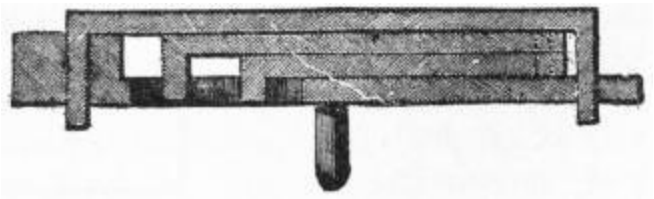

FIG. 7.

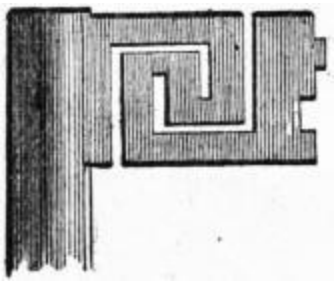

FIG. 8.

A lock operating on exactly the same principle but entirely different in construction (fig. 9) was invented by Joseph Bramah in 1784. It consists of an outer barrel *aaaa*, within which is a revolving barrel, *cccc*, held in place by a steel disk, *dd*, and provided with a pin *b* fixed eccentrically for operating the bolt; the barrel is prevented from turning by sheet metal sliders *ss*, which slide axially in radial grooves in the barrel and project into slots cut into the steel disk which is fastened to the case of the lock. Each slider has a gating cut in its outer edge sufficiently deep to allow it to embrace the inwardly projecting steel plate and turn on it with the barrel. The key is of tubular form having slots cut in its end, each of a depth corresponding to the position of the gating in one of the sliders; so that, on inserting the key, each slider is pushed in—against a spring—exactly far enough to bring its slot opposite the steel disk; in this position the barrel carrying the sliders is turned by the key and actuates the bolt.

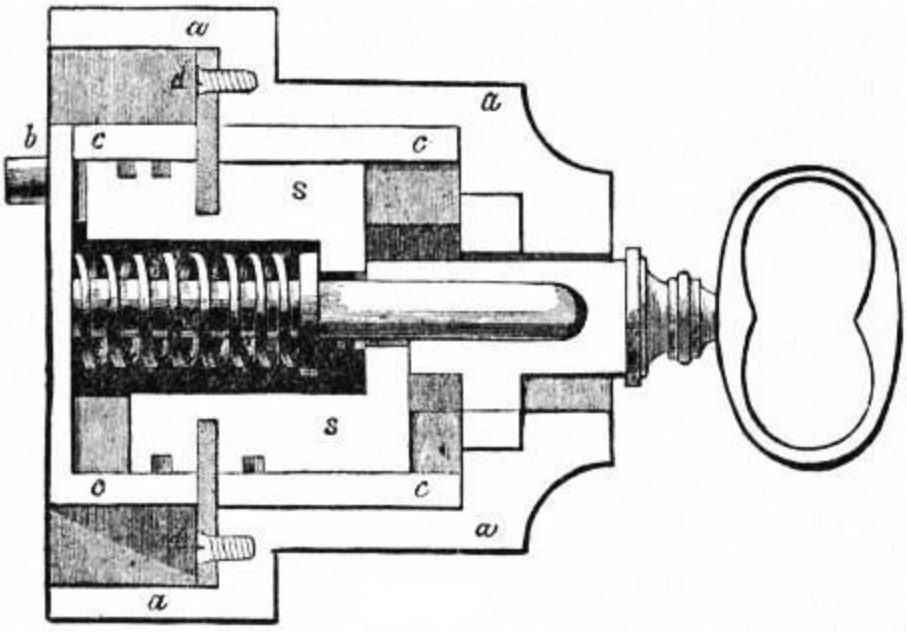

FIG. 9.

Up to 1851 it was generally believed that well-made lever locks of all types were practically unpickable, but at this time Alfred Charles Hobbs—an American—demonstrated, by picking the locks of Barron, Chubb, Bramah and others, that this belief was a fallacy. The method of Hobbs became widely known as the "tickling" or "tentative" method. In the modern lever lock the bolt carries a projecting piece—the "main stump"—which, when the levers are all raised to the proper height, enters the slots —"gatings"—in their faces. If, when the levers are not in this position, pressure is applied to the bolt, the main stump will press against the face of the levers; but owing to inaccuracies of workmanship and other causes the pressure will not be equal on all the levers. If now, the pressure on the bolt being maintained, each lever in turn is carefully raised a little, one will be found on which the pressure of the stump is greatest; this one is lifted till it becomes easy and then carefully lowered till it is sustained by the pressure of the stump in a new position. Another lever now bears the greatest

pressure, and this in its turn is similarly treated. By this gradual or "tentative" process the levers will in time all be raised to the correct height and the bolt will slip back without, if sufficient care has been exercised, any of the levers having been raised above its correct position. Although this method of picking only became generally known in 1851, it is evident that it was not novel, since in 1817 one of Bramah's workmen, named Russell, invented the use of false notches or gatings, which were slots similar to the true gating but of small depth cut in the face of the levers. Similar false gatings were used in Anthony Radford Strutt's lock in 1819. The only possible object of these gatings—two of which are shown in each of the sliders of Bramah's lock—was to prevent the tentative method of picking. They are, however, not efficient for their purpose although they render the operation more difficult and tedious.

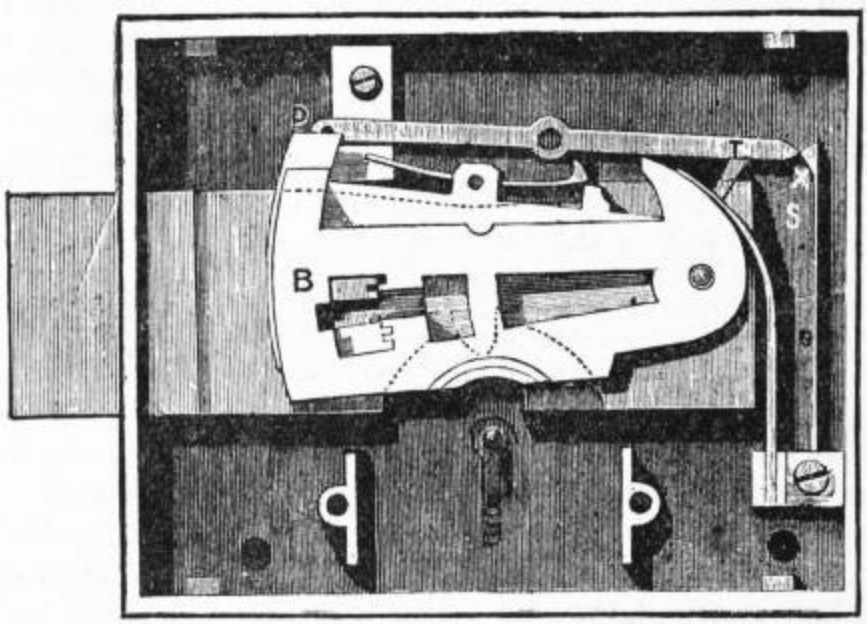

FIG. 10.

The best-known locks up to 1851 were those of Jeremiah Chubb, their popularity being due to their superior workmanship and probably still more to their title “detector.” His lock, patented in 1818, contained a device intended to frustrate attempts at picking, and further to detect if such an attempt had been made. This device, at any rate as far as detecting was concerned, had been anticipated by the patent of Thomas Ruxton in 1816. Since the device only comes into operation when any lever is raised too high, it is not effective against a skilful application of the tentative method. The original form of this lock is shown in fig. 10, when the lever DT, which turns on a pin in the middle, is acted upon at its end T by a spring S, which will evidently allow some play to the lever on either side of the corner X; but the moment it is pushed past that point the spring will carry it farther in the same direction, like what is called in clock-work a jumper. In its proper position that end always remains above the turning-point; but, if any one of the tumblers is raised too high, the other end D of the detector, which reaches over all the levers, is lifted so far that the end T is sent down below the corner, and the tooth T then falls into a notch in the bolt, and so prevents it from being drawn back, even though all the levers are raised properly by the right key. It thus at once becomes obvious that somebody has been trying to pick the lock. The way to open it, then, is to turn the key the other way, as if to overlock the bolt; a short piece of gating near the end of the levers allows the bolt to advance just far enough to push the tooth of the detector up again by means of its inclination there, and then the lock can be opened as usual. To render the mechanism of locks more inaccessible for picking purposes, two devices, the “curtain” and the “barrel,” were in use; these devices were simply the one a disk and the other a cylinder carrying a keyhole which revolved with the key and so closed the fixed keyhole in the case.

It is to Hobbs himself that we are indebted for the invention of the movable stump, since called the safety lever, the only device introduced

rendering the tentative method of picking inoperative. This invention was incorporated in the "protector" locks of Hobbs, Hart & Co.; it consists in the employment of a movable main stump which is not riveted into the bolt as usual, but is set on the end *b* of a bent lever *abc* (fig. 11) which lies in a hollow of the bolt A behind it, turning on a pivot in the bolt itself, and kept steady by a small friction-spring *e*. The stump comes through a hole in the bolt large enough to let it have a little play; and the long end *a* of the lever stands just above the edge of a square pin *d*, which is fixed in the back plate of the lock. When the lock is locked, if the bolt be pushed back, no sensible pressure on the levers is produced, but only just enough to turn this protector lever, as Hobbs called it, on its pivot *c*, and so bring down its end *a* in front of the square pin, and then the bolt can no more be pushed back than when held by Chubb's detector. The protector is set free again by merely pushing the bolt forward with the key, without reference to the levers. However, the protector could be prevented from acting by a method used by the inventor himself for another purpose, viz., by pushing a piece of watch-spring through the keyhole, and up behind the bolt, so as to reach the protector at *a*, and keep it up while the bolt was pushed back, or, again, by pushing up the watch-spring between any two of the levers, and holding the end *b* of the protector with it, so as to press the stump against the levers. Both these devices, however, are prevented now by letting in a feather FF in a groove between the bolt and the back of the lock, which no watch-spring can pass, and also bringing a piece of the feather forward through the front gating of the levers just under the stump. In this form the lock is safe against any mode of picking known. A lock possessing valuable features was invented in 1852 by Sir Edmund Beckett

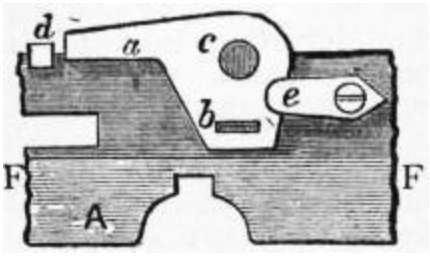

FIG. 11.

—afterwards Lord Grimthorpe—but did not come into general use for commercial reasons.

All the locks containing many levers so far described have a common defect in that the levers are moved in one direction by the key and in the other by springs. But it not infrequently happens that dirt or grease gets between the levers and causes two or more to stick together, in which case one of them is lifted too high and the bolt is prevented from operating. To overcome this difficulty locks, especially those intended for safes, have been made so that alternate levers move in opposite directions, the key having two bits on opposite sides. This construction entails that the key enter the body of the levers instead of passing below them, an arrangement that had previously been in use to reduce the space into which gunpowder could be packed through the keyhole.

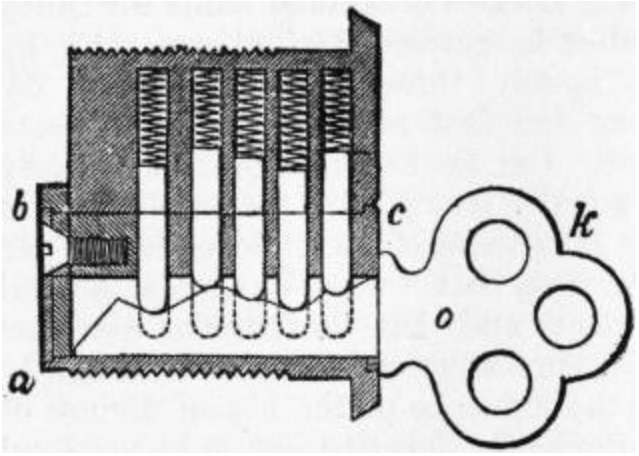

FIG. 12.

Key locks.

The key locks chiefly used in English safes have been the ordinary lever lock with 6-8 or 10 levers, Chubb's "detector," Hobbs's "protector" or variants of these. In the Yale lock, which reverts in some degree to the idea of the ancient Egyptian lock, America has produced one key lock which has come into almost universal use in that country and is certainly worthy of note. The key of this lock, shown full size at *ka* in fig. 12, is remarkably small, being stamped from a piece of flat steel and weighing only a small fraction of an ounce. The barrel *abc* has to turn, as in the Bramah lock, in

order to move the bolt, which is not shown in the figure. That may be done either as in Bramah locks or by a tongue or bit attached to the end *ab* of the barrel as in several other locks. The barrel is prevented from being turned, except by the proper key, thus. The (apparently) five plugs with spiral springs over them in fig. 12 are really all divided at the cross line *bc*, being all now lifted to the proper height by the key. Consequently the barrel *abc* can turn round, as there is no plug either projecting from it or projecting into it. But when the key is out, all the plugs are pushed down by the springs, and so the upper ones descend into the barrel and hold it fast. And again, if any of the steps of a false key are too high, some of the lower plugs will be pushed up beyond the barrel into the holes above them, and so the barrel cannot turn. The bevelled end of the key near *a* enables it to be pushed in under the plugs, though with some friction and resistance.

It is frequently convenient to have a number of different locks so arranged that, whilst each has its own individual key, yet one special or "master" key will operate any of the series. In warded locks this is done by "differing" the wards of the individual locks so that each key will only pass its own lock, and then filing away the bit of an extra key so that it will pass all the wards; the objection to this method is that any of the individual keys can easily be filed away and so form a master key. A better method, which meets this objection, consists in making all the levers except one—or if need be two—of each lock alike and cutting another gating or widening the gating in the differing levers, so as to pass the master key which has one—or two—special steps.

The growth of safe deposits has called for special locks so that when a box changes tenants the outgoing tenant's key shall be useless. In some cases the lock has been taken off and another substituted, but this is a clumsy makeshift now rarely employed, and has been superseded by the use of changeable key locks.

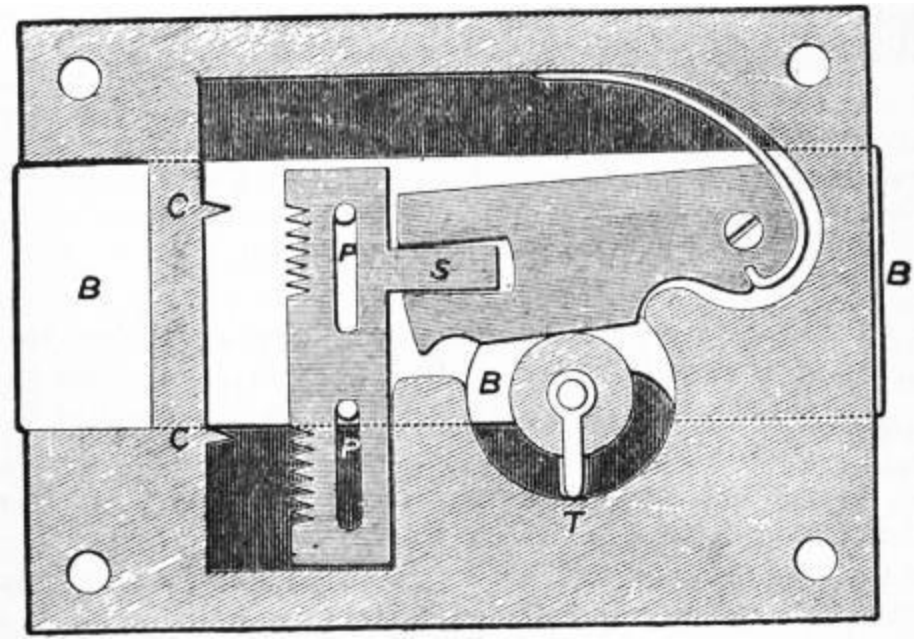

FIG. 13.

The first of these, invented by Robert Newell in 1841, was introduced into Great Britain from America by Hobbs in 1851. A simpler form, the construction of which is clearly shown by fig. 13, was brought out by Hobbs, Hart & Co. The bolt of this lock, instead of the ordinary main stump, carries a set of sliders, PPS, one corresponding to each lever and each carrying a projection S corresponding to a portion of the main stump. It will be seen that if any key having steps of certain lengths is inserted when the lock is unlocked and the bolt B thrown thereby, each slider will be raised to a height corresponding to that to which its lever is raised by the key, and the two fixed teeth CC will engage two of the teeth in the front of each slider, so that they will be held in place ready to enter the lever gatings when the same key is inserted.

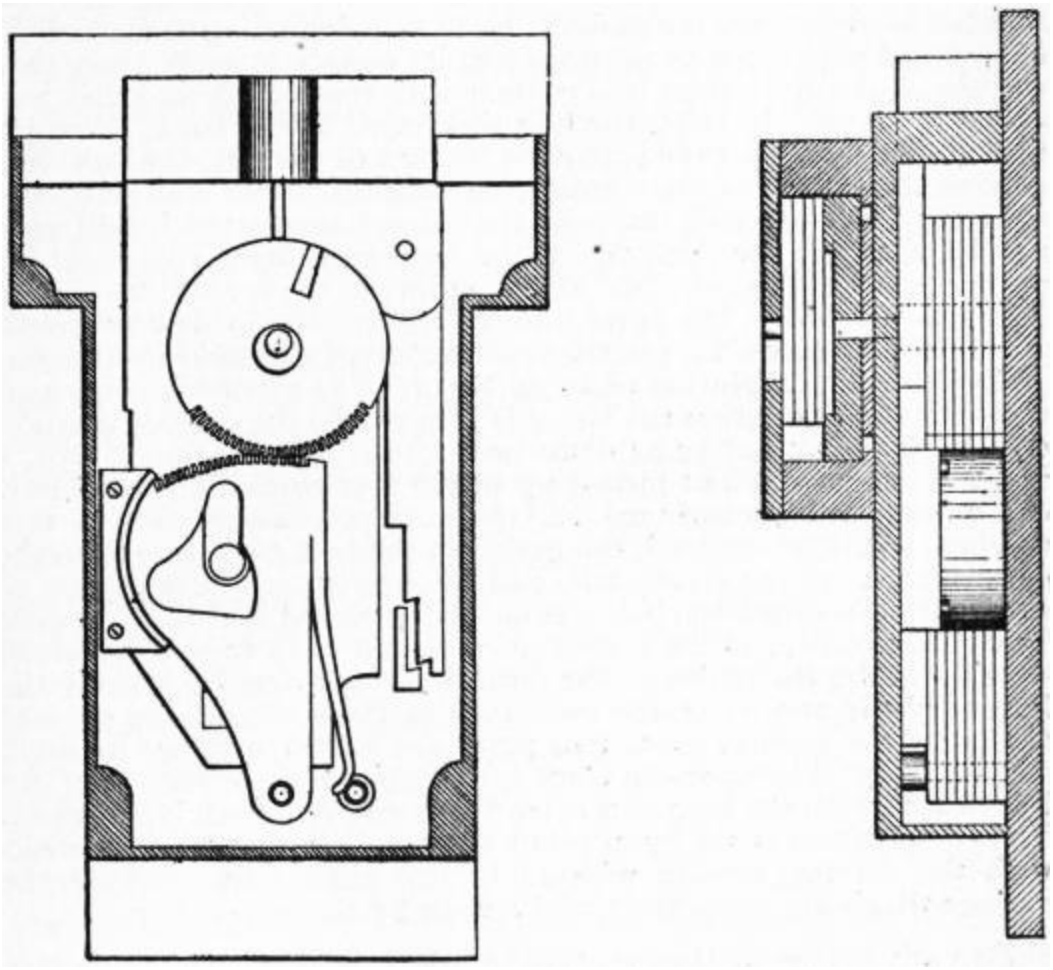

FIG. 14.

A changeable key lock introduced by the Chatwood Safe Co. has no gatings in the levers, whose fronts are cut with teeth gearing into similar teeth cut in a set of disks carrying the gatings. The disks are mounted on a stud which can be moved by a key from the back of the lock in such a way that while the main stump is in the gatings—keeping the disks in position—the disks are carried forward out of gear with the levers; the key can then be removed and another having steps of suitable length inserted and turned so as to raise the levers, the disks being then brought back into gear.

Both the above locks require that the key steps should have certain definite lengths corresponding to the teeth, but a later lock resembling to some extent that brought out by Hobbs, Hart & Co. has been introduced by the Chatwood Co., in which it is sufficient after unlocking the lock to file any of the key steps and so alter the pattern of the key in any way. In this lock, which is illustrated in fig. 14, unlike all those that have been described, the levers are not pivoted but slide upon guide stumps; the main stump is divided as in Hobbs Hart's lock, the various pieces being clamped together by a screw to form a solid stump. The sliders composing the main stump are not provided with teeth, the changing being effected as follows: when the bolt is partly shot by the correct key, the screw which binds the sliders together as it comes opposite an opening in the back of the case is loosened, the key is removed and altered—or a fresh key substituted—and is inserted so as to lift the levers to their correct height and expose the clamping screw at the back, which is then tightened. This lock is now commonly used for safe deposits, combined with a small lever lock of which the custodian carries the key, and which either blocks the bolt of the main lock or covers the keyhole.

FIG. 15.

In connexion with changeable key locks requiring key steps of definite lengths, much ingenuity has been displayed in designing keys with movable bits or steps, as fig. 15, which are useful chiefly as duplicates, being built up to match the key from time to time in use, and then deposited in some bank or other secure place to be used in case of emergency.

From the very earliest times secret devices, either to hide keyholes or to take the place of locks proper, have been in use; these are to-day only seriously represented by "combination" locks which, whilst following the

Combination locks.

same general principles as key locks, differ entirely in construction. Locks in which the arranging of the internal parts in their proper positions was secured by the manipulation of external parts marked with letters or numbers were common in China in very early times, but their history is unfortunately lost. This form of lock has been developed to a very high degree of perfection and is, for safes, in almost universal use to-day in America.

The American lock consists of a series of disks mounted upon one spindle, only one, however—the bolt disk—being fixed thereto, and provided each with a gating into which a stump connected with the bolt can drop when all the gatings lie upon a given line parallel to the axis of the spindle. Each disk is provided with a driving pin so arranged that it can impinge on and drive a similar pin in its next neighbour; the gating in the bolt disk and the portion of the stump which enters it are so formed that the disk can draw the bolt back. The spindle is provided on the outside with a knob and graduated disk—usually with 100 divisions—surrounded by an annulus on which a fixed position is denoted. Each disk, including the bolt disk, is provided with a pin projecting from its surface in such a way that the pin of one disk comes into contact with that of the next disk and drives it round. If, then, the bolt disk being at the back, there are three letter disks and the spindle is rotated to the left, the bolt disk will in the course of one revolution pick up letter disk No. 1—counting from the bolt disk—in the second revolution it will pick up No. 2, and in the third No. 3, the revolution being continued for part of a turn till the number corresponding to the correct position of No. 3 is reached. The revolution of the spindle is now reversed. The bolt disk leaves No. 1 in the first revolution and picks it up again, and the second revolution picks up No. 2. The motion is continued for part of a revolution till No. 2 is brought to the correct position (No. 3 obviously not being disturbed) and is then reversed. No. 1 is again left

behind and picked up in the first revolution to the left, the motion being continued till the correct position of No. 1 is reached, when, on reversal, the gating in the bolt disk comes into the correct position, the stump falls and a continuance of the motion to the right draws back the bolt. A lock constructed in this way would be of little utility, as the combination would have to be determined once for all by the maker. The difficulty is got over by making the letter disks in two parts, the inner part carrying the driving pin and the outer the gating; these two parts are locked together by small cams or other devices which come into such a position that they can be released with the help of a square key when the lock is unlocked. The combination is set by altering the position of the inner disks with the driving pins in relation to the outer part carrying the gatings which are meanwhile held steady by the square key.

One advantage of the combination lock is that there is no key to be lost or stolen, but the means adopted by burglars, especially in America, are such that even this is not a perfect protection, cases having occurred in which a person has been compelled to disclose the combination. With key locks the keyhole through the safe door forms a distinct point of danger, and with combination locks the spindle passing through the door may be attacked by explosives. To obviate these two risks time locks were introduced in America and have been used in Europe. Essentially the time lock consists of a high-class chronometer or watch movement, little liable to get out of order, driving a disk provided with a gating such that the bolt can only enter the gating during certain hours; as a rule two, three or four chronometers are used, any one of which can release the lock.

Time locks.

The Yale time lock contains two chronometer movements which revolve two dial plates studded with twenty-four pins to represent the twenty-four hours of the day. These pins, when pushed in, form a track on which run

rollers supporting the lever which secures the bolt or locking agency, but when they are drawn out the track is broken, the rollers fall down and the bolt is released. By pulling out the day pins, say from 9 till 4, the door is automatically prepared for opening between these hours, and at 4 it again of itself locks up. For keeping the repository closed over Sundays and holidays, a subsidiary segment or track is brought into play by which a period of twenty-four hours is added to the locked interval. Careful provision is made against the eventuality of running down or accidental stoppage of the clock motion, by which the rightful owner might be as seriously incommoded as the burglar. In the Yale lock, just before the chronometers run out, a trigger is released which depresses the lever by which the bolt is held in position.

(A. B. Ch.)

LOCKE, JOHN (1632-1704), English philosopher, was born at Wrington, 10 m. W. of Belluton, in Somersetshire, on the 29th of August 1632, six years after the death of Bacon, and three months before the birth of Spinoza. His father was a small landowner and attorney at Pensford, near the northern boundary of the county, to which neighbourhood the family had migrated from Dorsetshire early in that century. The elder Locke, a strict but genial Puritan, by whom the son was carefully educated at home, was engaged in the military service of the parliamentary party. “From the time that I knew anything,” Locke wrote in 1660, “I found myself in a storm, which has continued to this time.” For fourteen years his education, more or less interrupted, went on in the rural home at Belluton, on his

father's little estate, half a mile from Pensford, and 6 m. from Bristol. In 1646 he entered Westminster School and remained there for six years. Westminster was uncongenial to him. Its memories perhaps encouraged the bias against public schools which afterwards disturbed his philosophic calm in his *Thoughts on Education*. In 1652 he entered Christ Church, Oxford, then under John Owen, the Puritan dean and vice-chancellor of the university. Christ Church was Locke's occasional home for thirty years. For some years after he entered, Oxford was ruled by the Independents, who, largely through Owen, unlike the Presbyterians, were among the first in England to advocate genuine religious toleration. But Locke's hereditary sympathy with the Puritans was gradually lessened by the intolerance of the Presbyterians and the fanaticism of the Independents. He had found in his youth, he says, that "what was called general freedom was general bondage, and that the popular assertors of liberty were the greatest engrossers of it too, and not unfitly called its *keepers*." And the influence of the liberal divines of the Church of England afterwards showed itself in his spiritual development.

Under Owen scholastic studies were maintained with a formality and dogmatism unsuited to Locke's free inquisitive temper. The aversion to them which he expressed showed thus early an innate disposition to rebel against empty verbal reasoning. He was not, according to his own account of himself to Lady Masham, a hard student at first. He sought the company of pleasant and witty men, and thus gained knowledge of life. He took the ordinary bachelor's degree in 1656, and the master's in 1658. In December 1660 he was serving as tutor of Christ Church, lecturing in Greek, rhetoric and philosophy.

At Oxford Locke was nevertheless within reach of liberal intellectual influence tending to promote self-education and strong individuality. The metaphysical works of Descartes had appeared a few years before he went

to Oxford, and the *Human Nature* and *Leviathan* of Hobbes during his undergraduate years. It does not seem that Locke read extensively, but he was attracted by Descartes. The first books, he told Lady Masham, which gave him a relish for philosophy, were those of this philosopher, although he very often differed from him. At the Restoration potent influences were drawing Oxford and England into experimental inquiries. Experiment in physics became the fashion. The Royal Society was then founded, and we find Locke experimenting in chemistry in 1663, also in meteorology, in which he was particularly interested all his life.

The restraints of a professional career were not suited to Locke. There is a surmise that early in his Oxford career he contemplated taking orders in the Church of England. His religious disposition attracted him to theology. Revulsion from the dogmatic temper of the Presbyterians, and the unreasoning enthusiasm of the Independents favoured sympathy afterwards with Cambridge Platonists and other liberal Anglican churchmen. Whichcote was his favourite preacher, and close intimacy with the Cudworth family cheered his later years. But, though he has a place among lay theologians, dread of ecclesiastical impediment to free inquiry, added to strong inclination for scientific investigation, made him look to medicine as his profession, and before 1666 we find him practising as a physician in Oxford. Nevertheless, although known among his friends as “Doctor Locke,” he never graduated in medicine. His health was uncertain, for he suffered through life from chronic consumption and asthma. A fortunate event soon withdrew him from the medical profession.

Locke early showed an inclination to politics, as well as to theology and medicine. As early as 1665 he diverged for a short time from medical pursuits at Oxford, and was engaged as secretary to Sir Walter Vane on his mission to the Elector of Brandenburg. Soon after his return in 1666 the incident occurred which determined his career. Lord Ashley, afterwards first

earl of Shaftesbury, had come to Oxford for his health. Locke was introduced to him by his physician, Dr Thomas. This was the beginning of a lasting friendship, sustained by common sympathy with liberty—civil, religious and philosophical. In 1667 Locke moved from Christ Church to Exeter House, Lord Ashley's London residence, to become his confidential secretary. Although he retained his studentship at Christ Church, and occasionally visited Oxford, as well as his patrimony at Belluton, he found a home and shared fortune with Shaftesbury for fifteen years.

Locke's commonplace books throw welcome light on the history of his mind in early life. A paper on the "Roman Commonwealth" which belongs to this period, expresses convictions about religious liberty and the relations of religion to the state that were modified and deepened afterwards; objections to the sacerdotal conception of Christianity appear in another article; short work is made of ecclesiastical claims to infallibility in the interpretation of Scripture in a third; a scheme of utilitarian ethics, wider than that of Hobbes, is suggested in a fourth. The most significant of those early revelations is the *Essay concerning Toleration* (1666), which anticipates conclusions more fully argued nearly thirty years later.

The Shaftesbury connexion must have helped to save Locke from those idols of the "Den" to which professional life and narrow experience is exposed. It brought him into contact with public men, the springs of political action and the duties of high office. The place he held as Shaftesbury's adviser is indeed the outstanding circumstance in his middle life. Exeter House afforded every opportunity for society. He became intimate among others with the illustrious Sydenham; he joined the Royal Society and served on its council. The foundation of the monumental work of his life was laid when he was at Exeter House. He was led to it in this way. It was his habit to encourage informal reunions of his intimates, to discuss debatable questions in science and theology. One of these, in the

winter of 1670, is historically memorable. “Five or six friends,” he says, met in his rooms and were discussing “principles of morality and religion. They found themselves quickly at a stand by the difficulties that arose on every side.” Locke proposed some criticism of the necessary “limits of human understanding” as likely to open a way out of their difficulties. He undertook to attempt this, and fancied that what he had to say might find sufficient space on “one sheet of paper.” What was thus “begun by chance, was continued by entreaty, written by incoherent parcels, and after long intervals of neglect resumed again as humour and occasions permitted.” At the end of nearly twenty years the issue was given to the world as Locke’s now famous *Essay Concerning Human Understanding*.

The fall of Shaftesbury in 1675 enabled Locke to escape from English politics. He found a retreat in France, where he could unite calm reflection upon the legitimate operations of “human understanding” with attention to his health. He spent three years partly at Montpellier and partly in Paris. His journals and commonplace books in these years show the *Essay* in preparation. At Paris he met men of science and letters—Peter Guenellon, the well-known Amsterdam physician; Ole Römer, the Danish astronomer; Thoynard, the critic; Melchisédech Thévenot, the traveller; Henri Justel, the jurist; and François Bernier, the expositor of Gassendi. But there is no mention of Malebranche, whose *Recherche de la vérité* had appeared three years before, nor of Arnauld, the illustrious rival of Malebranche.

Locke returned to London in 1679. Reaction against the court party had restored Shaftesbury to power. Locke resumed his old confidential relations, now at Thanet House in Aldersgate. A period of often interrupted leisure for study followed. It was a time of plots and counterplots, when England seemed on the brink of another civil war. In the end Shaftesbury was committed to the Tower, tried and acquitted. More insurrectionary plots followed in the summer of 1682, after which, suspected at home, the

versatile statesman escaped to Holland, and died at Amsterdam in January 1683. In these two years Locke was much at Oxford and in Somerset, for the later movements of Shaftesbury did not commend themselves to him. Yet the government had their eyes upon him. “John Locke lives a very cunning unintelligible life here,” Prideaux reported from Oxford in 1682. “I may confidently affirm,” wrote John Fell, the dean of Christ Church, to Lord Sunderland, “there is not any one in the college who has heard him speak a word against, or so much as censuring, the government; and, although very frequently, both in public and private, discourses have been purposely introduced to the disparagement of his master, the earl of Shaftesbury, he could never be provoked to take any notice, or discover in word or look the least concern; so that I believe there is not in the world such a master of taciturnity and passion.” Unpublished correspondence with his Somerset friend, Edward Clarke of Chipley, describes Locke’s life in those troubled years. It also reveals the opening of his intimate intercourse with the Cudworth family, who were friends of the Clarkes, and connected by birth with Somerset. The letters allude to toleration in the state and comprehension in the church, while they show an indifference to theological dogma hardly consistent with an exclusive connexion with any sect.

In his fifty-second year, in the gloomy autumn of 1683, Locke retired to Holland, then the asylum of eminent persons who were elsewhere denied liberty of thought. Descartes and Spinoza had speculated there; it had been the home of Erasmus and Grotius; it was now the refuge of Bayle. Locke spent more than five years there; but his (unpublished) letters show that exile sat heavily upon him. Amsterdam was his first Dutch home, where he lived in the house of Dr Keen, under the assumed name of Dr Van der Linden. For a time he was in danger of arrest at the instance of the English government. After months of concealment he escaped; but he was deprived of his studentship at Christ Church by order of the king, and Oxford was

thus closed against him. Holland introduced him to new friends. The chief of these was Limborch, the successor of Episcopius as Remonstrant professor of theology, lucid, learned and tolerant, the friend of Cudworth, Whichcote and More. By Limborch he was introduced to Le Clerc, the youthful representative of letters and philosophy in Limborch's college, who had escaped from Geneva and Calvinism to the milder atmosphere of Holland and the Remonstrants. The *Bibliothèque universelle* of Le Clerc was then the chief organ in Europe of men of letters. Locke contributed several articles. It was his first appearance as an author, although he was now fifty-four years of age. This tardiness in authorship is a significant fact in his life, in harmony with his tempered wisdom.

In the next fourteen years the world received through his books the thoughts which had been gradually forming, and were taking final shape while he was in Holland. The *Essay* was finished there, and a French epitome appeared in 1688 in Le Clerc's journal, the forecast of the larger work. Locke was then at Rotterdam, where he lived for a year in the house of a Quaker friend, Benjamin Furley, or Furly, a wealthy merchant and lover of books. At Rotterdam he was a confidant of political exiles, including Burnet and the famous earl of Peterborough, and he became known to William, prince of Orange. William landed in England in November 1688; Locke followed in February 1689, in the ship which carried the princess Mary.

After his return to England in 1689 Locke emerged through authorship into European fame. Within a month after he reached London he had declined an offer of the embassy to Brandenburg, and accepted the modest office of commissioner of appeals. The two following years, during which he lived at Dorset Court in London, were memorable for the publication of his two chief works on social polity, and of the epoch-making book on modern philosophy which reveals the main principles of his life. The

earliest of these to appear was his defence of religious liberty, in the *Epistola de Tolerantia*, addressed to Limborch, published at Gouda in the spring of 1689, and translated into English in autumn by William Popple, a Unitarian merchant in London. *Two Treatises on Government*, in defence of the right of ultimate sovereignty in the people, followed a few months later. The famous *Essay concerning Human Understanding* saw the light in the spring of 1690. He received £30 for the copyright, nearly the same as Kant got in 1781 for his *Kritik der reinen Vernunft*. In the *Essay* Locke was the critic of the empirical data of human experience: Kant, as the critic of the intellectual and moral presuppositions of experience, supplied the complement to the incomplete and ambiguous answer to its own leading question that was given in Locke's *Essay*. The *Essay* was the first book in which its author's name appeared, for the *Epistola de Tolerantia* and the *Treatises on Government* were anonymous.

Locke's asthma was aggravated by the air of London; and the course of public affairs disappointed him, for the settlement at the Revolution fell short of his ideal. In spring, 1691, he took up his residence in the manor house of Otes in Essex, the country seat of Sir Francis Masham, between Ongar and Harlow. Lady Masham was the accomplished daughter of Ralph Cudworth, and was his friend before he went to Holland. She told Le Clerc that after Locke's return from exile, "by some considerably long visits, he had made trial of the air of Otes, which is some 20 m. from London, and he thought that none would be so suitable for him. His company," she adds, "could not but be very desirable for us, and he had all the assurances we could give him of being always welcome; but, to make him easy in living with us, it was necessary he should do so on his own terms, which Sir Francis at last assenting to, he then believed himself at home with us, and resolved, if it pleased God, here to end his days as he did." At Otes he enjoyed for fourteen years as much domestic peace and literary leisure as was consistent with broken health, and sometimes anxious visits to London

on public affairs, in which he was still an active adviser. Otes was in every way his home. In his letters and otherwise we have pleasant pictures of its inmates and domestic life and the occasional visits of his friends, among others Lord Peterborough, Lord Shaftesbury of the *Characteristics*, Sir Isaac Newton, William Molyneux and Anthony Collins.

At Otes he was busy with his pen. The *Letter on Toleration* involved him in controversy. An *Answer* by Jonas Proast of Queen's College, Oxford, had drawn forth in 1690 a *Second Letter*. A rejoinder in 1691 was followed by Locke's elaborate *Third Letter on Toleration* in the summer of the following year. In 1691 currency and finance were much in his thoughts, and in the following year he addressed an important letter to Sir John Somers on the *Consequences of the Lowering of Interest and Raising the Value of Money*. When he was in Holland he had written letters to his friend Clarke of Chipley about the education of his children. These letters formed the substance of the little volume entitled *Thoughts on Education* (1693), which still holds its place among classics in that department. Nor were the "principles of revealed religion" forgotten. The subtle theological controversies of the 17th century made him anxious to show how simple after all fundamental Christianity is. In the *Reasonableness of Christianity as delivered in the Scriptures* (anonymous, 1695), Locke sought to separate the divine essence of Christ's religion from later accretions of dogma, and from reasonings due to oversight of the necessary limits of human thought. This intended Eirenicon involved him in controversies that lasted for years. Angry polemics assailed the book. A certain John Edwards was conspicuous. Locke's *Vindication*, followed by a *Second Vindication* in 1697, added fuel to this fire. Above all, the great *Essay* was assailed and often misinterpreted by philosophers and divines. Notes of opposition had been heard almost as soon as it appeared. John Norris, the metaphysical rector of Bemerton and English disciple of Malebranche, criticized it in 1690. Locke took no notice at the time, but his second winter at Otes was

partly employed in *An Examination of Malebranche's Opinion of Seeing all Things in God*, and in *Remarks upon some of Mr Norris's Books*, tracts which throw light upon his own ambiguous theory of perception through the senses. These were published after his death. A second edition of the *Essay*, with a chapter added on "Personal Identity," and numerous alterations in the chapter on "Power," appeared in 1694. The third, which was only a reprint, was published in 1695. Wynne's well-known abridgment helped to make the book known in Oxford, and his friend William Molyneux introduced it in Dublin. In 1695 a revival of controversy about the currency diverted Locke's attention. Events in that year occasioned his *Observations on Silver Money* and *Further Considerations on Raising the Value of Money*.

In 1696 Locke was induced to accept a commissionership on the Board of Trade. This required frequent visits to London. Meantime the *Essay on Human Understanding* and the *Reasonableness of Christianity* were becoming more involved in a wordy warfare between dogmatists and latitudinarians, trinitarians and unitarians. The controversy with Edwards was followed by a more memorable one with Stillingfleet, bishop of Worcester. John Toland, in his *Christianity not Mysterious*, had exaggerated doctrines in the *Essay*, and then adopted them as his own. In the autumn of 1696, Stillingfleet, an argumentative ecclesiastic more than a religious philosopher, in his *Vindication of the Doctrine of the Trinity*, charged Locke with disallowing mystery in human knowledge, especially in his account of the metaphysical idea of "substance." Locke replied in January 1697. Stillingfleet's rejoinder appeared in May, followed by a *Second Letter* from Locke in August, to which the bishop replied in the following year. Locke's *Third Letter*, in which the ramifications of this controversy are pursued with a copious expenditure of acute reasoning and polished irony, was delayed till 1699, in which year Stillingfleet died. Other critics of the *Essay* entered the lists. One of the ablest was John Sergeant, a priest of the Roman

Church, in *Solid Philosophy Asserted Against the Fancies of the Ideists* (1697). He was followed by Thomas Burnet and Dean Sherlock. Henry Lee, rector of Tichmarch, criticized the *Essay*, chapter by chapter in a folio volume entitled *Anti-Scepticism* (1702); John Broughton dealt another blow in his *Psychologia* (1703); and John Norris returned to the attack, in his *Theory of the Ideal or Intelligible World* (1701-1704). On the other hand Locke was defended with vigour by Samuel Bolde, a Dorsetshire clergyman. The *Essay* itself was meanwhile spreading over Europe, impelled by the name of its author as the chief philosophical defender of civil and religious liberty. The fourth edition (the last while Locke was alive) appeared in 1700, with important additional chapters on "Association of Ideas" and "Enthusiasm." What was originally meant to form another chapter was withheld. It appeared among Locke's posthumous writings as *The Conduct of the Understanding*, one of the most characteristic of his works. The French translation of the *Essay* by Pierre Coste, Locke's amanuensis at Otes, was issued almost simultaneously with the fourth edition. The Latin version by Richard Burridge of Dublin followed a year after, reprinted in due time at Amsterdam and at Leipzig.

In 1700 Locke resigned his commission at the Board of Trade, and devoted himself to Biblical studies and religious meditation. The Gospels had been carefully studied when he was preparing his *Reasonableness of Christianity*. He now turned to the Epistles of St Paul, and applied the spirit of the *Essay* and the ordinary rules of critical interpretation to a literature which he venerated as infallible, like the pious Puritans who surrounded his youth. The work was ready when he died, and was published two years after. A tract on *Miracles*, written in 1702, also appeared posthumously. Fresh adverse criticism of the *Essay* was reported to him in his last year, and the book was formally condemned by the authorities at Oxford. "I take what has been done rather as a recommendation of the book," he wrote to his young friend Anthony Collins, "and when you and I next meet we shall

be merry on the subject." One attack only moved him. In 1704 his adversary, Jonas Proast, revived their old controversy. Locke in consequence began a *Fourth Letter on Toleration*. A few pages, ending in an unfinished paragraph, exhausted his remaining strength; but the theme which had employed him at Oxford more than forty years before, and had been a ruling idea throughout the long interval, was still dominant in the last days of his life.

All the summer of 1704 he continued to decline, tenderly nursed by Lady Masham and her step-daughter Esther. On the 28th of October he died, according to his last recorded words, "in perfect charity with all men, and in sincere communion with the whole church of Christ, by whatever names Christ's followers call themselves." His grave is on the south side of the parish church of High Laver, in which he often worshipped, near the tombs of the Mashams, and of Damaris, the widow of Cudworth. At the distance of 1 m. are the garden and park where the manor house of Otes once stood.

Locke's writings have made his intellectual and moral features familiar. The reasonableness of taking probability as our guide in life was in the essence of his philosophy. The desire to see for himself what is true in the light of reasonable evidence, and that others should do the same, was his ruling passion, if the term can be applied to one so calm and judicial. "I can no more know anything by another man's understanding," he would say, "than I can see by another man's eyes." This repugnance to believe blindly what rested on arbitrary authority, as distinguished from what was seen to be sustained by self-evident reason, or by demonstration, or by good probable evidence, runs through his life. He is typically English in his reverence for facts, whether facts of sense or of living consciousness, in his aversion from abstract speculation and verbal reasoning, in his suspicion of mysticism, in his calm reasonableness, and in his ready submission to truth, even when truth was incapable of being fully reduced to system by man.

The delight he took in exercising reason in regard to everything he did was what his friend Pierre Coste remarked in Locke's daily life at Otes. "He went about the most trifling things always with some good reason." Above all things he loved order; and he had got the way of observing it in everything with wonderful exactness. As he always kept the useful in his eye in all his disquisitions, he esteemed the employments of men only in proportion to the good they were capable of producing; for which cause he had no great value for the critics who waste their lives in composing words and phrases in coming to the choice of a various reading, in a passage that has after all nothing important in it. He cared yet less for those professed disputants, who, being taken up with the desire of coming off with victory, justify themselves behind the ambiguity of a word, to give their adversaries the more trouble. And whenever he had to deal with this sort of folks, if he did not beforehand take a strong resolution of keeping his temper, he quickly fell into a passion; for he was naturally choleric, but his anger never lasted long. If he retained any resentment it was against himself, for having given way to so ridiculous a passion; which, as he used to say, "may do a great deal of harm, but never yet did anyone the least good." Large, "round-about" common sense, intellectual strength directed by a virtuous purpose, not subtle or daring speculation sustained by an idealizing faculty, in which he was deficient, is what we find in Locke. Defect in speculative imagination appears when he encounters the vast and complex final problem of the universe in its organic unity.

Locke is apt to be forgotten now, because in his own generation he so well discharged the intellectual mission of initiating criticism of human knowledge, and of diffusing the spirit of free inquiry and universal toleration which has since profoundly affected the civilized world. He has not bequeathed an imposing system, hardly even a striking discovery in metaphysics, but he is a signal example in the Anglo-Saxon world of the love of attainable truth for the sake of truth and goodness. "If Locke made

few discoveries, Socrates made none." But both are memorable in the record of human progress.

In the inscription on his tomb, prepared by himself, Locke refers to his books as a true representation of what he was. They are concerned with *Social Economy*, *Christianity*, *Education* and *Philosophy*, besides *Miscellaneous* writings.

I. Social Economy.—(1) *Epistola de Tolerantia* (1689, translated into English in the same year). (2) *Two Treatises on Government* (1690) (the *Patriarcha* of Filmer, to which the *First Treatise* was a reply, appeared in 1680). (3) *A Second Letter concerning Toleration* (1690). (4) *Some Considerations on the Consequence of Lowering the Rate of Interest and Raising the Value of Money* (1691). (5) *A Third Letter for Toleration* (1692). (6) *Short Observations on a printed paper entitled, "For encouraging the Coining of Silver Money in England, and after for Keeping it here"* (1695). (7) *Further Considerations concerning Raising the Value of Money* (1695) (occasioned by a *Report* containing an "Essay for the Amendment of Silver Coins," published that year by William Lowndes, secretary for the Treasury). (8) *A Fourth Letter for Toleration* (1706, posthumous).

II. Christianity.—(1) *The Reasonableness of Christianity as delivered in the Scriptures* (1695). (2) *A Vindication of the Reasonableness of Christianity from Mr Edwards's Reflections* (1695). (3) *A Second Vindication of the Reasonableness of Christianity* (1697). (4) *A Paraphrase and Notes on the Epistles of St Paul to the Galatians, First and Second Corinthians, Romans and Ephesians. To which is prefixed an Essay for the understanding of St Paul's Epistles by consulting St Paul himself* (1705-1707, posthumous). (5) *A Discourse of Miracles* (1716, posthumous).

III. Education.—(1) *Some Thoughts concerning Education* (1693). (2) *The Conduct of the Understanding* (1706, posthumous). (3) *Some Thoughts*

concerning Reading and Study for a Gentleman (1706, posthumous). (4) *Instructions for the Conduct of a Young Gentleman* (1706, posthumous). (5) *Of Study* (written in France in Locke's journal, and published in L. King's *Life of Locke* in 1830).

IV. PHILOSOPHY.—(1) *An Essay concerning Human Understanding*, in four books (1690). (2) *A Letter to the Bishop of Worcester concerning some passages relating to Mr Locke's Essay of Human Understanding in a late Discourse of his Lordship's in Vindication of the Trinity* (1697). (3) *Mr Locke's Reply to the Bishop of Worcester's Answer to his Letter* (1697). (4) *Mr Locke's Reply to the Bishop of Worcester's Answer to his Second Letter* (1699). (5) *An Examination of Father Malebranche's Opinion of Seeing all Things in God* (1706, posthumous). (6) *Remarks upon Some of Mr Norris's Books, wherein he asserts Father Malebranche's Opinion of Seeing all Things in God* (1720, posthumous).

MISCELLANEOUS.—(1) *A New Method of a Common Place Book* (1686). This was Locke's first article in the *Bibliothèque* of Le Clerc; his other contributions to it are uncertain, except the *Epitome of the Essay*, (in 1688). (2) *The Fundamental Constitutions of Carolina* (prepared in 1673 when Locke was Lord Shaftesbury's secretary at Exeter House, remarkable for recognition of the principle of toleration, published in 1706, in the posthumous collection). (3) *Memoirs relating to the Life of Anthony, First Earl of Shaftesbury* (1706). (4) *Elements of Natural Philosophy* (1706). (5) *Observations upon the Growth and Culture of Vines and Olives* (1706). (6) *Rules of a Society which met once a Week, for their improvement in Useful Knowledge, and for the Promotion of Truth and Christian Charity* (1706). (7) *A Letter from a Person of Quality to his Friend in the Country*, published in 1875 (included by Des Maizeaux in his *Collection of Several Pieces of Mr John Locke's*, 1720), and soon afterwards burned by the common hangman by orders from the House of Lords, was disavowed by

Locke himself. It may have been dictated by Shaftesbury. There are also miscellaneous writings of Locke first published in the biographies of Lord King (1830) and of Mr Fox Bourne (1876).

Letters from Locke to Thoynard, Limborch, Le Clerc, Guenellon, Molyneux, Collins, Sir Isaac Newton, the first and the third Lord Shaftesbury, Lords Peterborough and Pembroke, Clarke of Chipley and others are preserved, many of them unpublished, most of them in the keeping of Lord Lovelace at Horseley Towers, and of Mr Sanford at Nynehead in Somerset, or in the British Museum. They express the gracious courtesy and playful humour which were natural to him, and his varied interests in human life.

I. *Social Economy.*—It has been truly said that all Locke's writings, even the *Essay on Human Understanding* itself, were occasional, and "intended directly to counteract the enemies of reason and freedom in his own age." This appears in his works on social polity, written at a time when the principles of democracy and toleration were struggling with divine right of kings, and when "the popular assertors of public liberty were the greatest engrossers of it too." "The state" with Locke was the deliberate outcome of free contract rather than a natural growth or organism. That the people, in the exercise of their sovereignty, have the right to govern themselves in the way they judge to be for the common good; and that civil government, whatever form it assumes, has no right to interfere with religious beliefs that are not inconsistent with civil society, is at the foundation of his political philosophy. He rested this sovereignty on virtual mutual contract on the part of the people themselves to be so governed. But the terms of the contract might be modified by the sovereign people themselves, from time to time, in accommodation to changing circumstances. He saw that things in this world were in a constant flux, so that no society could remain long in the same state, and that "the grossest absurdities" must be the issue of

"following custom when reason has left the custom." He was always disposed to liberal ecclesiastical concessions for the sake of peace, and he recommended harmonious co-operation with the civil magistrate in all matters of worship and government that were not expressly determined by Scripture.

The attack on Sir Robert Filmer in Locke's *First Treatise on Government* was an anachronism. The democratic principle argued for in the *Second Treatise*, while in advance of the practice of his age, was in parts anticipated by Aquinas and Bodin, as well as by Grotius and Hooker. Its guiding principle is, that civil rulers hold their power not absolutely but conditionally, government being essentially a moral trust, forfeited if the conditions are not fulfilled by the trustees. This presupposes an original and necessary law of nature or reason, as insisted on by Hooker. But it points to the constitution of civil society in the abstract rather than to the actual origin of government as a matter of fact and past history. There is no historical proof that power was formally entrusted to rulers by the conscious and deliberate action of the ruled. Indeed Locke seems to allow that the consent was at first tacit, and by anterior law of nature conditional on the beneficial purpose of the trust being realized. His *Treatises on Government* were meant to vindicate the Convention parliament and the English revolution, as well as to refute the ideas of absolute monarchy held by Hobbes and Filmer. They are classics in the library of English constitutional law and polity.

The social contract.

Locke's philosophical defence of religious liberty in the four *Letters of Toleration* is the most far-reaching of his contributions to social polity. He had a more modest estimate of human resources for forming true judgments in religion, and a less pronounced opinion of the immorality of religious error, than either the Catholic or the Puritan. The toleration which he spent his life in

Religious Toleration.

arguing for involved a change from the authoritative and absolute to the relative point of view, as regards man's means of knowledge and belief. It was a protest against those who in theology "peremptorily require demonstration and demand certainty where probability only is to be had." The practice of universal toleration amidst increasing religious differences was an application of the conception of human understanding which governs his *Essay*. Once a paradox it is now commonplace, and the superabundant argument in the *Letters on Toleration* fatigues the modern reader. The change is due more to Locke himself than to anyone else. Free thought and liberty of conscience had indeed been pleaded for, on various grounds, in the century in which he lived. Chillingworth, Jeremy Taylor, Glanvill and other philosophical thinkers in the Church of England urged toleration in the state, in conjunction with wide comprehension in the church, on the ground of our necessary intellectual limitation and inability to reach demonstration in theological debates. Puritans like Owen and Goodwin, whose idea of ecclesiastical comprehension was dogmatic and narrow, were ready to accept sectarian variety, because it was their duty to allow many religions in the nation, but only one form of theology within their own sect. The existence of separate nationalities, on the other hand, was the justification of national churches according to the latitudinarian churchmen with whom Locke associated: a national church comprehensive in creed, and thus co-extensive with the nation was their ideal. Locke went far to unite in a higher principle elements in the broad Anglican and the Puritan theories, while he recognized the individual liberty of thought which distinguishes the national church of England. A constant sense of the limits of human understanding was at the bottom of his arguments for tolerance. He had no objection to a national establishment of religion, provided that it was comprehensive enough, and was really the nation organized to promote goodness; not to protect the metaphysical subtleties of sectarian theologians. The recall of the national religion to the simplicity of

the gospels would, he hoped, make toleration of nonconformists unnecessary, as few would then remain. To the atheist alone Locke refuses full toleration, on the ground that social obligation can have no hold over him, for "the taking away of God dissolves all." He argued, too, against full toleration of the Church of Rome in England, on the ground of its unnational allegiance to a foreign sovereign. The unfitness of persecution as a means of propagating truth is copiously insisted on by Locke. Persecution can only transform a man into a hypocrite; belief is legitimately formed only by discernment of sufficient evidence; apart from evidence, a man has no right to control the understanding; he cannot determine arbitrarily what his neighbours must believe. Thus Locke's pleas for religious toleration resolve at last into his philosophical view of the foundation and limits of human knowledge.

II. *The Reasonableness of Christianity.*—The principles that governed Locke's social polity largely determined his attitude to Christianity. His "latitudinarianism" was the result of extraordinary reverence for truth, and a perception that knowledge may be sufficient for the purposes of human life while it falls infinitely short of speculative completeness. He never loses sight of essential reasonableness as the only ground on which Christian faith can ultimately rest. But Locke accepted Holy Scripture as infallible with the reverence of a Puritan. "It has God for its author, salvation for its end, and truth without any mixture of error for its matter." Yet he did not, like many Puritans, mean Scripture as interpreted by himself or by his sect. And faith in its infallibility was combined in Locke with deep distrust in "enthusiasm." This predisposed him to regard physical miracles as the solid criterion for distinguishing reasonable religious conviction from "inclinations, fancies and strong assurances." Assent in religion as in everything else he could justify only on the ground of its harmony with reason; professed "illumination without search, and certainty without proof" was to him a sign of absence of the divine spirit in the professor.

Confidence that we are right, he would say, is in itself no proof that we are right: when God asks assent to the truth of a proposition in religion, he either shows us its intrinsic rationality by ordinary means, or he offers miraculous proof of the reality of which we need reasonable evidence. But we must know what we mean by miracle. Reasonableness, in short, must always at last be our guide. His own faith in Christianity rested on its moral excellence when it is received in its primitive simplicity, combined with the miracles which accompanied its original promulgation. But "even for those books which have the attestation of miracles to confirm their being from God, the miracles," he says, "are to be judged by the doctrine, and not the doctrine by the miracles." Miracles alone cannot vindicate the divinity of immoral doctrine. Locke's *Reasonableness of Christianity* was an attempt to recall religion from the crude speculations of theological sects, destructive of peace among Christians, to its original simplicity; but this is apt to conceal its transcendent mystery. Those who practically acknowledge the supremacy of Jesus as Messiah accept all that is essential to the Christianity of Locke. His own Christian belief, sincere and earnest, was more the outcome of the common sense which, largely through him, moulded the prudential theology of England in the 18th century, than of the nobler elements present in More, Cudworth and other religious thinkers of the preceding age, or afterwards in Law and Berkeley, Coleridge and Schleiermacher.

III. *Education.*—Locke has his place among classic writers on the theory and art of Education. His contribution may be taken as either an introduction to or an application of the *Essay on Human Understanding*. In the *Thoughts on Education* imaginative sentiment is never allowed to weigh against utility; information is subordinate to the formation of useful character; the part which habit plays in individuals is always kept in view; the dependence of intelligence and character, which it is the purpose of education to improve, upon health of body is steadily inculcated; to make

children happy in undergoing education is a favourite precept; accumulating facts without exercising thought, and without accustoming the youthful mind to look for evidence, is always referred to as a cardinal vice. Wisdom more than much learning is what he requires in the teacher. In instruction he gives the first place to "that which may direct us to heaven," and the second to "the study of prudence, or discreet conduct, and management of ourselves in the several occurrences of our lives, which most assists our quiet prosperous passage through this present life." The infinity of real existence, in contrast with the necessary finitude of human understanding and experience, is always in his thoughts. This "disproportionateness" between the human mind and the universe of reality imposes deliberation in the selection of studies, and disregard for those which lie out of the way of a wise man. Knowledge of what other men have thought is perhaps of too little account with Locke. "It is an idle and useless thing to make it one's business to study what have been other men's sentiments in matters where only reason is to be judge." In his *Conduct of the Understanding* the pupil is invited to occupy the point at which "a full view of all that relates to a question" is to be had, and at which alone a rational discernment of truth is possible. The uneducated mass of mankind, he complains, either "seldom reason at all," or "put passion in the place of reason," or "for want of large, sound, round-about sense" they direct their minds only to one part of the evidence, "converse with one sort of men, read but one sort of books, and will not come in the hearing of but one sort of notions, and so carve out to themselves a little Goshen in the intellectual world, where light shines, and, as they conclude, day blesses them; but the rest of the vast expansion they give up to night and darkness, and avoid coming near it." Hasty judgment, bias, absence of an a priori "indifference" to what the evidence may in the end require us to conclude, undue regard for authority, excessive love for custom and antiquity, indolence and sceptical despair are among the states

of mind marked by him as most apt to interfere with the formation of beliefs in harmony with the Universal Reason that is active in the universe.

IV. *Philosophy.*—The *Essay Concerning Human Understanding* embodies Locke's philosophy. It was the first attempt on a great scale, and in the Baconian spirit, to estimate critically the certainty and the adequacy of human knowledge, when confronted with God and the universe.

The "Introduction" to the *Essay* is the keynote to the whole. The ill-fortune of men in their past endeavours to comprehend themselves and their environment is attributed in a great measure to their disposition to extend their inquiries into matters beyond the reach of human understanding. To inquire with critical care into "the original, certainty and extent of human knowledge, together with the grounds and degrees of belief, opinion and assent," is accordingly Locke's design in this *Essay*. Excluding from his enquiry "the physical consideration of the mind," he sought to make a faithful report, based on an introspective study of consciousness, as to how far a human understanding of the universe can reach. Although his report might show that our knowledge at its highest must be far short of a "universal or perfect comprehension of whatsoever is," it might still be "sufficient" for us, because "suited to our individual state." The "light of reason," the "candle of the Lord," that is set up in us may be found to shine bright enough for all *our* purposes. If human understanding cannot fully solve the infinite problem of the universe, man may at least see that at no stage of his finite experience is he necessarily the sport of chance, and that he can practically secure his own wellbeing.

The last book of the *Essay*, which treats of Knowledge and Probability, is concerned more directly than the three preceding ones with Locke's professed design. It has been suggested that Locke may have begun with this book. It contains few references to the foregoing parts of the *Essay*, and it might have appeared separately without being much less intelligible than

it is. The other books, concerned chiefly with ideas and words, are more abstract, and may have opened gradually on his mind as he studied more closely the subject treated in the fourth book. For Locke saw that the ultimate questions about our knowledge and its extent *presuppose* questions about ideas. Without ideas knowledge is impossible. "Idea" is thus a leading term in the *Essay*. It is used in a way peculiar to himself—"the term which, I think, stands best for whatsoever is the object of the understanding when a man thinks" or "whatever it is which the mind can be employed about." But ideas themselves are, he reminds us, "neither true nor false, being nothing but bare appearances," phenomena as we might call them. Truth and falsehood belong only to assertions or denials concerning ideas, that is, to our interpretations of our ideas according to their mutual relations.

Innate ideas.

That none of our ideas are "innate" is the argument contained in the first book. This means that the human mind, before any ideas are present to it, is a *tabula rasa*: it needs the quickening of ideas to become intellectually alive. The inward purpose of this famous argument is apt to be overlooked. It has been criticized as if it was a speculative controversy between empiricism and intellectualism. For this Locke himself is partly to blame. It is not easy to determine the antagonist he had in view. Lord Herbert is referred to as a defender of innateness. Locke was perhaps too little read in the literature of philosophy to do full justice to those more subtle thinkers who, from Plato downwards, have recognized the need for categories of the understanding and presuppositions of reason in the constitution of knowledge. "Innate," Lord Shaftesbury says, "is a word Mr Locke poorly plays on." For the real question is not about the *time* when ideas entered the mind, but "whether the constitution of man be such that, being adult and grown up, the ideas of order and administration of a God will not infallibly and necessarily spring up in him." This Locke himself sometimes seems to allow. "That there are certain propositions," we find him saying, "which, though the soul from the

beginning, or when a man is born, does not know, yet, by assistance from the outward senses, and the help of some previous cultivation, it may afterwards come certainly to know the truth of, is no more than what I have affirmed in my first book" ("Epistle to Reader," in second edition). And much of our knowledge, as he shows in the fourth book, is rational insight, immediate or else demonstrable, and thus intellectually necessary in its constitution.

What Locke really objects to is, that any of our supposed knowledge should claim immunity from free criticism. He argues in the first book against the innateness of our knowledge of God and of morality; yet in the fourth book he finds that the existence of God is demonstrable, being supported by causal necessity, without which there can be no knowledge; and he also maintains that morality is as demonstrable as pure mathematics. The positions are not inconsistent. The demonstrable rational necessity, instead of being innate, or conscious from our birth, may lie latent or subconscious in the individual mind; but for all that, when we gradually become more awake intellectually, such truths are seen to "carry their own evidence along with them." Even in the first book he appeals to the common reason, which he calls "common sense." "He would be thought void of common sense who asked, on the one side, or, on the other, went to give a reason, *why* 'it is impossible for the same thing to be and not to be.' It carries its own light and evidence with it, and needs no other proof: he that understands the terms assents to it for its own sake, or else nothing else will ever be able to prevail with him to do it" (bk. i. chap. 3, § 4).

The truth is that neither Locke, on the one hand, nor the intellectualists of the 17th century, on the other, expressed their meaning with enough of precision; if they had, Locke's argument would probably have taken a form less open to the charge of mere empiricism. Locke believed that in attacking "innate principles" he was pleading for universal reasonableness instead of

blind reliance on authority, and was thus, as he says, not "pulling up the foundations of knowledge," but "laying those foundations surer." When men heard that there were propositions that could not be doubted, it was a short and easy way to assume that what are only arbitrary prejudices are "innate" certainties, and therefore must be accepted unconditionally. This "eased the lazy from the pains of search, stopped the inquiry of the doubtful, concerning all that was once styled innate. It was no small advantage to those who affected to be masters and teachers to make this the principle of principles—that principles must not be questioned." The assumption that they were "innate" was enough "to take men off the use of their own reason and judgment, and to put them upon believing and taking upon trust without further examination.... Nor is it a small power it gives one man over another to have the authority to make a man swallow that for an innate principle which may serve his purpose who teacheth them" (bk. i. chap. 4, § 24).

Genesis of ideas.

The second book proposes a hypothesis regarding the genesis of our ideas and closes after an elaborate endeavour to verify it. The hypothesis is, that all human ideas, even the most complex and abstract and sublime, ultimately depend upon "experience." Otherwise, what we take to be ideas are only empty words. Here the important point is what human "experience" involves. Locke says that our "ideas" all come, either from the five senses or from reflective consciousness; and he proposes to show that even those concerned with the Infinite depend at last on one or other of these two sources: our "complex ideas" are all made up of "simple ideas," either from without or from within. The "verification" of this hypothesis, offered in the thirteenth and following chapters of the second book, goes to show in detail that even those ideas which are "most abstruse," how remote soever they may seem from original data of outward sense, or of inner consciousness, "are only such as the understanding frames to itself by repeating and joining

together simple ideas that it had at first, either from perceiving objects of sense, or from reflection upon its own operations."

To prove this, our thoughts of space, time, infinity, power, substance, personal identity, causality, and others which "seem most remote from the supposed original" are examined in a "plain historical method," and shown to depend either on (*a*) perception of things external, through the five senses, or on (*b*) reflection upon operations of the mind within. Reflection, "though it be not sense, as having nothing to do with external objects," is yet, he says, "very like it, and might properly enough be called internal sense." But the suggestion that "sense" might designate *both* the springs of experience is misleading, when we find in the sequel how much Locke tacitly credits "reflection" with. The ambiguity of his language makes opposite interpretations of this cardinal part of the Essay possible; the best we can do is to compare one part with another, and in doubtful cases to give him the benefit of the doubt.

Although the second book is a sort of inventory of our ideas, as distinguished from the certainty and boundaries of our knowledge, Locke even here makes the assumption that the "simple ideas" of the five senses are practically qualities of things which exist without us, and that the mental "operations" discovered by "reflection" are those of a person continuously existing. He thus relieves himself of the difficulty of having at the outset to explain *how* the immediate data of outward sense and reflection are accepted as "qualities" of things and persons. He takes this as a fact.

Such, according to Locke, are the only simple ideas which can appear even in the sublimest human speculations. But the mind, in becoming gradually stored with its "simple ideas" is able to elaborate them in numberless modes and relations; although it is not in the power of the most exalted wit or enlarged understanding to invent or frame any new simple idea, not taken in in one or the other of these two ways. All that man can

imagine about the universe or about God is necessarily confined to them. For proof of this Locke would have any one try to fancy a taste which had never affected his palate, or to frame the idea of a scent he had never felt, or an operation of mind, divine or human, foreign to all human consciousness.

The contrast and correlation of these two data of experience is suggested in the chapter on the "qualities of matter" in which we are introduced to a noteworthy vein of speculation (bk. ii. chap. 8). This chapter, on "things and their qualities," looks like an interpolation in an analysis of mere "ideas." Locke here treats simple ideas of the five senses as qualities of outward things. And the sense data are, he finds, partly (*a*) revelations of external things themselves in their mathematical relations, and partly (*b*) sensations, boundless in variety, which are somehow awakened in us through contact and collision with things relatively to their mathematical relations. Locke calls the former sort "primary, original or essential qualities of matter," and the others "secondary or derived qualities." The primary, which are quantities rather than qualities, are inseparable from matter, and virtually identical with the ideas we have of them. On the other hand, there is nothing perceived in the mathematical relations of bodies which in the least resembles their secondary qualities. If there were no sentient beings in existence, the secondary qualities would cease to exist, "except perhaps as unknown modes of the primary, or, if not, as something still more obscure." On the other hand, "solidity, extension, figure and motion would," he assumes, "be really in the world as they are, whether there were any sensible being to perceive them or not."

Qualities of matter.

Thus far the outcome of what Locke teaches about matter is, that it is Something capable of being expressed in terms of mathematical quantity, and also in terms of our own sensations. A further step was to suggest the ultimate dependence of the secondary qualities of bodies upon "the bulk,

Matter.

figures, number, situation and motions of the solid parts of which the bodies consist," these mathematical or primary qualities "existing as we think of them whether or not they are perceived." This Locke proposes in a hesitating way. For we, "not knowing what particular size, figure and texture of parts they are on which depend, and from which result, those qualities which make our complex idea, for example, of gold, it is impossible we should know what other qualities result from, or are incompatible with, the same constitution of the insensible parts of gold; and so consequently must always coexist with that complex idea we have of it, or else are inconsistent with it."

Some of the most remarkable chapters in the second book concern what may be called "crucial instances" in verification of its fundamental hypothesis of the dependence of human knowledge upon the simple ideas presented in our dual experience (bk. ii. ch. 13-28). They carry us towards the ultimate mysteries which attract meditative minds. The hypothesis, that even our most profound and sublime speculations are all limited to data of the senses and of reflection, is crucially tested by the "modes" and "substances" and "relations" under which, in various degrees of complexity, we somehow find ourselves obliged to conceive those simple phenomena. Such are modes of quantity in space, and time and number, under which Locke reports that we find ourselves mentally impelled towards immensity, eternity and the innumerable—in a word, towards Infinity which seems to transcend quantity; then there is the complex thought of Substance, to which we find ourselves mysteriously impelled, when the simple phenomena of the senses come to be regarded as qualities of "something"; again there is the obscure idea of the identity of persons, notwithstanding their constant changes of state; and there is, above all, the inevitable tendency we somehow have to refund a change into what we call its "Cause," with the associated idea of active power. Locke begins with our complex ideas of Space, Succession or Time, and Number.

Space, he says, appears when we use our senses of sight and touch; succession he finds "suggested" by all the changing phenomena of sense, and by "what passes in our minds"; number is "suggested by every object of our senses, and every thought of our minds, by everything that either doth exist or can be imagined." The modifications of which these are susceptible he reports to be "inexhaustible and truly infinite, extension alone affording a boundless field to the mathematicians." But the mystery latent in our ideas of space and time is, that "something in the mind" irresistibly hinders us from allowing the possibility of any limit to either. We find ourselves, when we try, compelled to lose our positive ideas of finite spaces in the negative idea of Immensity or Boundlessness, and our positive ideas of finite times in the negative thought of Endlessness. We have never seen, and we cannot imagine, an object whose extent is boundless. Yet we find when we reflect that something forces us to think that space and time must be unlimited. Thus Locke seems by implication to acknowledge something added by the mind to the original "simple ideas" of extension and succession; though he finds that what is added is not positively conceivable. When we reflect on immensity and eternity, we find them negations of all that is imaginable; and that whether we try infinite addition or infinite subdivision. He accepts this fact; he does not inquire why mind finds itself obliged to add without limit and to divide without limit. He simply reports that immensity and eternity are inevitable negative ideas, and also that every endeavour to realize them in positive images must be an attempt to represent as quantity what is beyond quantity. After all our additions we are as far from the infinite idea as we were at the beginning.

Immensity and endlessness and infinity.

Locke is too faithful to facts to overlook the ultimate mysteries in human experience. This is further illustrated in his acknowledgment of the inconceivable that is at the root of our idea of Substance. He tries to phenomenalize it, and thus resolve it into simple ideas; but he finds that it

Substance and personality.

cannot be phenomenalized, and yet that we cannot dispense with it. An unsubstantiated succession of phenomena, without a centre of unity to which they are referable as qualities, is unintelligible: we cannot have a language of adjectives without nouns. Locke had some apprehension of this transcendent intellectual obligation. According to his report, "the mind" always obliges us to suppose Something beyond positive phenomena to which the phenomena must be attributed; but he was perplexed by this "confused negative" idea. So for him the word substance means "only an uncertain supposition of we know not what." If one were to ask him what the substance is in which this colour and that taste or smell inhere, "he would find himself in a difficulty like that of the Indian, who, after saying that the world rested on an elephant, and the elephant on a broad-backed tortoise, could only suppose the tortoise to rest on 'Something, I know not what.'" The attempt to conceive it is like the attempt positively to conceive immensity or eternity: we are involved in an endless, ultimately incomprehensible, regress. We fail when we try either positively to phenomenalize substance or to dispense with the superphenomenal abstraction. Our only positive idea is of an aggregate of phenomena. And it is only thus, he says, that we can approach a positive conception of God, namely by "enlarging indefinitely some of the simple ideas we received from reflection." Why man must remain in this mental predicament, Locke did not inquire. He only reported the fact. He likewise struggled bravely to be faithful to fact in his report of the state in which we find ourselves when we try to conceive continued personal identity. The paradoxes in which he here gets involved illustrate this (bk. ii. ch. 27).

Locke's thoughts about Causality and Active Power are especially noteworthy, for he rests our knowledge of God and of the external universe on those ultimate ideas. The intellectual demand for "the cause" of an event is what we find we cannot help having; yet it is a demand for what in the

Causality.

end the mind cannot fully grasp. Locke is content to trace the idea of "cause and effect," as far as mere natural science goes, to our "constant observation" that "qualities and finite substances begin to exist, and receive their existence from other beings which produce them." We find that this connexion is what gives intelligibility to ceaseless and what seemed chaotic changes, converting them into the divinely concatenated system which we call "the universe." Locke seems hardly to realize all that is implied in scientific prevision or expectation of change. Anything, as far as "constant observation" tells us, might a priori have been the natural cause of anything; and no finite number of "observed" sequences, *per se*, can guarantee universality and necessity. The idea of power, or *active* causation, on the other hand, "is got," he acknowledges, not through the senses, but "through our consciousness of our own voluntary agency, and therefore through reflection" (bk. ii. ch. 21). In bodies we observe no active agency, only a sustained natural order in the succession of passive sensuous phenomena. The true source of change in the material world must be analogous to what we are conscious of when we exert volition. Locke here unconsciously approaches the spiritual view of active power in the physical universe afterwards taken by Berkeley, forming the constructive principle of his philosophy.

Locke's book about Ideas leads naturally to his Third Book which is concerned with Words, or the sensible signs of ideas. Here he analyses "abstract ideas," and instructively illustrates the confusion apt to be produced in them by the inevitable imperfection of words. He unfolds the relations between verbal signs and the several sorts of ideas; words being the means for enabling us to treat ideas as typical, abstract and general. "Some parts of this third book," concerning Words, Locke tells his friend Molyneux, "though the thoughts were easy and clear enough, yet cost me more pains to

Ideas and words.

express than all the rest of my *Essay*. And therefore I should not much wonder, if there be in some places of it obscurity and doubtfulness."

The Fourth Book, about Knowledge proper and Probability, closes the *Essay*. Knowledge, he says, is perception of relations among ideas; it is expressed in our affirmations and negations; and real knowledge is discernment of the relations of ideas to what is real. In the foregoing part of the *Essay* he had dealt with "ideas" and "simple apprehension," here he is concerned with intuitive "judgment" and demonstrative "reasoning," also with judgments and reasonings about matters of fact. At the end of this patient search among our ideas, he supposes the reader apt to complain that he has been "all this while only building a castle in the air," and to ask what the purpose of all this stir is, if we are not thereby carried beyond mere ideas. "If it be true that knowledge lies only in the agreement or disagreement of ideas, the visions of an enthusiast and the reasonings of a sober man will be equally certain. It is no matter how things themselves are" (bk. iv. 4). This gives the keynote to the fourth book. It does not, however, carry him into a critical analysis of the rational constitution of knowledge, like Kant. Hume had not yet shown the sceptical objections against conclusions which Locke accepted without criticism. The subtle agnostic, who doubted reason because reason could not be supported in the end by empirical evidence, was less in his view than persons blindly resting on authority or prejudice. Total scepticism he would probably have regarded as unworthy of the serious attention of a wise man. "Where we perceive the agreement or disagreement of any of our ideas there is certain knowledge; and wherever we are sure these ideas agree with the reality of things, there is certain *real* knowledge" (bk. iv. ch. 4).

Theory of knowledge.

Locke's report about human knowledge and its narrow extent forms the first thirteen chapters of the fourth book. The remainder of the book is

concerned for the most part with the probabilities on which human life practically turns, as he and Butler are fond of reminding us. As regards kinds of knowledge, he finds that "all knowledge we are capable of" must be assertion or denial of some one of three sorts of relation among our ideas themselves, or else of relations between our ideas and reality that exists independently of us and our ideas. Accordingly, knowledge is concerned either with (*a*) relations of identity and difference among ideas, as when we say that "blue is not yellow"; or (*b*) with mathematical relations, as that "two triangles upon equal bases between two parallels must be equal"; or (*c*) in assertions that one quality does or does not coexist with another in the same substance, as that "iron is susceptible of magnetical impressions, or that ice is not hot"; or (*d*) with ontological reality, independent of our perceptions, as that "God exists" or "I exist" or "the universe exists." The first sort is analytical; mathematical and ethical knowledge represents the second; physical science forms the third; real knowledge of self, God and the world constitutes the fourth.

Four sorts of knowable relations.

Locke found important differences in the way in which knowledge of any sort is reached. In some instances the known relation is self-evident, as when we judge intuitively that a circle cannot be a triangle, or that three must be more than two. In other cases the known relation is perceived to be intellectually necessary through the medium of premisses, as in a mathematical demonstration. All that is strictly knowledge is reached in these two ways. But there is a third sort, namely sense-perception, which hardly deserves the name. For "our perceptions of the particular existence of finite beings without us" go beyond mere probability, yet they are not purely rational. There is nothing self-contradictory in the supposition that our perceptions of things external are illusions, although we are somehow unable to doubt them. We find ourselves inevitably "conscious of a different

Intuition and demonstration.

sort of perception," when we actually see the sun by day and when we only imagine the sun at night.

Locke next inquired to what extent knowledge—in the way either of intuitive certainty, demonstrative certainty, or sense perception—is possible, in regard to each of the four (already mentioned) sorts of knowable relation. There is only one of the four in which our knowledge is co-extensive with our ideas. It is that of "identity and diversity": we cannot be conscious at all without distinguishing, and every affirmation necessarily implies negation. The second sort of knowable relation is sometimes intuitively and sometimes demonstrably discernible. Morality, Locke thinks, as well as mathematical quantity, is capable of being demonstrated. "Where there is no property there is no injustice," is an example of a proposition "as certain as any demonstration in Euclid." Only we are more apt to be biassed, and thus to leave reason in abeyance, in dealing with questions of morality than in dealing with problems in mathematics.

Turning from abstract mathematical and moral relations to concrete relations of coexistence and succession among phenomena—the third sort of knowable relation—Locke finds the light of pure reason disappear; although these relations form "the greatest and most important part of what we desire to know." Of these, including as they do all inductive science, he reports that demonstrable knowledge "is very short, if indeed we have any at all"; and are not thrown wholly on presumptions of probability, or else left in ignorance. Man cannot attain perfect and infallible science of bodies. For natural science depends, he thinks, on knowledge of the relations between their secondary qualities on the one hand, and the mathematical qualities of their atoms on the other, or else "on something yet more remote from our comprehension." Now, as perception of these atoms and their relations is beyond us, we must be satisfied with inductive presumptions, for which "experimental verification" affords, after all, only conclusions

that wider experience may prove to be inadequate. But this moral venture Locke accepts as "sufficient for our purposes."

Our knowledge under Locke's fourth category of relations—real existence—includes (*a*) intuitive perceptions of our own existence; (*b*) demonstrable certainty of the existence of God; and (*c*) actual perception of the existence of surrounding things, as long as, but only as long as the things are present to sense. "If I doubt all other things, that very doubt makes me perceive my own existence, and will not suffer me to doubt of that" (iv. 9. 3). Faith in the existence of God is virtually with Locke an expression of faith in the principle of active causality in its ultimate universality. Each person knows that he now exists, and is convinced that he had a beginning; with not less intuitive certainty he knows that "*nothing* can no more produce any real being than it can be equal to two right angles." His final conclusion is that there must be eternally "a most powerful and most knowing Being, in which, as the origin of all, must be contained all the perfections that can ever after exist," and out of which can come only what it has already in itself; so that as the cause of my mind, it must be Mind. There is thus causal necessity for Eternal Mind, or what we call "God." This is cautiously qualified thus in a letter to Anthony Collins, written by Locke a few months before he died: "Though I call the thinking faculty in me 'mind,' yet I cannot, because of that name, equal it in anything to that infinite and incomprehensible Being, which, for want of right and distinct conceptions, is called 'Mind' also." But the immanence of God in the things and persons that compose the universal order, with what this implies, is a conception foreign to Locke, whose habitual conception was of an extra-mundane deity, the dominant conception in the 18th century.

Real existence.

Turning from our knowledge of Spirit to our knowledge of Matter, nearly all that one can affirm or deny about "things external is," according to

Locke, not knowledge but venture or presumptive trust. We have, strictly speaking, no "knowledge" of real beings beyond our own self-conscious existence, the existence of God, and the existence of objects of sense as long as they are actually present to sense. "When I see an external object at a distance, a man for instance, I cannot but be satisfied of his existence while I am looking at him. (Locke might have added that when one only 'sees a man' it is merely his *visible* qualities that are perceived; his other qualities are as little 'actual present sensations' as if he were out of the range of sense.) But when the man leaves me alone, I cannot be certain that he still exists." "There is no necessary connexion between his existence a minute since (when he was present to any sense of sight) and his existence now (when he is absent from all my senses); by a thousand ways he may have ceased to be. I have not that certainty of his continued existence which we call knowledge; though the great likelihood of it puts it past doubt. But this is but probability and not knowledge" (chap. 11, § 9). Accordingly, purely rational science of external Nature is, according to Locke, impossible. All our "interpretations of nature" are inadequate; only reasonable probabilities, not final rational certainties. This boundless region affords at the best probabilities, ultimately grounded on moral faith, all beyond lies within the veil. Such is Locke's "plain, matter-of-fact" account of the knowledge of the Real that is open to man.

Knowledge of the external world.

We learn little from Locke as to the rationale of the probabilities on which man thus depends when he deals with the past, the distant or the future. The concluding chapters of the fourth book contain wise advice to those whose lives are passed in an ever-changing environment, for avoiding the frequent risk of error in their conclusions, with or without the help of syllogism, the office of which, as a means of discovery, is here critically considered.

The rationale of probability.

Investigation of the foundation of inductive inference was resumed by Hume where Locke left it. With a still humbler view of human reason than Locke's, Hume proposed as "a subject worthy of curiosity," to inquire into "the nature of that evidence which assures us of any real existence and matter of fact, *beyond* the present testimony of our senses and the records of our memory; a part of philosophy that has been little cultivated either by the ancients or the moderns." Hume argues that custom is a sufficient practical explanation of this gradual enlargement of our objective experience, and that no deeper explanation is open to man. All beyond each present transitory "impression" and the stores of memory is therefore reached blindly, through custom or habitual association. Associative tendency, individual or inherited, has since been the favourite constructive factor of human experience in Empirical Philosophy. This factor is not prominent in Locke's *Essay*. A short chapter on "association of ideas" was added to the second book in the fourth edition. And the tendency to associate is there presented, not as the fundamental factor of human knowledge, but as a chief cause of human error.

Locke and Hume.

Kant's critical analysis of pure reason is more foreign to Locke than the attempts of 18th- and 19th-century associationists and evolutionists to explain experience and science. Kant's aim was to show the necessary rational constitution of experience. Locke's design was less profound. It was his distinction to present to the modern world, in his own "historical plain method," perhaps the largest assortment ever made by any individual of facts characteristic of human understanding. Criticism of the presuppositions implied in those facts—by Kant and his successors, and in Britain more unpretentiously by Reid, all under the stimulus of Hume's sceptical criticism—has employed philosophers since the author of the *Essay on Human Understanding* collected materials that raised deeper philosophical

Locke and Kant.

problems than he tried to solve. Locke's mission was to initiate modern criticism of the foundation and limits of our knowledge. Hume negatively, and the German and Scottish schools constructively, continued what it was Locke's glory to have begun.

BIBLIOGRAPHY.—The *Essay concerning Human Understanding* has passed through more editions than any classic in modern philosophical literature. Before the middle of the 18th century it had reached thirteen, and it has now passed through some forty editions, besides being translated into Latin, French, Dutch, German and modern Greek. There are also several abridgments. In addition to those criticisms which appeared when Locke was alive, among the most important are Leibnitz's *Nouveaux Essais sur l'entendement humain*—written about 1700 and published in 1765, in which each chapter of the *Essay* of Locke is examined in a corresponding chapter by Leibnitz; Cousin's "École sensualiste: système de Locke," in his *Histoire de la philosophie au XVIII*e *siècle* (1829); and the criticisms in T. H. Green's Introduction to the *Philosophical Works of Hume* (1874). The *Essay, with Prolegomena, biographical, critical and historical*, edited by Professor Campbell Fraser and published by the Oxford Clarendon Press in 1894, is the only annotated edition, unless the *Nouveaux Essais* of Leibnitz may be reduced to this category.

The *Letters on Toleration*, *Thoughts on Education* and *The Reasonableness of Christianity* have also gone through many editions, and been translated into different languages.

The first collected edition of Locke's *Works* was in 1714, in three folio volumes. The best is that by Bishop Law, in four quartos (1777). The one most commonly known is in ten volumes (1812).

The *Éloge* of Jean le Clerc (*Bibliothèque choisie*, 1705) has been the basis of the memoirs of Locke prefixed to the successive editions of his

Works, or contained in biographical dictionaries. In 1829 a *Life of Locke* (2nd ed. in two volumes, with considerable additions, 1830), was produced by Peter, 7th Baron King, a descendant of Locke's cousin, Anne Locke. This adds a good deal to what was previously known, as Lord King was able to draw from the mass of correspondence, journals and commonplace books of Locke in his possession. In the same year Dr Thomas Foster published some interesting letters from Locke to Benjamin Furly. The most copious account of the life is contained in the two volumes by H. R. Fox-Bourne (1876), the results of laborious research among the Shaftesbury Papers, Locke MSS. in the British Museum, the Public Record Office, the Lambeth, Christ Church and Bodleian libraries, and in the Remonstrants' library at Amsterdam. Monographs on Locke by T. H. Fowler in 1880, in "English Men of Letters," and by Fraser, in 1890, in Blackwood's "Philosophical Classics" may be mentioned; also addresses by Sir F. Pollock and Fraser at the bicentenary commemoration by the British Academy of Locke's death, published in the *Proceedings* of the Academy (1904). See also C. Bastide, *John Locke; ses théories politiques et leur influence en Angleterre* (Paris, 1907); H. Ollion, *La Philosophie générale de J. L.* (1909).

LOCKE, MATTHEW (*c*. 1630-1677), English musician, perhaps the earliest English writer for the stage, was born at Exeter, where he became a chorister in the cathedral. His music, written with Christopher Gibbons (son of Orlando Gibbons), for Shirley's masque *Cupid and Death*, was performed in London in 1653. He wrote some music for Davenant's *Siege of Rhodes* in 1656; and in 1661 was appointed composer in ordinary to Charles II. During the following years he wrote a number of anthems for the Chapel Royal, and excited some criticism on the score of novelty, to which he replied with considerable heat (*Modern Church Music; pre-accused, censured and obstructed in its Performance before His Majesty, April 1st, 1666, &c.*; copies in the Fitzwilliam Museum, Cambridge, and the Royal College of Music). A good deal of music for the theatre followed, the most important being for Davenant's productions of *The Tempest* (1667) and of *Macbeth* (1672), but some doubt as to this latter has arisen, Purcell, Eccles or Leveridge, being also credited with it. He also composed various songs and instrumental pieces, and published some curious works on musical theory. He died in August 1677, an elegy being written by Purcell.

LOCKERBIE, a municipal and police burgh of Dumfriesshire, Scotland, in the district of Annandale, 14½ m. E.N.E. of Dumfries by the Caledonian railway. Pop. (1901) 2358. It has long been famous for its cattle and sheep sales, but more particularly for the great August lamb fair, the largest in Scotland, at which as many as 126,000 lambs have been sold. The town hall and Easton institute are in the Scottish Baronial style. The police station is partly accommodated in an ancient square tower, once the stronghold of the Johnstones, for a long period the ruling family under whose protection the town gradually grew up. At Dryfe Sands, about 2 m. to the W., a bloody encounter took place in 1593 between the Johnstones and Maxwells. The Maxwells were pursued into Lockerbie and almost exterminated; hence "Lockerbie Lick" became a proverbial expression, signifying an overwhelming defeat.

LOCKER-LAMPSON, FREDERICK (1821-1895), English man of letters, was born, on the 29th of May 1821, at Greenwich Hospital. His father, who was Civil Commissioner of the Hospital, was Edward Hawke Locker, youngest son of that Captain William Locker who gave Nelson the memorable advice "to lay a Frenchman close, and beat him." His mother, Eleanor Mary Elizabeth Boucher, was a daughter of the Rev. Jonathan Boucher, vicar of Epsom and friend of George Washington. After a desultory education, Frederick Locker began life in a colonial broker's office. Soon deserting this uncongenial calling, he obtained a clerkship in Somerset House, whence he was transferred to Lord Haddington's private office at the

Admiralty. Here he became deputy-reader and *précis* writer. In 1850 he married Lady Charlotte Bruce, daughter of the Lord Elgin who brought the famous marbles to England, and sister of Lady Augusta Stanley. After his marriage he left the Civil Service, in consequence of ill-health. In 1857 he published *London Lyrics*, a slender volume of 90 pages, which, with subsequent extensions, constitutes his poetical legacy. *Lyra Elegantiarum* (1867), an anthology of light and familiar verse, and *Patchwork* (1879), a book of extracts, were his only other publications. In 1872 Lady Charlotte Locker died. Two years later Locker married Miss Hannah Jane Lampson, the only daughter of Sir Curtis Miranda Lampson, Bart., of Rowfant, Sussex, and in 1885 took his wife's surname. At Rowfant he died on the 30th of May 1895. Chronic ill-health debarred Locker from any active part in life, but it did not prevent his delighting a wide circle of friends by his gifts as a host and *raconteur*, and from accumulating many treasures as a connoisseur. His books are catalogued in the volume called the *Rowfant Library* (1886), to which an appendix (1900) was added, after his death, under the superintendence of his eldest son. As a poet, Locker belongs to the choir who deal with the gay rather than the grave in verse—with the polished and witty rather than the lofty or emotional. His good taste kept him as far from the broadly comic on the one side as his kind heart saved him from the purely cynical on the other. To something of Prior, of Praed and of Hood he added qualities of his own which lent his work distinction—a distinction in no wise diminished by his unwearied endeavour after directness and simplicity.

A posthumous volume of Memoirs, entitled *My Confidences* (1896), and edited by his son-in-law, Mr Augustine Birrell, gives an interesting idea of his personality and a too modest estimate of his gifts as a poet.

(A. D.)

LOCKHART, GEORGE (1673-1731), of Carnwath, Scottish writer and politician, was a member of a Lanarkshire family tracing descent from Sir Simon Locard (the name being originally territorial, de Loch Ard), who is said to have accompanied Sir James Douglas on his expedition to the East with the heart of Bruce, which relic, according to Froissart, Locard brought home from Spain when Douglas fell in battle against the Moors, and buried in Melrose Abbey; this incident was the origin of the "man's heart within a fetterlock" borne on the Lockhart shield, which in turn perhaps led to the altered spelling of the surname. George Lockhart's grandfather was Sir James Lockhart of Lee (d. 1674), a lord of the court of session with the title of Lord Lee, who commanded a regiment at the battle of Preston. Lord Lee's eldest son, Sir William Lockhart of Lee (1621-1675), after fighting on the king's side in the Civil War, attached himself to Oliver Cromwell, whose niece he married, and by whom he was appointed commissioner for the administration of justice in Scotland in 1652, and English ambassador at the French court in 1656, where he greatly distinguished himself by his successful diplomacy. Lord Lee's second son, Sir George Lockhart (*c.* 1630-1689), was lord-advocate in Cromwell's time, and was celebrated for his persuasive eloquence; in 1674, when he was disbarred for alleged disrespect to the court of session in advising an appeal to parliament, fifty barristers showed their sympathy for him by withdrawing from practice. Lockhart was readmitted in 1676, and became the leading advocate in political trials, in which he usually appeared for the defence. He was appointed lord-president of the court of session in 1685; and was shot in the streets of Edinburgh on

the 31st of March 1689 by John Chiesley, against whom the lord-president had adjudicated a cause. Sir George Lockhart purchased the extensive estates of the earls of Carnwath in Lanarkshire, which were inherited by his eldest son, George, whose mother was Philadelphia, daughter of Lord Wharton.

George Lockhart, who was member for the city of Edinburgh in the Scottish parliament, was appointed a commissioner for arranging the union with England in 1705. After the union he continued to represent Edinburgh, and later the Wigton burghs. His sympathies were with the Jacobites, whom he kept informed of all the negotiations for the union; in 1713 he took part in an abortive movement aiming at the repeal of the union. He was deeply implicated in the rising of 1715, the preparations for which he assisted at Carnwath and at Dryden, his Edinburgh residence. He was imprisoned in Edinburgh castle, but probably, through the favour of the duke of Argyll, he was released without being brought to trial; but his brother Philip was taken prisoner at the battle of Preston and condemned to be shot, the sentence being executed on the 2nd of December 1715. After his liberation Lockhart became a secret agent of the Pretender; but his correspondence with the prince fell into the hands of the government in 1727, compelling him to go into concealment at Durham until he was able to escape abroad. Argyll's influence was again exerted in Lockhart's behalf, and in 1728 he was permitted to return to Scotland, where he lived in retirement till his death in a duel on the 17th of December 1731. Lockhart was the author of *Memoirs of the Affairs of Scotland*, dealing with the reign of Queen Anne till the union with England, first published in 1714. These *Memoirs*, together with Lockhart's correspondence with the Pretender, and one or two papers of minor importance, were published in two volumes in 1817, forming the well-known "Lockhart Papers," which are a valuable authority for the history of the Jacobites.

Lockhart married Eupheme Montgomerie, daughter of Alexander, 9th earl of Eglinton, by whom he had a large family. His grandson James, who

assumed his mother's name of Wishart in addition to that of Lockhart, was in the Austrian service during the Seven Years' War, and was created a baron and count of the Holy Roman Empire. He succeeded to the estates of Lee as well as of Carnwath, both of which properties passed, on the death of his son Charles without issue in 1802, to his nephew Alexander, who was created a baronet in 1806.

See *The Lockhart Papers* (2 vols., London, 1817); Andrew Lang, *History of Scotland* (4 vols., London, 1900). For the story of Sir Simon Lockhart's adventures with the heart of the Bruce, see Sir Walter Scott's *The Talisman*.

(R. J. M.)

LOCKHART, JOHN GIBSON (1794-1854), Scottish writer and editor, was born on the 14th of July 1794 in the manse of Cambusnethan in Lanarkshire, where his father, Dr John Lockhart, transferred in 1796 to Glasgow, was minister. His mother, who was the daughter of the Rev. John Gibson, of Edinburgh, was a woman of considerable intellectual gifts. He was sent to the Glasgow high school, where he showed himself clever rather than industrious. He fell into ill-health, and had to be removed from school before he was twelve; but on his recovery he was sent at this early age to Glasgow University, and displayed so much precocious learning, especially in Greek, that he was offered a Snell exhibition at Oxford. He was not fourteen when he entered Balliol College, where he acquired a great store of knowledge outside the regular curriculum. He read French, Italian, German and Spanish, was interested in classical and British antiquities, and became versed in heraldic and genealogical lore. In 1813 he took a first class in classics in the final

schools. For two years after leaving Oxford he lived chiefly in Glasgow before settling to the study of Scottish law in Edinburgh, where he was called to the bar in 1816. A tour on the continent in 1817, when he visited Goethe at Weimar, was made possible by the kindness of the publisher Blackwood, who advanced money for a promised translation of Schlegel's *Lectures on the History of Literature*, which was not published until 1838. Edinburgh was then the stronghold of the Whig party, whose organ was the *Edinburgh Review*, and it was not till 1817 that the Scottish Tories found a means of expression in *Blackwood's Magazine*. After a somewhat hum-drum opening, *Blackwood* suddenly electrified the Edinburgh world by an outburst of brilliant criticism. John Wilson (Christopher North) and Lockhart had joined its staff in 1817. Lockhart no doubt took his share in the caustic and aggressive articles which marked the early years of *Blackwood*; but his biographer, Mr Andrew Lang, brings evidence to show that he was not responsible for the virulent articles on Coleridge and on "The Cockney School of Poetry," that is on Leigh Hunt, Keats and their friends. He has been persistently accused of the later *Blackwood* article (August 1818) on Keats, but he showed at any rate a real appreciation of Coleridge and Wordsworth. He contributed to *Blackwood* many spirited translations of Spanish ballads, which in 1823 were published separately. In 1818 the brilliant and handsome young man attracted the notice of Sir Walter Scott, and the acquaintance soon ripened into an intimacy which resulted in a marriage between Lockhart and Scott's eldest daughter Sophia, in April 1820. Five years of domestic happiness followed, with winters spent in Edinburgh and summers at a cottage at Chiefswood, near Abbotsford, where Lockhart's two eldest children, John Hugh and Charlotte, were born; a second son, Walter, was born later at Brighton. In 1820 John Scott, the editor of the *London Magazine*, wrote a series of articles attacking the conduct of *Blackwood's Magazine*, and making Lockhart chiefly responsible for its extravagances. A correspondence followed, in which a meeting between Lockhart and John Scott was proposed, with Jonathan Henry Christie and Horace Smith as seconds. A series of delays

and complicated negotiations resulted early in 1821 in a duel between Christie and John Scott, in which Scott was killed. This unhappy affair, which has been the subject of much misrepresentation, is fully discussed in Mr Lang's book on Lockhart.

Between 1818 and 1825 Lockhart worked indefatigably. In 1819 *Peter's Letters to his Kinsfolk* appeared, and in 1822 he edited Peter Motteux's edition of *Don Quixote*, to which he prefixed a life of Cervantes. Four novels followed: *Valerius* in 1821, *Some Passages in the Life of Adam Blair*, *Minister of Gospel at Cross Meikle* in 1822, *Reginald Dalton* in 1823 and *Matthew Wald* in 1824. But his strength did not lie in novel writing, although the vigorous quality of *Adam Blair* has been recognized by modern critics. In 1825 Lockhart accepted the editorship of the *Quarterly Review*, which had been in the hands of Sir John Taylor Coleridge since Gifford's resignation in 1824. He had now established his literary position, and, as the next heir to his unmarried half-brother's property in Scotland, Milton Lockhart, he was sufficiently independent, though he had abandoned the legal profession. In London he had great social success, and was recognized as a brilliant editor. He contributed largely to the *Quarterly Review* himself, his biographical articles being especially admirable. He showed the old railing spirit in an amusing but violent article in the *Quarterly* on Tennyson's *Poems* of 1833, in which he failed to discover the mark of genius. He continued to write for *Blackwood*; he produced for *Constable's Miscellany* in 1828 what remains the most charming of the biographies of Burns; and he undertook the superintendence of the series called "Murray's Family Library," which he opened in 1829 with a *History of Napoleon*. But his chief work was the *Life of Sir Walter Scott* (7 vols., 1837-1838; 2nd ed., 10 vols., 1839). There were not wanting those in Scotland who taxed Lockhart with ungenerous exposure of his subject, but to most healthy minds the impression conveyed by the biography was, and is, quite the opposite. Carlyle did justice to many of its excellencies in a criticism contributed to the *London and Westminster Review* (1837). Lockhart's account of the transactions between Scott and the

Ballantynes and Constable caused great outcry; and in the discussion that followed he showed unfortunate bitterness by his pamphlet, “The Ballantyne Humbug handled.” The *Life of Scott* has been called, after Boswell’s *Johnson*, the most admirable biography in the English language. The proceeds, which were considerable, Lockhart resigned for the benefit of Scott’s creditors.

The close of Lockhart’s life was saddened by family bereavement, resulting in his own breakdown in health and spirits. His eldest boy (the suffering “Hugh Littlejohn” of Scott’s *Tales of a Grandfather*) died in 1831; Scott himself in 1832; Mrs Lockhart in 1837; and the surviving son, Walter Lockhart, in 1852. Resigning the editorship of the *Quarterly Review* in 1853, he spent the next winter in Rome, but returned to England without recovering his health; and being taken to Abbotsford by his daughter Charlotte, who had become Mrs James Robert Hope-Scott, he died there on the 25th of November 1854. He was buried in Dryburgh Abbey, near Sir Walter Scott.

Lockhart’s *Life* (2 vols., London and New York, 1897) was written by Andrew Lang. A. W. Pollard’s edition of the *Life of Scott* (1900) is the best.

LOCKHART, SIR WILLIAM STEPHEN ALEXANDER

(1841-1900), British general, was born in Scotland on the 2nd of September 1841, his father being a Lanarkshire clergyman. He entered the Indian army in 1858, in the Bengal native infantry. He served in the Indian Mutiny, the Bhutan campaign (1864-66), the Abyssinian expedition (1867-68; mentioned in despatches), the Hazara Black Mountain expedition

(1868-69; mentioned in despatches). From 1869 to 1879 he acted as deputy-assistant and assistant quartermaster-general in Bengal. In 1877 he was military attaché with the Dutch army in Acheen. He served in the Afghan War of 1878-80, was mentioned in despatches and made a C.B., and from 1880 to 1885 was D.Q.G. in the intelligence branch at headquarters. He commanded a brigade in the Third Burmese War (1886-87), and was made K.C.B., C.S.I., and received the thanks of the government. An attack of fever brought him to England, where he was employed as assistant military secretary for Indian affairs; but in 1890 he returned to India to take command of the Punjab frontier force, and for five years was engaged in various expeditions against the hill tribes. After the Waziristan campaign in 1894-95 he was made K.C.S.I. He became full general in 1896, and in 1897 he was given the command against the Afridis and Mohmands, and conducted the difficult Tirah campaign with great skill. He was made G.C.B., and in 1898 became commander-in-chief in India. He died on the 18th of March 1900. Sir William Lockhart was not only a first-rate soldier, but also had a great gift for dealing with the native tribesmen. Among the latter he had the *sobriquet* of Amir Sahib, on account of their respect and affection for him.

LOCK HAVEN, a city and the county-seat of Clinton county, Pennsylvania, U.S.A., on the west branch of the Susquehanna river, near the mouth of Bald Eagle Creek, about 70 m. N.N.W. of Harrisburg. Pop. (1900) 7210 (618 foreign-born and 122 negroes); (1910) 7772. It is served by branches of the Pennsylvania and the New York Central & Hudson River railways and by electric interurban railways. The city is pleasantly situated in

an agricultural region, and there are large deposits of cement and of fire-brick clay in the vicinity. Lock Haven is the seat of the Central State Normal School (opened 1877), and has a public library and a hospital. There are various manufactures. The municipality owns and operates the water-works. The locality was settled in 1769. A town was founded in 1833, the Pennsylvania Canal (no longer in use here) was completed to this point in 1834, and the name of the place was suggested by two canal locks and the harbour, or haven, for rafts in the river. Lock Haven was made the county-seat immediately after the erection of Clinton county in 1839, was incorporated as a borough in 1840, and first chartered as a city in 1870.

LOCKPORT, a city of Will county, Illinois, U.S.A., on the Des Plaines river and the Illinois & Michigan Canal, and the terminus of the Chicago Sanitary District Drainage Canal, about 33 m. S.W. of Chicago and 4 m. N.N.E. of Joliet. Pop. (1900) 2659 (552 being foreign-born and 130 negroes); (1910) 2555. Lockport is served by the Chicago & Alton, and the Atchison, Topeka & Santa Fé railways, and by the Chicago & Joliet Electric railway. It is in a picturesque farming country, and there are good limestone quarries in the valley of the Des Plaines river. It has manufactures and a considerable trade, especially in grain. A settlement was made here about 1827; in 1837 the site was chosen as headquarters for the Illinois & Michigan Canal and a village was laid out; it was incorporated in 1853, and was chartered as a city in 1904. In 1892 work was begun on the Chicago Drainage Canal, whose controlling works are here and whose plant, developing 40,000

h.p. from the 40 ft. fall between Joliet and Lockport, supplies Lockport with cheap power and has made it a manufacturing rather than a commercial city.

LOCKPORT, a city and the county-seat of Niagara county, New York, U.S.A., on the Erie Canal, 26 m. by rail N. by E. of Buffalo and 56 m. W. of Rochester. Pop. (1900) 16,581, of whom 2036 were foreign-born and 160 were negroes; (1910 census) 17,970. It is served by the New York Central & Hudson River and the Erie railways, by the International railway (electric interurban), and by the Erie Canal. The city owes its name to the five double locks of the canal, which here falls 66 ft. (over a continuation of the Niagara escarpment locally known as “Mountain Ridge”) from the level of Lake Erie to that of the Genesee river. In 1909 a scheme was on foot to replace these five locks by a huge lift lock and to construct a large harbour immediately W. of the city. The surplus water from Tonawanda Creek, long claimed both by the Canal and by the Lockport manufacturers, after supplying the canal furnishes water-power, and electric power is derived from Niagara. The factory products, mostly paper and wood-pulp, flour and cereal foods, and foundry and machine-shop products, were valued in 1905 at $5,807,980. Lockport lies in a rich farming and fruit (especially apple and pear) country, containing extensive sandstone and Niagara limestone quarries, and is a shipping point for the fruits and grains and the limestone and sandstone of the surrounding country. Many buildings in the business part of the city are heated by the Holly distributing system, which pipes steam from a central station or plant, and originated in Lockport. The city owns and operates the water-works, long operated under the Holly system, which, as well as the

Holly distributing system, was devised by Birdsill Holly, a civil engineer of Lockport. In 1909 a new system was virtually completed, water being taken from the Niagara river at Tonawanda and pumped thence to a stand-pipe in Lockport.

The site, that of the most easterly village in New York state held by the Neutral Nation of Indians, was part of the tract bought by the Holland Company in 1792-1793. Subsequently most of the land on which the city stands was bought from the Holland Company by Esek Brown, the proprietor of a local tavern, and fourteen others, but there were few settlers until after 1820. In 1822 the place was made the county-seat, and in 1823 it was much enlarged by the settlement here of workmen on the Erie Canal, and was the headquarters for a time of the canal contractors. It was incorporated as a village in 1829, was reached by the Erie railway in 1852, and in 1865 was chartered as a city.

LOCKROY, ÉDOUARD (1838-), French politician, son of Joseph Philippe Simon (1803-1891), an actor and dramatist who took the name of Lockroy, was born in Paris on the 18th of July 1838. He had begun by studying art, but in 1860 enlisted as a volunteer under Garibaldi. The next three years were spent in Syria as secretary to Ernest Renan, and on his return to Paris he embarked in militant journalism against the second empire in the *Figaro*, the *Diable à quatre*, and eventually in the *Rappel*, with which his name was thenceforward intimately connected. He commanded a battalion during the siege of Paris, and in February 1871 was elected deputy to the

National Assembly where he sat on the extreme left and protested against the preliminaries of peace. In March he signed the proclamation for the election of the Commune, and resigned his seat as deputy. Arrested at Vanves he remained a prisoner at Versailles and Chartres until June when he was released without being tried. He was more than once imprisoned for violent articles in the press, and in 1872 for a duel with Paul de Cassagnac. He was returned to the Chamber in 1873 as Radical deputy for Bouches-du-Rhône in 1876, 1877 and 1881 for Aix, and in 1881 he was also elected in the 11th arrondissement of Paris. He elected to sit for Paris, and was repeatedly re-elected. During the elections of 1893 he was shot at by a cab-driver poet named Moore, but was not seriously injured. For the first ten years of his parliamentary life he voted consistently with the extreme left, but then adopted a more opportunist policy, and gave his unreserved support to the Brisson ministry of 1885. In the new Freycinet cabinet formed in January he held the portfolio of commerce and industry, which he retained in the Goblet ministry of 1886-1887. In 1885 he had been returned at the head of the poll for Paris, and his inclusion in the Freycinet ministry was taken to indicate a prospect of reconciliation between Parisian Radicalism and official Republicanism. During his tenure of the portfolio of commerce and industry he made the preliminary arrangements for the Exposition of 1889, and in a witty letter he defended the erection of the Tour Eiffel against artistic Paris. After the Panama and Boulangist scandals he became one of the leading politicians of the Radical party. He was vice-president of the Chamber in 1894 and in 1895, when he became minister of marine under Léon Bourgeois. His drastic measures of reform alarmed moderate politicians, but he had the confidence of the country, and held the same portfolio under Henri Brisson (1898) and Charles Dupuy (1898-1899). He gave his support to the Waldeck-Rousseau Administration, but actively criticized the marine policy of Camille Pelletan in the Combes ministry of 1902-1905, during which period he was again vice-president of the Chamber. M. Lockroy was a persistent and successful advocate of a strong naval policy, in defence of which he published

La Marine de Guerre (1890), *Six mois rue Royale* (1897), *La Défense navale* (1900), *Du Weser à la Vistula* (1901), *Les Marines française et allemande* (1904), *Le Programme naval* (1906). His other works include *M. de Moltke et la guerre future* (1891) and *Journal d'une bourgeoise pendant la Révolution* (1881) derived from the letters of his great-grandmother. M. Lockroy married in 1877 Madame Charles Hugo, the daughter-in-law of the poet.

LOCKWOOD, SIR FRANK (1846-1897), English lawyer, was born at Doncaster. His grandfather and great-grandfather were mayors of Doncaster, and the former for some years filled the office of judge on the racecourse. He was educated at a private school, at Manchester grammar school, and Caius College, Cambridge. Called to the bar at Lincoln's Inn in 1872, he joined the old midland circuit, afterwards going to the north-eastern, making in his first year 120 guineas and in the next 265 guineas. From that time he had a career of uninterrupted success. In 1882 he was made a queen's counsel, in 1884 he was made recorder of Sheffield, and in 1894 he became solicitor-general in Lord Rosebery's ministry, and was knighted, having first entered parliament as Liberal member for York in 1885, after two unsuccessful attempts, the one at King's Lynn in 1880, the other at York in 1883. He was solicitor-general for less than a year. In 1896 Lord Chief Justice Coleridge, Mr Montague Crackanthorpe and Sir Frank Lockwood went to the United States to attend, as specially invited representatives of the English bar, the nineteenth meeting of the American Bar Association. On this trip Sir Frank Lockwood sustained the reputation which he enjoyed in England as a humorous after-dinner speaker, and helped to strengthen the bond of

friendship which unites the bench and bar of the United States with the bench and bar of England. He died in London on the 18th of December 1897. Lockwood had considerable talent for drawing, inherited from his father, which he employed, chiefly for the amusement of himself and his friends, in the making of admirable caricatures in pen and ink, and of sketches of humorous incidents, real or imaginary, relating to the topic nearest at hand. An exhibition of them was held soon after his death.

See Augustine Birrell's biography of Lockwood and *The Frank Lockwood Sketch-Book* (1898).

LOCKWOOD, WILTON (1861-), American artist, was born at Wilton, Connecticut, on the 12th of September 1861. He was a pupil and an assistant of John La Farge, and also studied in Paris, becoming a well-known portrait and flower painter. He became a member of the Society of American Artists (1898), and of the Copley Society, Boston, and an associate of the National Academy of Design, New York.

LOCKYER, SIR JOSEPH NORMAN (1836-), English astronomer, was born at Rugby on the 17th of May 1836. After completing his education on the Continent of Europe, he obtained a clerkship in the War Office in 1857. His leisure was devoted to the study of astronomy, and he was appointed in 1870 secretary to the duke of Devonshire's royal commission on science. In 1875 he was transferred to the Science and Art Department at South Kensington, and on the foundation of the Royal College of Science he became director of the solar physics observatory and professor of astronomical physics. Eight British government expeditions for observing total solar eclipses were conducted by him between 1870 and 1905. On the 26th of October 1868 he communicated to the Paris Academy of Sciences, almost simultaneously with Dr P. J. C. Janssen, a spectroscopic method for observing the solar prominences in daylight, and the names of both astronomers appear on a medal which was struck by the French government in 1872 to commemorate the discovery. Lockyer was elected a fellow of the Royal Society in 1869, and received the Rumford medal in 1874. He initiated in 1866 the spectroscopic observation of sunspots; applied Doppler's principle in 1869 to determine the radial velocities of the chromospheric gases; and successfully investigated the chemistry of the sun from 1872 onward. Besides numerous contributions to the *Proceedings* of the Royal and the Royal Astronomical Societies, he published several books, both explanatory and speculative. The *Chemistry of the Sun* (1887) is an elaborate treatise on solar spectroscopy based on the hypothesis of elemental dissociation through the intensity of solar heat. The *Meteoritic Hypothesis* (1890) propounds a comprehensive scheme of cosmical evolution, which has evoked more dissent than approval, while the *Sun's Place in Nature* (1897) lays down the lines of a classification of the stars, depending upon their supposed temperature-relations. Among Lockyer's other works are—*The Dawn of Astronomy* (1894), to which *Stonehenge and other British Stone Monuments astronomically considered* (1906) may be considered a sequel; *Recent and coming Eclipses* (1897); and *Inorganic Evolution* (1900). He was

created K.C.B. in 1897, and acted as president of the British Association in 1903-1904. His fifth son, WILLIAM JAMES STEWART LOCKYER (b. 1868), devoted himself to solar research, and became chief assistant in the Solar Physics Observatory, South Kensington.

LOCLE, LE, a town in the Swiss canton of Neuchâtel, 24 m. by rail N. of Neuchâtel, and 5 m. S.W. of La Chaux de Fonds. It is built (3035 ft. above the sea-level) on the Bied stream in a valley of the Jura, and is about 1 m. from the French frontier. In 1681 Daniel Jean Richard introduced watch-making here, which soon drove out all other industries. In 1900 the population was 12,559, mainly Protestants and French-speaking. The church tower dates from 1521, but the old town was destroyed by fire in 1833. The valley in which the town is situated used to be subject to inundations, but in 1805 a tunnel was constructed by means of which the surplus waters of the Bied are carried into the Doubs. About 1 m. W. of the town the Bied plunged into a deep chasm, on the steep rock face of which were formerly the subterranean mills of the Col des Roches, situated one above another; but the stream is now diverted by the above-mentioned tunnel, while another serves the railway line from Le Locle to Morteau in France (8 m.).

(W. A. B. C.)

LOCMARIAQUER, a village of western France, on the W. shore of the Gulf of Morbihan, in the department of Morbihan, 8½ m. S. of Auray by road. Pop. (1906) 756. Locmariaquer has a small port, and oyster culture is carried on close to it. Roman remains are to be seen, but the place owes its celebrity to the megalithic monuments in the vicinity, some of which are among the largest extant. The menhir of Men-er-H'roeck (Fairy stone), which was broken into four pieces by lightning in the 18th century, previously measured about 67 ft. in height, and from 9 to 13 ft. in thickness.

LOCOMOTOR ATAXIA (Gr. ἀ, priv., and τάξις, order; synonyms, *Tabes dorsalis*, *posterior spinal sclerosis*), a progressive degeneration of the nervous system, involving the posterior columns of the spinal cord with other structures, and causing muscular incoordination and disorder of gait and station. The essential symptoms of the disease—stamping gait, and swaying with the eyes shut, the occurrence of blindness and of small fixed pupils—were recognized by Romberg (1851), but it was the clinical genius of Duchenne and his masterly description of the symptoms which led to its acceptance as a definite disease (1858), and he named it locomotor

ataxia after its most striking symptom. In 1869 Argyll Robertson discovered that the eye-pupil is inactive to light but acts upon accommodation in the great majority of cases. This most important sign is named the "Argyll Robertson pupil." With an ever-increasing knowledge of the widespread character of this disease and its manifold variations in the complex of symptoms, the tendency among neurologists is to revert to the term employed by Romberg—*tabes dorsalis*. "Locomotor ataxia," although it expresses a very characteristic feature of the disease, has this objection: it is a symptom which does not occur in the first (preataxic) stage of the disease; indeed a great number of years may elapse before ataxy comes on, and sometimes the patient, after suffering a very long time from the disease, may die from some intercurrent complication, having never been ataxic.

It is generally recognized by neurologists that persons who are not the subjects of acquired or hereditary syphilis do not suffer from this disease; and the average time of onset after infection is ten years (see NEUROPATHOLOGY). There are three stages: (1) The preataxic, (2) the ataxic, (3) the bed-ridden paralytic. The duration of the first stage may be from one or two years, up to twenty years or even longer. In this stage various symptoms may arise. The patient usually complains of shooting, lightning-like pains in the legs, which he may attribute to rheumatism. If a physician examines him he will almost certainly find the knee-jerks absent and Argyll Robertson pupils present; probably on inquiry he will ascertain that the patient has had some difficulty in starting urination, or that he is unable to retain his water or to empty his bladder completely. In other cases, temporary or permanent paralysis of one or more muscles of the eyeball (which causes squint and double vision), a failure of sight ending in blindness, attacks of vomiting (or gastric crises), painless spontaneous fractures of bones and dislocations of joints, failing sexual power and impotence, may lead the patient to consult a physician, when this disease will be diagnosed, although the patient may not as yet have had locomotor ataxy. All cases, however, if they live long enough, pass into the second ataxic stage. The sufferer complains now of difficulty of walking

in the dark; he sways with his eyes shut and feels as if he would fall (Romberg's symptom); he has the sensation of walking on wool, numbness and formication of the skin, and many sensory disturbances in the form of partial or complete loss of sensibility to pain, touch and temperature. These disturbances affect especially the feet and legs, and around the trunk at the level of the fourth to the seventh ribs, giving rise to a "girdle sensation." There may be a numbed feeling on the inner side of the arm, and muscular incoordination may affect the upper limb as well as the lower, although there is no wasting or any electrical change. The ataxic gait is very characteristic, owing to the loss of reflex tonus in the muscles, and the absence of guiding sensations from all the deep structures of the limbs, muscles, joints, bones, tendons and ligaments, as well as from the skin of the soles of the feet; therefore the sufferer has to be guided by vision as to where and how to place his feet. This necessitates the bending forward of the body, extension of the knees and broadening of the basis of support; he generally uses a walking stick or even two, and he jerks the leg forward as if he were on wires, bringing the sole of the foot down on the ground with a wide stamping action. If the arm be affected, he is unable to touch the tip of his nose with the eyes shut. Sooner or later he passes into the *third* bed-ridden stage, with muscles wasted and their tonus so much lost that he is in a perfectly helpless condition.

The complications which may arise in this disease are intercurrent affections due to septic conditions of the bladder, bedsores, pneumonia, vascular and heart affections. About 10% of the cases, at least, develop general paralysis of the insane. This is not surprising seeing that it is due to the same cause, and the etiology of the two diseases is such as to lead many neurologists to consider them one and the same disease affecting different parts of the nervous system. *Tabes dorsalis* occurs with much greater frequency in men than in women (see NEUROPATHOLOGY).

The avoidance of all stress of the nervous system, whether physical, emotional or intellectual, is indicated, and a simple regular life, without stimulants or indulgence of the sexual passion, is the best means of delaying the progress of the disease. Great attention should be paid to micturition, so as to avoid retention and infection of the bladder. Drugs, even anti-syphilitic remedies, appear to have but little influence upon the course of the disease.

LOCO-WEEDS, or CRAZY-WEEDS, leguminous plants, chiefly species of *Astragalus* and *Lupinus*, which produce a disease in cattle known as "loco-disease." The name is apparently taken from the Spanish *loco*, mad. The disease affects the nervous system of the animals eating the plants, and is accompanied by exhaustion and wasting.

LOCRI, a people of ancient Greece, inhabiting two distinct districts, one extending from the north-east of Parnassus to the northern half of the Euboean channel, between Boeotia and Malis, the other south-west of Parnassus, on the north shore of the Corinthian Gulf, between Phocis and Aetolia. The former were divided into the northern Locri Epicnemidii,

situated on the spurs of Mount Cnemis, and the southern Locri Opuntii, so named from their chief town Opus (*q.v.*): and the name Opuntia is often applied to the whole of this easterly district. Homer mentions only these eastern Locrians: their national hero in the Trojan war is Ajax Oileus, who often appears afterwards on Locrian coins. From Hesiod's time onwards, the Opuntians were thought by some to be of "Lelegian" origin (see LELEGES), but they were Hellenized early (though matriarchal customs survived among them)—, and Deucalion, the father of Hellen himself, is described as the first king of Opus. The westerly Locri "in Ozolae" on the Corinthian Gulf, a rude and barbarous people, make no appearance in Greek history till the Peloponnesian war. It was believed that they had separated from the eastern Locrians four generations before the Trojan war; yet Homer has no hint of their existence. Probably the Locrians were once a single people, extending from sea to sea, till subsequent immigrations forced them apart into two separate districts. The Locrian dialect of Greek is little known, but resembles that of Elis: it has στ for σθ; uses α; and has οις in dat. plur. 3rd decl. A colony of Locrians (whether from Opus or Ozolae was disputed in antiquity) settled, about the end of the 8th century B.C., at the south-west extremity of Italy. They are often called Locri Epizephyrii from Cape Zephyrion 15 m. S. of the city. Their founder's name was Euanthes. Their social organization resembled that of the Opuntian Locri, and like them they venerated Ajax Oileus and Persephone. Aristotle (ap. Polyb. xii. 5 sqq.) records a tradition that these western Locrians were base-born, like the Parthenians of Tarentum; but this was disputed by his contemporary Timaeus. See LOCRI (town) below.

(J. L. M.)

LOCRI, an ancient city of Magna Graecia, Italy. The original settlers took possession of the Zephyrian promontory (Capo Bruzzano some 12 m. N. of Capo Spartivento), and though after three or four years they transplanted themselves to a site 12 m. farther north, still near the coast, 2 m. S. of Gerace Marina below the modern Gerace, they still retained the name of Locri Epizephyrii (Λοκροὶ οἱ ἐπιζεφύριοι), which served to distinguish them from the Ozolian and Opuntian Locri of Greece itself (see preceding article). The foundation of Locri goes back to about 683 B.C. It was the first of all Greek communities to have a written code of laws given by Zaleucus in 664 B.C. From Locri were founded the colonies of Meisma and Heiponium (Hipponium). It succeeded in repelling the attacks of Croton (battle on the river Sagras, perhaps sometime in the 6th century), and found in Syracuse a support against Rhegium: it was thus an active adversary of Athenian aggrandisement in the west. Pindar extolls its uprightness and love of the heroic muse of beauty, of wisdom, and of war, in the 10th and 11th Olympian Odes. Stesichorus (*q.v.*) was indeed of Locrian origin. But it owed its greatest external prosperity to the fact that Dionysius I. of Syracuse selected his wife from Locri: its territory was then increased, and the circuit of its walls was doubled, but it lost its freedom. In 356 B.C. it was ruled by Dionysius II. From the battle of Heraclea to the year 205 (when it was captured by P. Cornelius Scipio Africanus Maior, and placed under the control of his legate Q. Pleminius), Locri was continually changing its allegiance between Rome and her enemies; but it remained an ally, and was only obliged like other Greek coast towns to furnish ships. In later Roman times it is often mentioned, but was apparently of no great importance. It is mentioned incidentally until the 6th century A.D., but was destroyed by the Saracens in 915.

Excavations in 1889-1890 led to the discovery of an Ionic temple (the Doric style being usual in Magna Graecia) at the north-west angle of the town —originally a cella with two naves, a closed pronaos on the E. and an adytum at the back (W.), later converted into a hexastyle peripheral temple with 34

painted terra-cotta columns. This was then destroyed about 400 B.C. and a new temple built on the ruins, heptastyle peripteral, with no intermediate columns in the cella and opisthodomos, and with 44 columns in all. The figures from the pediment of the twin Dioscuri, who according to the legend assisted Locri against Crotona, are in the Naples museum (see R. Koldewey and O. Puchstein, *Griechische Tempel in Unteritalien und Sicilien*, Berlin, 1899, pp. 1 sqq.). Subsequent excavations in 1890-1891 were of the greatest importance, but the results remained unpublished up to 1908. From a short account by P. Orsi in *Atti del Congresso Storico*, vol. v. (Archeologia) Rome, 1904, p. 201, we learn that the exploration of the environs of the temple led to the discovery of a large number of archaic terra-cottas, and of some large trenches, covered with tiles, containing some 14,000 scyphoi arranged in rows. The plan of the city was also traced; the walls, the length of which was nearly 5 m., consisted of three parts—the fortified castles (φρούρια) with large towers, on three different hills, the city proper, and the lower town—the latter enclosed by long walls running down to the sea. In the Roman period the city was restricted to the plain near the sea. Since these excavations, a certain amount of unauthorized work has gone on, and some of the remains have been destroyed. In the course of these excavations some prehistoric objects have been discovered, which confirm the accounts of Thucydides and Polybius that the Greek settlers found the Siculi here before them.

(T. As.)

LÖCSE (Ger. *Leutschau*), the capital of the county of Szepes, in Hungary, 230 m. N.E. of Budapest by rail. Pop. (1900) 6845, mostly Germans

and Slovaks. The county of Szepes is the highest part of Hungary, and its north-western portion is occupied by the Tátra Mountains. Löcse lies in an elevated position surrounded by mountains, and is one of the oldest towns of Hungary. The church of St James is a Gothic structure of the 13th century, with richly carved altar, several monuments, and a celebrated organ erected in 1623, and long reputed the largest in Hungary. The old town-hall, restored in 1894, contains a Protestant upper gymnasium, founded in 1544, and one of the oldest printing establishments in Hungary, founded in 1585. Bee-keeping and the raising of garden produce are the chief industries.

Founded by Saxon colonists in 1245, Löcse had by the early part of the 16th century attained a position of great relative importance. In 1599 a fire destroyed the greater part of the town, and during the 17th century it suffered repeatedly at the hands of the Transylvanian princes and leaders.

LOCUS (Lat. for "place"; in Gr. τόπος), a geometrical term, the invention of the notion of which is attributed to Plato. It occurs in such statements as these: the locus of the points which are at the same distance from a fixed point, or of a point which moves so as to be always at the same distance from a fixed point, is a circle; conversely a circle is the locus of the points at the same distance from a fixed point, or of a point moving so as to be always at the same distance from a fixed point; and so in general a curve of any given kind is the locus of the points which satisfy, or of a point moving so as always to satisfy, a given condition. The theory of loci is thus identical with that of curves (see CURVE and GEOMETRY: § *Analytical*). The notion of a

locus applies also to solid geometry. Here the locus of the points satisfying a single (or onefold) condition is a surface; the locus of the points satisfying two conditions (or a twofold condition) is a curve in space, which is in general a twisted curve or curve of double curvature.

LOCUST.[1] In its general acceptation this term is applied only to certain insects of the order *Orthoptera*, family *Acridiidae*. The family *Locustidae* is now viewed zoologically in a sense that does not admit of the species best known as "locusts" being included therein. The idea of a very destructive insect is universally associated with the term; therefore many orthopterous species that cannot be considered true locusts have been so-called; in North America it has even embraced certain *Hemiptera-Homoptera*, belonging to the *Cicadidae*, and in some parts of England cockchafers are so designated. In a more narrow definition the attribute of migration is associated with the destructive propensities, and it therefore becomes necessary that a true locust should be a migratory species of the family *Acridiidae*. Moreover, the term has yet a slightly different signification as viewed from the Old or New World. In Europe by a locust is meant an insect of large size, the smaller allied species being ordinarily known as "grasshoppers," hence the "Rocky Mountain locust" of North America is to Eastern ideas rather a grasshopper than a locust.

In Europe, and a greater part of the Old World, the best known migratory locust is that which is scientifically termed *Pachytylus cinerascens* with which an allied species *P. migratorius* has been often confounded. Another

locust found in Europe and neighbouring districts is *Caloptenus italicus*, and still another, *Acridium peregrinum*, has once or twice occurred in Europe, though its home (even in a migratory sense) is more properly Africa and Asia. These practically include all the locusts of the Old World, though a migratory species of South Africa known as *Pachytylus pardalinus* (presumed to be distinct from *P. migratorius*) should be mentioned. The Rocky Mountain locust of North America is *Caloptenus spretus*, and in that continent there occurs an *Acridium* (*A. americanum*) so closely allied to *A. peregrinum* as to be scarcely distinct therefrom, though there it does not manifest migratory tendencies. In the West Indies and Central America *A. peregrinum* is also reported to occur.

The females excavate holes in the earth in which the eggs are deposited in a long cylindrical mass enveloped in a glutinous secretion. The young larvae hatch and immediately commence their destructive career. As these insects are “hemimetabolic” there is no quiescent stage; they go on increasing rapidly in size, and as they approach the perfect state the rudiments of the wings begin to appear. Even in this stage their locomotive powers are extensive and their voracity great. Once winged and perfect these powers become infinitely more disastrous, redoubled by the development of the migratory instinct. The laws regulating this instinct are not perfectly understood. Food and temperature have a great deal to do with it, and there is a tendency for the flights to take a particular direction, varied by the physical circumstances of the breeding districts. So likewise each species has its area of constant location, and its area of extraordinary migration. Perhaps the most feasible of the suggestions as to the causes of the migratory impulse is that locusts naturally breed in dry sandy districts in which food is scarce, and are impelled to wander to procure the necessaries of life; but against this it has been argued that swarms bred in a highly productive district in which they have temporarily settled will seek the barren home of their ancestors. Another ingenious suggestion is that migration is intimately connected with a dry condition of the atmosphere, urging them to move on until compelled to stop

for food or procreative purposes. Swarms travel considerable distances, though probably generally fewer than 1000 m., though sometimes very much more. As a rule the progress is only gradual, and this adds vastly to the devastating effects. When an extensive swarm temporarily settles in a district, all vegetation rapidly disappears, and then hunger urges it on another stage. The large Old World species, although undoubtedly phytophagous, when compelled by hunger sometimes attack at least dry animal substances, and even cannibalism has been asserted as an outcome of the failure of all other kinds of food. The length of a single flight must depend upon circumstances. From peculiarities in the examples of *Acridium peregrinum* taken in England in 1869, it has been asserted that they must have come direct by sea from the west coast of Africa; and what is probably the same species has been seen in the Atlantic at least 1200 m. from land, in swarms completely covering the ship; thus, in certain cases flight must be sustained for several days and nights together. The height at which swarms fly, when their horizontal course is not liable to be altered by mountains, has been very variously estimated at from 40 to 200 ft., or even in a particular case to 500 ft. The extent of swarms and the number of individuals in a swarm cannot be accurately ascertained. They come sometimes in such numbers as to completely obscure the sun, when the noise made by the rustling of the wings is deafening. Nevertheless some idea on this point may be formed from the ascertained fact that in Cyprus in 1881, at the close of the season, 1,600,000,000 egg-cases, each containing a considerable number of eggs, had been destroyed; the estimated weight exceeding 1300 tons. Yet two years later, it is believed that not fewer than 5,076,000,000 egg-cases were again deposited in the island.

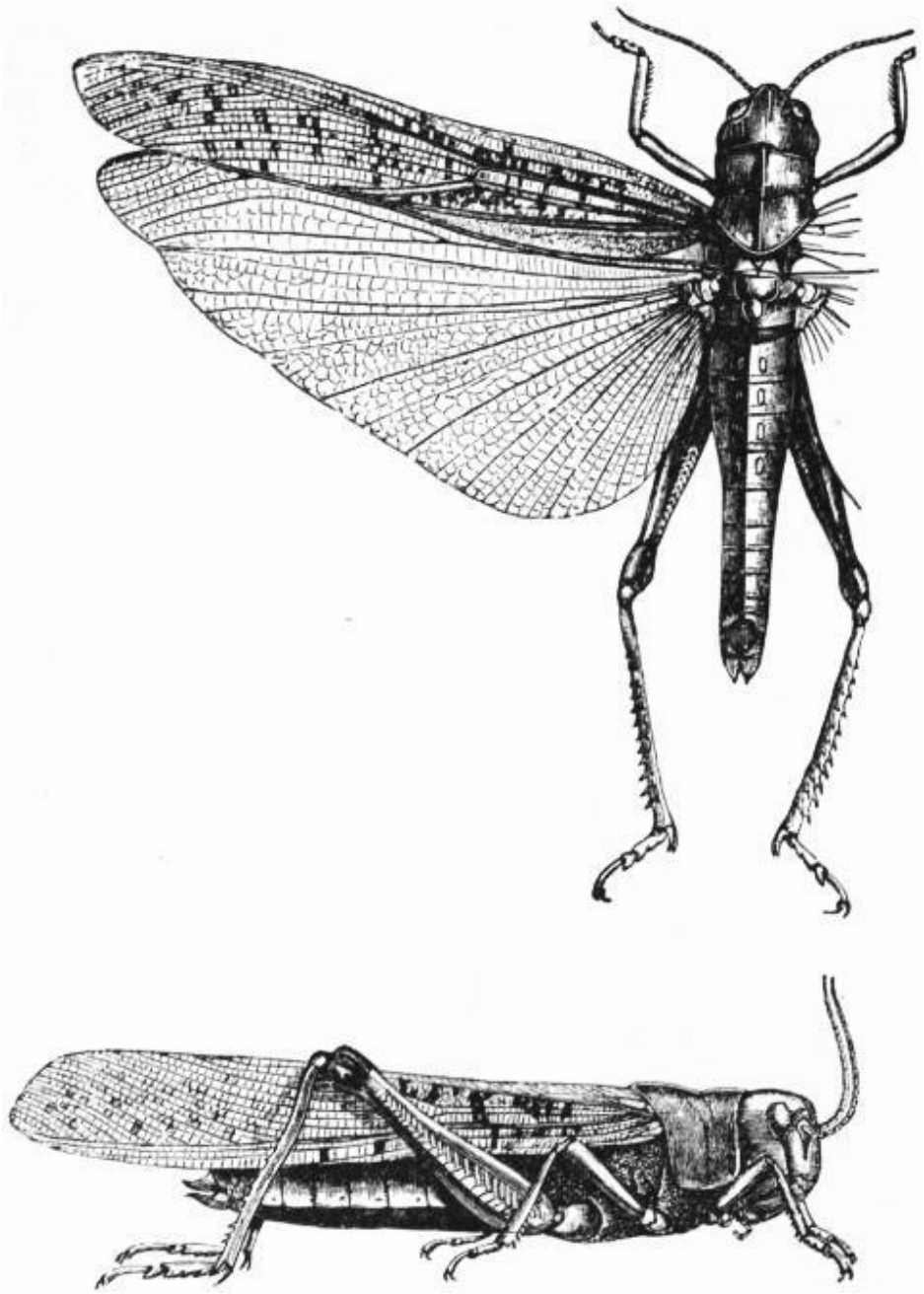

FIG. 1.—*Pachytylus migratorius*. This and the other figures are all natural size.

In Europe the best known and ordinarily most destructive species is *Pachytylus cinerascens*, and it is to it that most of the numerous records of devastations in Europe mainly refer, but it is probably not less destructive in

many parts of Africa and Asia. That the arid steppes of central Asia are the home of this insect appears probable; still much on this point is enveloped in uncertainty. In any case the area of permanent distribution is enormous, and that of occasional distribution is still greater. The former area extends from the parallel of 40° N. in Portugal, rising to 48° in France and Switzerland, and passing into Russia at 55°, thence continuing across the middle of Siberia, north of China to Japan; thence south to the Fiji Islands, to New Zealand and North Australia; thence again to Mauritius and over all Africa to Madeira. The southern distribution is uncertain and obscure. Taking exceptional distribution, it is well known that it occasionally appears in the British Isles, and has in them apparently been noticed as far north as Edinburgh; so also does it occasionally appear in Scandinavia, and it has probably been seen up to 63° N. in Finland. Looking at this vast area, it is easy to conceive that an element of uncertainty must always exist with regard to the exact determination of the species, and in Europe especially is this the case, because there exists a distinct species, known as *P. migratorius*, the migratory area of which appears to be confined to Turkestan and eastern Europe.

P. cinerascens is certainly the most common of the “locusts” occasionally found in the British Isles, and E. de Selys-Longchamps is of opinion that it breeds regularly in Belgium, whereas the true *P. migratorius* is only accidental in that country.

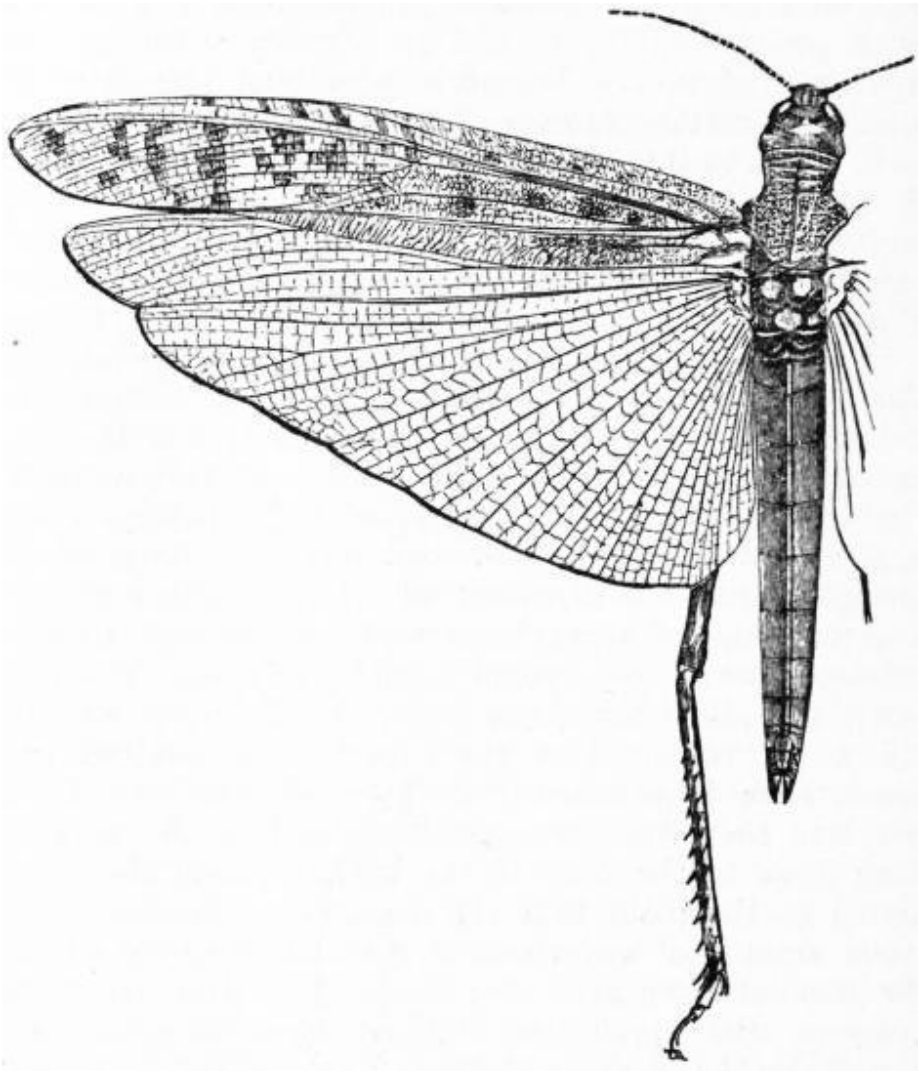

FIG. 2.—*Acridium peregrinum*.

A South African species allied to the preceding and provisionally identified as *Pachytylus salcicollis* is noteworthy from the manifestation of the migratory instinct in immature wingless individuals. The families of young, after destroying the vegetation of a district, unite in a vast army and move away in search of fresh pastures, devastating the country as they go and proceeding of necessity on foot, hence they are known to the Dutch as "voetgangers." Travelling northwards towards the centre of the continent, the

home of their parents before migration, they are diverted from their course by no obstacles. Upon reaching a river or stream they search the bank for a likely spot to cross, then fearlessly cast themselves upon the water where they form floating islands of insects, most of which usually succeed in gaining the opposite bank, though many perish in the attempt.

Acridium peregrinum (fig. 2) can scarcely be considered even an accidental visitor to Europe; yet it has been seen in the south of Spain, and in many examples spread over a large part of England in the year 1869. It is a larger insect than *P. migratorius*. There is every reason to believe that it is the most destructive locust throughout Africa and in India and other parts of tropical Asia, and its ravages are as great as those of *P. migratorius*. Presumably it is the species occasionally noticed in a vast swarm in the Atlantic, very far from land, and presumably also it occurs in the West Indies and some parts of Central America. In the Argentine Republic a (possibly) distinct species (*A. paranense*) is the migratory locust.

Caloptenus italicus (fig. 3) is a smaller insect, with a less extended area of migration; the destruction occasioned in the districts to which it is limited is often scarce less than that of its more terrible allies. It is essentially a species of the Mediterranean district, and especially of the European side of that sea, yet it is also found in North Africa, and appears to extend far into southern Russia.

Caloptenus spretus (fig. 4) is the “Rocky Mountain locust” or “hateful grasshopper” of the North American continent. Though a comparatively small insect, not so large as some of the grasshoppers of English fields, its destructiveness has procured for it great notoriety. By early travellers and settlers the species was not recognized as distinct from some of its non-migratory congeners. But in 1877, Congress appointed a United States Entomological Commission to investigate the subject. The report of the commissioners (C. V. Riley, A. S. Packard and C. Thomas) deals with the whole subject of locusts both in America and the Old world. *C. spretus* has its

home or permanent area in the arid plains of the central region east of the Rocky Mountains, extending slightly into the southern portion of Canada; outside this is a wide fringe to which the term sub-permanent is applied, and this is again bounded by the limits of only occasional distribution, the whole occupying a large portion of the North American continent; but it is not known to have crossed the Rocky Mountains westward, or to have extended into the eastern states.

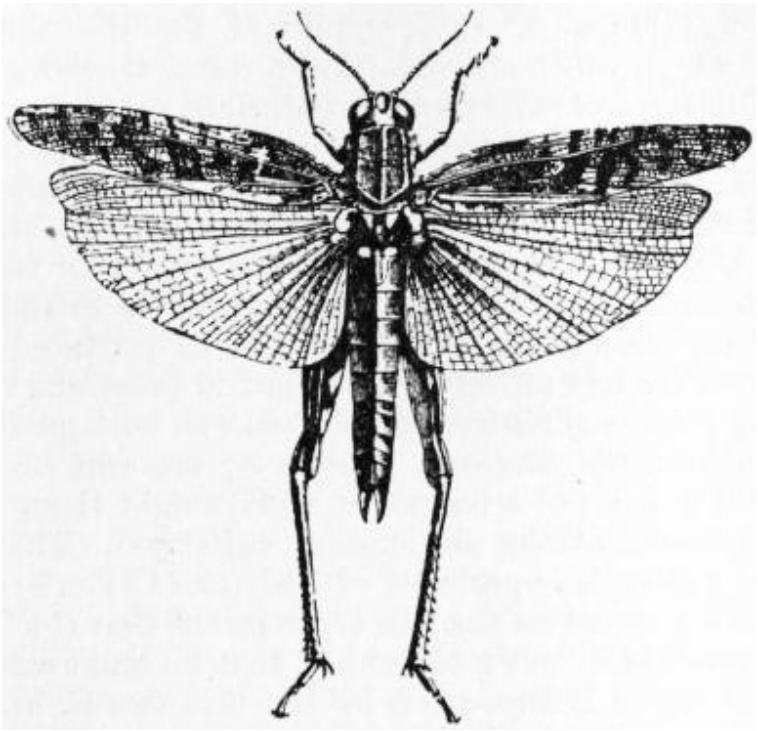

FIG. 3.—*Caloptenus italicus*.

As to remedial or preventive measures tending to check the ravages of locusts, little unfortunately can be said; but anything that will apply to one species may be used with practically all. Something can be done (as is now done in Cyprus) by offering a price for all the egg-tubes collected, which is the most direct manner of attacking them. Some little can be done by

destroying the larvae while in an unwinged condition, and by digging trenches in the line of march into which they can fall and be drowned or otherwise put an end to. Little can be done with the winged hordes; starvation, the outcome of their own work, probably here does much. In South Africa some success has attended the spraying of the swarms with arsenic. It has been shown that with all migratory locusts the breeding-places, or true homes, are comparatively barren districts (mostly elevated plateaus); hence the progress of colonization, and the conversion of those heretofore barren plains into areas of fertility, may (and probably will) gradually lessen the evil.

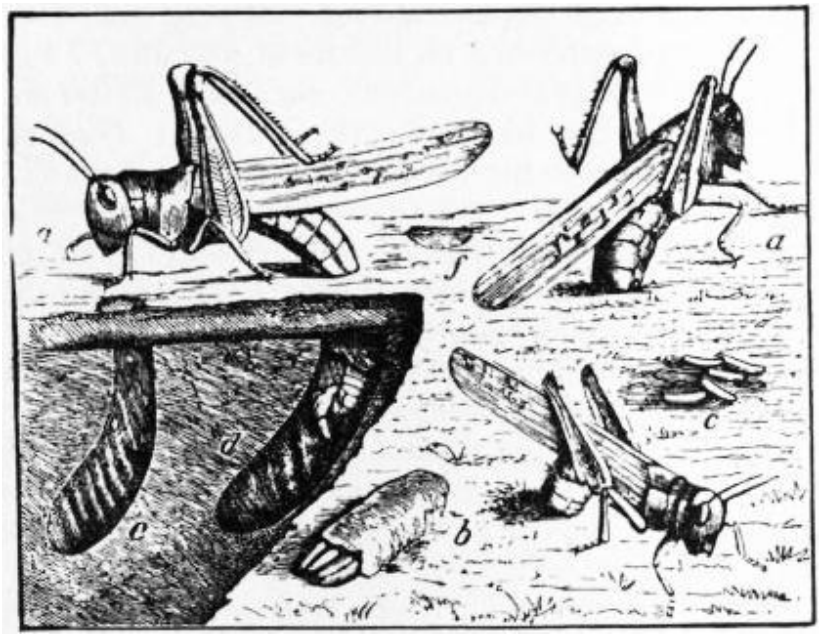

FIG. 4.—Rocky Mountain Locust (*Caloptenus spretus*). (After Riley.)

a, *a*, *a*, Female in different positions, ovipositing.

b, Egg-pod extracted from ground, with the end broken open.

c, A few eggs lying loose on the ground.

d, *e* show the earth partially removed, to illustrate an egg-mass already in place, and one being placed.

f, shows where such a mass has been covered up.

Locusts have many enemies besides man. Many birds greedily devour them, and it has many times been remarked that migratory swarms of the insects were closely followed by myriads of birds. Predatory insects of other

orders also attack them, especially when they are in the unwinged condition. Moreover, they have still more deadly insect foes as parasites. Some attack the fully developed winged insect. But the greater part attack the eggs. To such belong certain beetles, chiefly of the family *Cantharidae*, and especially certain two-winged flies of the family *Bombyliidae*. These latter, both in the Old and New World, must prevent vast quantities of eggs from producing larvae.

The larger Old World species form articles of food with certain semi-civilized and savage races, by whom they are considered as delicacies, or as part of ordinary diet, according to the race and the method of preparation.

(R. M. L.; R. T. P.)

1 The Lat. *locusta* was first applied to a lobster or other marine shell-fish and then, from its resemblance, to the insect.

LOCUST-TREE, or CAROB-TREE (*Ceratonia siliqua*), a member of the tribe *Cassieae* of the order Leguminosae, the sole species of its genus, and widely diffused spontaneously and by cultivation from Spain to the eastern Mediterranean regions. The name of the genus is derived from the often curved pod (Gr. κεράτιον, a little horn). The flowers have no petals and are polygamous or dioecious (male, female and hermaphrodite flowers occur). The seed-pod is compressed, often curved, indehiscent and coriaceous, but with sweet pulpy divisions between the seeds, which, as in other genera of the *Cassieae*, are albuminous. The pods are eaten by men and animals, and in Sicily a spirit and a syrup are made from them. These husks being often used

for swine are called swine's bread, and are probably referred to in the parable of the Prodigal Son. It is also called St John's bread, from a misunderstanding of Matt. iii. 4. The carob-tree was regarded by Sprengel as the tree with which Moses sweetened the bitter waters of Marah (Exod. xv. 25), as the *kharrúb*, according to Avicenna (p. 205), has the property of sweetening salt and bitter waters. Gerard (*Herball*, p. 1241) cultivated it in 1597, it having been introduced in 1570.

LODÈVE, a town of southern France, capital of an arrondissement of the department of Hérault, 36 m. W.N.W. of Montpellier by rail. Pop. (1906), 6142. It is situated in the southern Cévennes at the foot of steep hills in a small valley where the Soulondres joins the Lergue, a tributary of the Hérault. Two bridges over the Lergue connect the town with the faubourg of Carmes on the left bank of the river, and two others over the Soulondres lead to the extensive ruins of the château de Montbrun (13th century). The old fortified cathedral of St Fulcran, founded by him in 950, dates in its present condition from the 13th, 14th and 16th centuries; the cloister, dating from the 15th and 17th centuries, is in ruins. In the picturesque environs of the town stands the well-preserved monastery of St Michel de Grammont, dating from the 12th century and now used as farm buildings. In the neighbourhood are three fine dolmens. The manufacture of woollens for army clothing is the chief industry. Wool is imported in large quantities from the neighbouring departments, and from Morocco; the exports are cloth to Italy and the Levant, wine, brandy and wood. The town has tribunals of first instance and of commerce, a board of

trade-arbitrators, a chamber of arts and manufactures, and a communal college.

Lodève (Luteva) existed before the invasion of the Romans, who for some time called it *Forum Neronis*. The inhabitants were converted to Christianity by St Flour, first bishop of the city, about 323. After passing successively into the hands of the Visigoths, the Franks, the Ostrogoths, the Arabs and the Carolingians, it became in the 9th century a separate countship, and afterwards the domain of its bishops. During the religious wars it suffered much, especially in 1573, when it was sacked. It ceased to be an episcopal see at the Revolution.

LODGE, EDMUND (1756-1839), English writer on heraldry, was born in London on the 13th of June 1756, son of Edmund Lodge, rector of Carshalton, Surrey. He held a cornet's commission in the army, which he resigned in 1773. In 1782 he became Bluemantle pursuivant-at-arms in the College of Arms. He subsequently became Lancaster herald, Norroy king-at-arms, Clarencieux king-at-arms, and, in 1832, knight of the order of the Guelphs of Hanover. He died in London on the 16th of January 1839. He wrote *Illustrations of British History, Biography and Manners in the reigns of Henry VIII., Edward VI., Mary, Elizabeth and James I.* ... (3 vols., 1791), consisting of selections from the MSS. of the Howard, Talbot and Cecil families preserved at the College of Arms; *Life of Sir Julius Caesar* ... (2nd ed., 1827). He contributed the literary matter to *Portraits of Illustrious Personages of Great Britain* (1814, &c.), an elaborate work of which a

popular edition is included in Bohn's "Illustrated Library." His most important work on heraldry was *The Genealogy of the existing British Peerage* ... (1832; enlarged edition, 1859). In *The Annual Peerage and Baronetage* (1827-1829), reissued after 1832 as *Peerage of the British Empire*, and generally known as Lodge's Peerage, his share did not go beyond the title-page.

LODGE, HENRY CABOT (1850-), American political leader and author, was born in Boston, Massachusetts, on the 12th of May 1850. He graduated at Harvard College in 1871 and at the Harvard Law School in 1875; was admitted to the Suffolk (Massachusetts) bar in 1876; and in 1876-1879 was instructor in American history at Harvard. He was a member of the Massachusetts House of Representatives in 1880-1881, and of the National House of Representatives in 1887-1893; succeeded Henry L. Dawes as United States Senator from Massachusetts in 1893; and in 1899 and in 1905 was re-elected to the Senate, where he became one of the most prominent of the Republican leaders, and an influential supporter of President Roosevelt. He was a member of the Alaskan Boundary Commission of 1903, and of the United States Immigration Commission of 1907. In the National Republican Convention of 1896 his influence did much to secure the adoption of the gold standard "plank" of the party's platform. He was the permanent chairman of the National Republican Convention of 1900, and of that of 1908. In 1874-1876 he edited the *North American Review* with Henry Adams; and in 1879-1882, with John T. Morse, Jr., he edited the *International Review*. In 1884-1890 he was an overseer of Harvard College. His doctoral thesis at

Harvard was published with essays by Henry Adams, J. L. Laughlin and Ernest Young, under the title *Essays on Anglo-Saxon Land Law* (1876). He wrote: *Life and Letters of George Cabot* (1877); *Alexander Hamilton* (1882), *Daniel Webster* (1883) and *George Washington* (2 vols., 1889), in the "American Statesmen" series; *A Short History of the English Colonies in America* (1881); *Studies in History* (1884); *Boston* (1891), in the "Historic Towns" series; *Historical and Political Essays* (1892); with Theodore Roosevelt, *Hero Tales from American History* (1895); *Certain Accepted Heroes* (1897); *The Story of the American Revolution* (2 vols., 1898); *The War with Spain* (1899); *A Fighting Frigate* (1902); *A Frontier Town* (1906); and, with J. W. Garner, *A History of the United States* (4 vols., 1906). He edited *The Works of Alexander Hamilton* (9 vols., 1885-1886) and *The Federalist* (1891).

His son, George Cabot Lodge (1873-1909), also became known as an author, with *The Song of the Wave* (1898), *Poems, 1899-1902* (1902), *The Great Adventure* (1905), *Cain: a Drama* (1904), *Herakles* (1908) and other verse.

LODGE, SIR OLIVER JOSEPH (1851-), English physicist, was born at Penkhull, Staffordshire, on the 12th of June 1851, and was educated at Newport (Salop) grammar school. He was intended for a business career, but being attracted to science he entered University College, London, in 1872, graduating D.Sc. at London University in 1877. In 1875 he was appointed reader in natural philosophy at Bedford College for Women,

and in 1879 he became assistant professor of applied mathematics at University College, London. Two years later he was called to the chair of physics in University College, Liverpool, where he remained till in 1900 he was chosen first principal of the new Birmingham University. He was knighted in 1902. His original work includes investigations on lightning, the seat of the electromotive force in the voltaic cell, the phenomena of electrolysis and the speed of the ion, electromagnetic waves and wireless telegraphy, the motion of the aether near the earth, and the application of electricity to the dispersal of fog and smoke. He presided over the mathematical and physical section of the British Association in 1891, and served as president of the Physical Society in 1899-1900 and of the Society for Psychical Research in 1901-1904. In addition to numerous scientific memoirs he wrote, among other works, *Lightning Conductors and Lightning Guards*, *Signalling without Wires*, *Modern Views of Electricity*, *Electrons* and *The Ether of Space*, together with various books and papers of a metaphysical and theological character.

LODGE, THOMAS (*c.* 1558-1625), English dramatist and miscellaneous writer, was born about 1558 at West Ham. He was the second son of Sir Thomas Lodge, who was lord mayor of London in 1562-1563. He was educated at Merchant Taylors' School and Trinity College, Oxford; taking his B.A. degree in 1577 and that of M.A. in 1581. In 1578 he entered Lincoln's Inn, where, as in the other Inns of Court, a love of letters and a crop of debts and difficulties were alike wont to spring up in a kindly soil. Lodge, apparently in disregard of the wishes of his family, speedily showed his

inclination towards the looser ways of life and the lighter aspects of literature. When the penitent Stephen Gosson had (in 1579) published his *Schoole of Abuse*, Lodge took up the glove in his *Defence of Poetry, Music and Stage Plays* (1579 or 1580; reprinted for the Shakespeare Society, 1853), which shows a certain restraint, though neither deficient in force of invective nor backward in display of erudition. The pamphlet was prohibited, but appears to have been circulated privately. It was answered by Gosson in his *Playes Confuted in Five Actions*; and Lodge retorted with his *Alarum Against Usurers* (1584, reprinted ib.)—a "tract for the times" which no doubt was in some measure indebted to the author's personal experience. In the same year he produced the first tale written by him on his own account in prose and verse, *The Delectable History of Forbonius and Prisceria*, both published and reprinted with the *Alarum*. From 1587 onwards he seems to have made a series of attempts as a playwright, though most of those attributed to him are mainly conjectural. That he ever became an actor is improbable in itself, and Collier's conclusion to that effect rested on the two assumptions that the "Lodge" of Henslowe's M.S. was a player and that his name was Thomas, neither of which is supported by the text (see C. M. Ingleby, *Was Thomas Lodge an Actor?* 1868). Having, in the spirit of his age, "tried the waves" with Captain Clarke in his expedition to Terceira and the Canaries, Lodge in 1591 made a voyage with Thomas Cavendish to Brazil and the Straits of Magellan, returning home by 1593. During the Canaries expedition, to beguile the tedium of his voyage, he composed his prose tale of *Rosalynde, Euphues' Golden Legacie*, which, printed in 1590, afterwards furnished the story of Shakespeare's *As You Like It*. The novel, which in its turn owes some, though no very considerable, debt to the medieval *Tale of Gamelyn* (unwarrantably appended to the fragmentary *Cookes Tale* in certain MSS. of Chaucer's works), is written in the euphuistic manner, but decidedly attractive both by its plot and by the situations arising from it. It has been frequently reprinted. Before starting on his second expedition he had published an historical romance, *The History of Robert, Second Duke of Normandy,*

surnamed Robert the Divell; and he left behind him for publication *Catharos, Diogenes in his Singularity*, a discourse on the immorality of Athens (London). Both appeared in 1591. Another romance in the manner of Lyly, *Euphues Shadow, the Battaile of the Sences* (1592), appeared while Lodge was still on his travels. His second historical romance, the *Life and Death of William Longbeard* (1593), was more successful than the first. Lodge also brought back with him from the new world *A Margarite of America* (published 1596), a romance of the same description interspersed with many lyrics. Already in 1589 Lodge had given to the world a volume of poems bearing the title of the chief among them, *Scillaes Metamorphosis, Enterlaced with the Unfortunate Love of Glaucus*, more briefly known as *Glaucus and Scilla* (reprinted with preface by S. W. Singer in 1819). To this tale Shakespeare was possibly indebted for the idea of *Venus and Adonis*. Some readers would perhaps be prepared to give up this and much else of Lodge's sugared verse, fine though much of it is in quality, largely borrowed from other writers, French and Italian in particular, in exchange for the lost *Sailor's Kalendar*, in which he must in one way or another have recounted his sea adventures. If Lodge, as has been supposed, was the Alcon in *Colin Clout's come Home Again*, it may have been the influence of Spenser which led to the composition of *Phillis*, a volume of sonnets, in which the voice of nature seems only now and then to become audible, published with the narrative poem, *The Complaynte of Elstred*, in 1593. *A Fig for Momus*, on the strength of which he has been called the earliest English satirist, and which contains eclogues addressed to Daniel and others, an epistle addressed to Drayton, and other pieces, appeared in 1595. Lodge's ascertained dramatic work is small in quantity. In conjunction with Greene he, probably in 1590, produced in a popular vein the odd but far from feeble play of *A Looking Glasse for London and England* (printed in 1594). He had already written *The Wounds of Civile War. Lively set forth in the Tragedies of Marius and Scilla* (produced perhaps as early as 1587, and published in 1594), a good second-rate piece in the half-chronicle fashion of its age. Mr F. G. Fleay thinks there were grounds for

assigning to Lodge *Mucedorus and Amadine*, played by the Queen's Men about 1588, a share with Robert Greene in *George a Greene, the Pinner of Wakefield*, and in Shakespeare's 2nd part of *Henry VI.*; he also regards him as at least part-author of *The True Chronicle of King Leir and his three Daughters* (1594); and *The Troublesome Raigne of John, King of England* (*c.* 1588); in the case of two other plays he allowed the assignation to Lodge to be purely conjectural. That Lodge is the "Young Juvenal" of Greene's *Groatsworth of Wit* is no longer a generally accepted hypothesis. In the latter part of his life—possibly about 1596, when he published his *Wits Miserie* and the *World's Madnesse*, which is dated from Low Leyton in Essex, and the religious tract *Prosopopeia* (if, as seems probable, it was his), in which he repents him of his "lewd lines" of other days—he became a Catholic and engaged in the practice of medicine, for which Wood says he qualified himself by a degree at Avignon in 1600. Two years afterwards he received the degree of M.D. from Oxford University. His works henceforth have a sober cast, comprising translations of Josephus (1602), of Seneca (1614), a *Learned Summary* of Du Bartas's *Divine Sepmaine* (1625 and 1637), besides a *Treatise of the Plague* (1603), and a popular manual, which remained unpublished, on *Domestic Medicine*. Early in 1606 he seems to have left England, to escape the persecution then directed against the Catholics; and a letter from him dated 1610 thanks the English ambassador in Paris for enabling him to return in safety. He was abroad on urgent private affairs of one kind and another in 1616. From this time to his death in 1625 nothing further concerning him remains to be noted.

Lodge's works, with the exception of his translations, have been reprinted for the Hunterian Club with an introductory essay by Mr Edmund Gosse. This preface was reprinted in Mr Gosse's *Seventeenth Century Studies* (1883). Of *Rosalynde* there are numerous modern editions. See also J. J. Jusserand, *English Novel in the Time of Shakespeare* (Eng. trans., 1890); F. G. Fleay, *Biographical Chronicle of the English Drama* (vol. ii., 1891).

(A. W. W.)

LODGE, a dwelling-place, small and usually temporary, a hut, booth or tent. The word was in M. Eng. *logge*, from Fr. *loge*, arbour, in modern French a hut; also box in a theatre; the French word, like the Italian *loggia*, came from the Med. Lat. *laubia* or *lobia*, the sheltered promenade in a cloister, from which English "lobby" is derived. The Latin is of Teutonic origin from the word which survives in the Mod. Ger. *Laube*, an arbour, but which earlier was used for any hut, booth, &c. The word is probably ultimately from the root which appears in "leaf," meaning a rough shelter of foliage or boughs. The word is especially used of a house built either in a forest or away from habitation, where people stay for the purpose of sport, as a "hunting lodge," "shooting lodge," &c. The most frequent use of the word is of a small building, usually placed at the entrance to an estate or park and inhabited by a dependant of the owner. In the same sense the word means the room or box inhabited by the porter of a college, factory or public institution. Among Freemasons and other societies the "lodge" is the name given to the meeting-place of the members of the branch or district, and is applied to the members collectively as "a meeting of the lodge." The governing body of the Freemasons presided over by the grand master is called the "Grand Lodge." At the university of Cambridge the house where the head of a college lives is called the "lodge." Formerly the word was used of the den or lair of an animal, but is now only applied to that of the beaver and the otter. It is also applied to the tent of a North American Indian, a wigwam or tepee, and to the number of inhabitants of such a tent. In mining the term is used of a subterraneous reservoir made at the bottom of the pit, or at different levels in

the shaft for the purpose of draining the mine. It is used also of a room or landing-place next to the shaft, for discharging ore, &c.

LODGER AND LODGINGS. The term "lodger" (Fr. *loger*, to lodge) is used in English law in several slightly different senses. It is applied (i.) most frequently and properly to a person who takes furnished rooms in a house, the landlord also residing on the premises, and supplying him with attendance; (ii.) sometimes to a person, who takes unfurnished rooms in a house finding his own attendance; (iii.) to a boarder in a boarding-house (*q.v.*). It is with (i.) and (ii.) alone that this article is concerned.

Where furnished apartments are let for immediate use, the law implies an undertaking on the part of the landlord that they are fit for habitation, and, if this condition is broken, the tenant may refuse to occupy the premises or to pay any rent. But there is no implied contract that the apartments shall *continue* fit for habitation; and the rule has no application in the case of unfurnished lodgings. In the absence of express agreement to the contrary, a lodger has a right to the use of everything necessary to the enjoyment of the premises, such as the door bell and knocker and the skylight of a staircase, whether the rent of apartments can be distrained for by the immediate landlord where he resides on the premises and supplies attendance is a question the answer to which is involved in some uncertainty. The weight of authority seems to support the negative view (see Foa, *Landlord and Tenant*, 3rd ed. p. 434). To make good a right to distrain it is necessary to show that the terms of the letting create a tenancy or exclusive occupation and not a

mere licence, where the owner, although residing on the premises, does not supply attendance, the question depends on whether there is a real tenancy, giving the lodger an exclusive right of occupation as against the owner. The ordinary test is whether the lodger has the control of the outer door. But the whole circumstances of each case have to be taken account of. A lodger is rateable to the poor-rate where he is in exclusive occupation of the apartments let to him, and the landlord does not retain the control and dominion of the whole structure. As to distress on a lodger's goods for rent due by an immediate to a superior landlord, see RENT. As to the termination of short tenancies, as of apartments, see LANDLORD AND TENANT. The landlord has no lien on the goods of the lodger for rent or charges. Overcrowding lodging-houses may be dealt with as a nuisance under the Public Health Acts 1875 and 1891 and the Housing of the Working Classes Acts. As to the lodger franchise, see REGISTRATION OF VOTERS. It has been held in England that keepers of lodging-houses do not come within the category of those persons (see CARRIER; INNKEEPER) who hold themselves out to the public generally as trustworthy in certain employments; but that they are under an obligation to take reasonable care for the safety of their lodgers' goods; see *Scarborough* v. *Cosgrove*, 1905, 2 K.B. 805. As to Scots Law see Bell's *Prin.* s. 236 (4).

In the United States, the English doctrine of an implied warranty of fitness for habitation on a letting of furnished apartments has only met with partial acceptance; it was repudiated, *e.g.* in the District of Columbia, but has been accepted in Massachusetts. In the French *Code Civil*, there are some special rules with regard to furnished apartments. The letting is reputed to be made for a year, a month or a day, according as the rent is so much per year, per month or per day; if that test is inapplicable, the letting is deemed to be made according to the custom of the place (art. 1758). There are similar provisions in the Civil Codes of Belgium (art. 1758), Holland (art. 1622) and Spain (Civil Code, art. 1581).

See also the articles, Boarding House, and Flat; and the bibliographies to Flat and Landlord and Tenant.

(A. W. R.)

LODI, a town and episcopal see of Piedmont, Italy, in the province of Milan, 20½ m. by rail S.E. of that city, on a hill above the right bank of the Adda, 230 ft. above sea-level. Pop. (1901) 19,970 (town), 26,827 (commune). The site of the city is an eminence rising very gradually from the Lombard plain, and the surrounding country is one of the richest dairy districts in Italy. The cathedral (1158), with a Gothic façade and a 16th-century lateral tower, has a restored interior. The church of the Incoronata was erected by Battaggio (1488) in the Bramantesque style. It is an elegant octagonal domed structure, and is decorated with frescoes by the Piazza family, natives of the town, and four large altar-pieces by Calisto Piazza (died after 1561). There is a fine organ of 1507. The 13th-century Gothic church of San Francesco, restored in 1889, with 14th-century paintings, is also noticeable. The Palazzo Modegnani has a fine gateway in the style of Bramante, and the hospital a cloistered quadrangle. In the Via Pompeia is an early Renaissance house with fine decorations in marble and terra-cotta. Besides an extensive trade in cheese (Lodi producing more Parmesan than Parma itself) and other dairy produce, there are manufactures of linen, silk, majolica and chemicals.

The ancient Laus Pompeia lay 3½ m. W. of the present city, and the site is still occupied by a considerable village, Lodi Vecchio, with the old cathedral of S. Bassiano, now a brick building, which contains 15th-century frescoes. It was the point where the roads from Mediolanum to Placentia and Cremona

diverged, and there was also a road to Ticinum turning off from the former, but it is hardly mentioned by classical writers. It appears to have been a *municipium*. No ruins exist above ground, but various antiquities have been found here. From which Pompeius, whether Cn. Pompeius Strabo, who gave citizenship to the Transpadani, or his son, the more famous Pompey, it took its name is not certain. In the middle ages Lodi was second to Milan among the cities of northern Italy. A dispute with the archbishop of Milan about the investiture of the bishop of Lodi (1024) proved the beginning of a protracted feud between the two cities. In 1111 the Milanese laid the whole place in ruins and forbade their rivals to restore what they had destroyed, and in 1158, when in spite of this prohibition a fairly flourishing settlement had again been formed, they repeated their work in a more thorough manner. A number of the Lodigians had settled on Colle Eghezzone; and their village, the Borgo d'Isella, on the site of a temple of Hercules, soon grew up under the patronage of Frederick Barbarossa into a new city of Lodi (1162). At first subservient to the emperor, Lodi was before long compelled to enter the Lombard League, and in 1198 it formed alliance offensive and defensive with Milan. The strife between the Sommariva or aristocratic party and the Overgnaghi or democratic party was so severe that the city divided into two distinct communes. The Overgnaghi, expelled in 1236, were restored by Frederick II. who took the city after three months' siege. Lodi was actively concerned in the rest of the Guelph and Ghibelline struggle. In 1416 its ruler, Giovanni Vignati, was treacherously taken prisoner by Filippo Maria Visconti, and after that time it became dependent on Milan. The duke of Brunswick captured it in 1625, in the interests of Spain; and it was occupied by the French (1701), by the Austrians (1706), by the king of Sardinia (1733), by the Austrians (1736), by the Spaniards (1745), and again by the Austrians (1746). On the 10th of May 1796 was fought the battle of Lodi between the Austrians and Napoleon, which made the latter master of Lombardy.

LODZ (*Lódź*; more correctly *Lodzia*), a town of Russian Poland, in the government of Piotrków, 82 m. by rail S.W. of Warsaw. It is situated on the Lodz plateau, which at the beginning of the 19th century was covered with impenetrable forests. Now it is the centre of a group of industrial towns—Zgerź, Lęczyca, Pabianice, Konstantinov and Aleksandrov. Chiefly owing to a considerable immigration of German capitalists and workers, Lodz has grown with American-like rapidity. It consists principally of one main street, 7 m. long, and is a sort of Polish Manchester, manufacturing cottons, woollens and mixed stuffs, with chemicals, beer, machinery and silk. One of the very few educational institutions is a professional industrial school. The population, which was only 50,000 in 1872, reached 351,570 in 1900; the Poles numbering about 37%, Germans 40% and Jews 22½%.

LOESS (Ger. *Löss*), in geology, a variety of loam. Typical loess is a soft, porous rock, pale yellowish or buff in colour; one characteristic property is its capacity to retain vertical, or even over-hanging, walls in the banks of streams. These vertical walls have been well described by von Richthofen (*Führer für Forschungsreisende*, Berlin, 1886) in China, where they stand in

some places 500 ft. high and contain innumerable cave dwellings; ancient roads too have worn their way vertically downwards deep into the deposit, forming trench-like ways. This character in the loess of the Mississippi region gave rise to the name “Bluff formation.” A coarse columnar structure is often exhibited on the vertical weathered faces of the rock. Another characteristic is the presence throughout the rock of small capillary tubules, which appear to have been occupied by rootlets; these are often lined with calcite. Typical loess is usually calcareous; some geologists regard this as an essential property, and when the rock has become decalcified, as it frequently is on the surface by weathering, they call it “loess-loam” (*lösslehm*). In the lower portions of a loess deposit the calcium carbonate tends to form concretions, which on account of their mimetic forms have received such names as *lösskindchen*, *lösspuppen*, *poupées du loess*, “loess dolls.” In deposits of this nature in South America these concretionary masses form distinct beds. Bedding is absent from typical loess. The mineral composition of loess varies somewhat in different regions, but the particles are always small; they consist of angular grains of quartz, fine particles of hydrated silicates of alumina, mica scales and undecomposed fragments of felspar, hornblende and other rock-forming silicates.

In Europe and America loess deposits are associated with the margins of the great ice sheets of the glacial period; thus in Europe they stretch irregularly through the centre eastwards from the north-west of France, and are not found north of the 57th parallel. In both regions loess deposits are found within and upon glacial deposits. For this reason the loess is very commonly assigned to the Pleistocene period; but some of the loess deposits of northern Europe have been in process of formation intermittently from the Miocene period onward, and in South America the great loess formations known as the Pampean or Patagonian belong to the Eocene, Oligocene and Pleistocene periods. Most geologists are agreed that the loess is an aeolian or wind-borne rock, formed most probably during periods of tundra or steppe conditions. The capillary tubules are supposed to have been caused by the

roots of grass and herbage which kept growing upon the surface even while the deposit was slowly increasing. Others contend that loess is of the nature of alluvial loam; this may be true of certain deposits classed as loess, but it cannot be true of most of the typical loess formations, for they lie upon older rocks quite independently of altitude, from near sea level up to 5000 ft. in Europe and to 11,500 ft. in China; they are often developed on one side of a mountain range and not upon the other, and in a series of approximately parallel valleys the loess is frequently found lying upon one side and that the same in each case, facts pointing to the agency of prevalent winds.

The thickness of loess deposits is usually not more than 33 ft., but in China it reaches 1000 ft. or more; it also attains a great thickness in South America. Numerous proboscidian and other mammalian fossils have been found in the loess of Europe; the tapir, mastodon and giant sloths occur in South America, but the most common fossils are small land shells and such amphibious pond forms as *Succinea*. Certain loess deposits in Turkestan have been attributed to rain-wash, this is the so-called “lake-loess” (*see-löss*); according to Tukowski the difference between sub-aerial and lake loess is that the former is porous, dry and pervious, while the latter is laminated, plastic and impervious. Two types of loess have been recognized in Russia, the Hill- or Terrace-loess and the Low-level-loess, a product of the weathering of underlying rocks. In South Germany the following order has been recognized: (1) an upper unbedded, non-calcareous loess, (2) the *gehanglöss*, mixed with subsoil rocks, and (3) the sand or *thal-löss*, with some gravel. The effect of vegetation on the upper layers of loess is to produce soils of great fertility, such as the black earth (*Tschernozom*) of southern Russia, the dark *Bordelöss* of the Magdeburg district, and the black “cotton soil” (*regur*) of the Deccan.

LOFFT, CAPEL (1751-1824), English miscellaneous writer, was born in London on the 14th of November 1751. He was educated at Eton, and Peterhouse, Cambridge, which he left to become a member of Lincoln's Inn. He was called to the bar in 1775, and left by his father's and uncle's deaths with a handsome property and the family estates. He was a prolific writer on a variety of topics, and a vigorous contentious advocate of parliamentary and other reforms, and carried on a voluminous correspondence with all the literary men of his time. He became the patron of Robert Bloomfield, the author of *The Farmer's Boy*, and secured for him the very successful publication of that work. Byron, in a note to his *English Bards and Scotch Reviewers*, ridiculed Lofft as "the Maecenas of shoemakers and preface-writer general to distressed versemen; a kind of gratis *accoucheur* to those who wish to be delivered of rhyme, but do not know how to bring forth." He died at Montcalieri, near Turin, on the 26th of May 1824.

His fourth son Capel Lofft, the younger (1806-1873), also a writer on various topics, inherited his father's liberal ideas and principles, and carried them in youth to greater extremes. In his old age he abandoned these theories, which had brought him into the company of some of the leading political agitators of the day. He died in America, where he had a Virginia estate.

LOFOTEN AND VESTERAALEN, a large and picturesque group of islands lying N.E. and S.W. off the N.W. coast of Norway, between 67° 30′ and 69° 20′ N., and between 12° and 16° 35′ E. forming part of the *amt* (county) of Nordland. The extreme length of the group from Andenaes, at the north of Andö, to Röst, is about 150 m.; the aggregate area about 1560 sq. m. It is separated from the mainland by the Vestfjord, Tjaeldsund and Vaagsfjord, and is divided into two sections by the Raftsund between Hindö and Öst-Vaagö. To the W. and S. of the Raftsund lie the Lofoten Islands proper, of which the most important are Öst-Vaagö, Gimsö, Vest-Vaagö, Flakstadö, Moskenaesö, Mosken, Värö and Röst; E. and N. of the Raftsund are the islands of Vesteraalen, the chief being Hindö, Ulvö, Langö, Skogsö and Andö. The islands, which are all of granite or metamorphic gneiss, are precipitous and lofty. The highest points and finest scenery are found on Öst-Vaagö, in the neighbourhood of the narrow, cliff-bound Raftsund and Troldfjord. The principal peaks are Higrafstind (3811 ft.), Gjeitgaljartind (3555), Rulten (3483), the Noldtinder (3467), Svartsundtind (3506). The long line of jagged and fantastic peaks seen from the Vestfjord forms one of the most striking prospects on the Norwegian coast, but still finer is the panorama from the Digermuler (1150 ft.), embracing the islands, the Vestfjord, and the mountains of the mainland. The channels which separate the islands are narrow and tortuous, and generally of great depth; they are remarkable for the strength of their tidal currents, particularly the Raftsund and the famous Maelström or Moskenström between Moskenaes and Mosken. The violent tempests which sweep over the Vestfjord, which is exposed to the S.W., are

graphically described in Jonas Lie's *Den Fremsynte* (1870) and in H. Schultze's *Udvalgte Skrifter* (1883), as the Maelström is imaginatively by Edgar Allan Poe. Though situated wholly within the Arctic circle, the climate of the Lofoten and Vesteraalen group is not rigorous when compared with that of the rest of Norway. The isothermal line which marks a mean January temperature of 32° F. runs south from the Lofotens, passing a little to the east of Bergen onward to Gothenburg and Copenhagen. The prevailing winds are from the S. and W., the mean temperature for the year is 38.5° F., and the annual rainfall is 43.34 in. In summer the hills have only patches of snow, the snow limit being about 3000 ft. The natural pasture produced in favourable localities permits the rearing of cattle to some extent; but the growth of cereals (chiefly barley, which here matures in ninety days) is insignificant. The islands yield no wood. The characteristic industry, and an important source of the national wealth, is the cod fishery carried on along the east coast of the Lofotens in the Vestfjord in spring. This employs about 40,000 men during the season from all parts of Norway, the population being then about doubled, and the surplus accommodated in temporary huts. The average yield is valued at about £35,000. The fish are taken in nets let down during the night, or on lines upwards of a mile in length, or on ordinary hand-lines. The fishermen are paid in cash, and large sums of money are sent to the islands by the Norwegian banks each February. Great loss of life is frequent during the sudden local storms. The fish, which is dried during early summer, is exported to Spain (where it is known as *bacalao*), Holland, Great Britain, Belgium, &c. Industries arising out of the fishery are the manufacture of cod-liver oil and of artificial manure. The summer cod fisheries and the lobster fishery are also valuable. The herring is taken in large quantities off the west coasts of Vesteraalen, but is a somewhat capricious visitant. The islands contain no towns properly so called, but Kabelvaag on Öst-Vaagö and Svolvaer on a few rocky islets off that island are considerable centres of trade and (in the fishing season) of population; Lödingen also, at the head of the Vestfjord on Hindö, is much frequented as a port of call. A church existed at

Vaagen (Kabelvaag) in the 12th century, and here Hans Egede, the missionary of Greenland, was pastor. There are factories for fish guano at Henningvaer (Öst-Vaagö), Kabelvaag, Svolvaer, Lödingen, and at Bretesnäs on Store Molla. Regular means of communication are afforded by the steamers which trade between Hamburg or Christiania and Hammerfest, and also by local vessels; less accessible spots can be visited by small boats, in the management of which the natives are adepts. There are some roads on Hindö, Langö, and Andö. The largest island in the group, and indeed in Norway, is Hindö, with an area of 860 sq. m. The south-eastern portion of it belongs to the *amt* of Tromsö. In the island of Andö there is a bed of coal at the mouth of Ramsaa.

LOFT (connected with "lift," *i.e.* raised in the air; O. Eng. *lyft*; cf. Ger. *Luft*; the French term is *grenier* and Ger. *Boden*), the term given in architecture to an upper room in the roof, sometimes called "cockloft"; when applied over stabling it is known as a hay-loft; the gallery over a chancel screen, carrying a cross, is called a rood-loft (see ROOD). The term is also given to a gallery provided in the choir-aisle of a cathedral or church, and used as a watching-loft at night.

LOFTUS, ADAM (*c.* 1533-1605), archbishop of Armagh and Dublin, and lord chancellor of Ireland, the son of a Yorkshire gentleman, was educated at Cambridge. He accompanied the earl of Sussex to Ireland as his chaplain in 1560, and three years later was consecrated archbishop of Armagh by Hugh Curwen, archbishop of Dublin. In 1565 Queen Elizabeth, to supplement the meagre income derivable from the archiepiscopal see owing to the disturbed state of the country, appointed Loftus temporarily to the deanery of St Patrick's; and in the same year he became president of the new commission for ecclesiastical causes. In 1567 he was translated to the archbishopric of Dublin, where the queen looked to him to carry out reforms in the Church. On several occasions he temporarily executed the functions of lord keeper, and in August 1581 he was appointed lord chancellor of Ireland. Loftus was constantly occupied in attempts to improve his financial position by obtaining additional preferment. He had been obliged to resign the deanery of St Patrick's in 1567, and twenty years later he quarrelled violently with Sir John Perrot, the lord deputy, over the proposal to appropriate the revenues of the cathedral to the foundation of a university. Loftus, however, favoured the project of founding a university in Dublin, though on lines different from Perrot's proposal, and it was largely through his influence that the corporation of Dublin granted the lands of the priory of All Hallows as a beginning of the endowment of Trinity College, of which he was named first provost in the charter creating the foundation in 1591. Loftus, who had an important share in the administration of Ireland under successive lords deputy, and whose zeal

and efficiency were commended by James I. on his accession, died in Dublin on the 5th of April 1605. By his wife, Jane Purdon, he had twenty children.

His brother Robert was father of ADAM LOFTUS (*c.* 1568-1643), who became lord chancellor of Ireland in 1619, and in 1622 was created Viscount Loftus of Ely, King's county, in the peerage of Ireland. Lord Loftus came into violent conflict with the lord deputy, Viscount Falkland, in 1624; and at a later date his quarrel with Strafford was still more fierce. One of the articles in Strafford's impeachment was based on his dealings with Loftus. The title, which became extinct on the death of his grandson, the 3rd viscount, in 1725 (when the family estate of Monasterevan, re-named Moore Abbey, passed to his daughter's son Henry, 4th earl of Drogheda), was re-granted in 1756 to his cousin Nicholas Loftus, a lineal descendant of the archbishop. It again became extinct more than once afterwards, but was on each occasion revived in favour of a descendant through the female line; and it is now held by the marquis of Ely in conjunction with other family titles.

See Richard Mant, *History of the Church of Ireland* (2 vols., London, 1840); J. R. O'Flanagan, *Lives of the Lord Chancellors of Ireland* (2 vols., London, 1870); John D'Alton, *Memoirs of the Archbishops of Dublin* (Dublin, 1838); Henry Cotton, *Fasti Ecclesiae Hibernicae* (5 vols., Dublin, 1848-1878); William Monck Mason, *History and Antiquities of the College and Cathedral Church of St Patrick, near Dublin* (Dublin, 1819); G. E. C., *Complete Peerage* vol. iii., sub. "Ely" (London, 1890).

LOG (a word of uncertain etymological origin, possibly onomatopoeic; the *New English Dictionary* rejects the derivation from Norwegian *lág*, a fallen tree), a large piece of generally unhewn, wood. The word is also used in various figurative senses, and more particularly for the "nautical log," an apparatus for ascertaining the speed of ships. Its employment in this sense depends on the fact that a piece of wood attached to a line was thrown overboard to lie like a log in a fixed position, motionless, the vessel's speed being calculated by observing what length of line ran out in a given time ("common log"); and the word has been retained for the modern "patent" or "continuous" log, though it works in an entirely different manner.

The origin of the "common log" is obscure, but the beginnings of the "continuous log" may be traced back to the 16th century. By an invention probably due to Humfray Cole and published in 1578 by William Bourne in his *Inventions and Devices*, it was proposed to register a ship's speed by means of a "little small close boat," with a wheel, or wheels, and an axle-tree to turn clockwork in the little boat, with dials and pointers indicating fathoms, leagues, scores of leagues and hundreds of leagues. About 1668 Dr R. Hooke showed some members of the Royal Society an instrument for the same purpose, depending on a vane or fly which rotated as the vessel progressed (Birch, *History of the Royal Society*, iv. 231), and Sir Isaac Newton in 1715 reported unfavourably on the "marine surveyor" of Henry de Saumarez, which also depended on a rotator. Conradus Mel in his *Antiquarius Sacer* (1719) described a "pantometron nauticum" which he claimed would show without calculation the distance sailed by the ship; and J. Smeaton in 1754 published improvements on the apparatus of Saumarez. William Foxon of Deptford in 1772, James Guerimand of Middlesex in 1776 (by his "marine perambulator"), and R. H. Gower in 1772, practically demonstrated the registration of a vessel's speed by mechanical means. Viscount de Vaux in 1807 made use of water-pressure, as did the Rev. E. L. Berthon in 1849, and C. E. Kelway invented an electrical log in 1876.

Common Log.—To ascertain the ship's speed by the common log four articles are necessary—a log-ship or log-chip, log-reel, log-line and log-glass. The log-ship (fig. 1) is a wooden quadrant ½ in. thick, with a radius of 5 or 6 in., the circumference of which is weighted with lead to keep it upright and retard its passage through the water. Two holes are made near its lower angles.

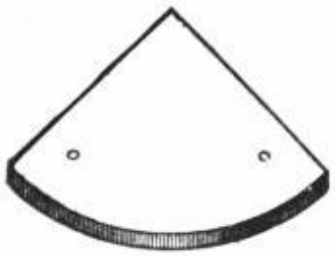

FIG. 1.

One end of a short piece of thin line is passed through one of these holes, and knotted; the other end has spliced to it a hard bone peg which is inserted in the other hole. The holes are so placed that the log-ship will hang square from the span thus formed. The log-line is secured to this span and consists of two parts. The portion nearest the log-ship is known as the "stray line"; its length varies from 10 to 20 fathoms, but should be sufficient to ensure that the log-ship shall be outside the disturbing element of the ship's wake. The point where it joins the other part is marked by a piece of bunting, and the line from this point towards its other end is marked at known intervals with "knots," which consist of pieces of cord worked in between its strands. A mean degree of the meridian being assumed to be 69.09 statute miles of 5280 ft., the nautical mile (1/60 degree) is taken as 6080 ft., which is a sufficiently close approximation for practical purposes, and the distances between the knots are made to bear the same relation to 6080 ft. as 28 seconds to an hour (3600 seconds); that is, they are placed at intervals of 47 ft. 3 in. The end of the first interval of this length (counting from the piece of bunting) is marked by a bit of leather, the second by a cord with two knots, the third by one with three knots, and so on; the middle of each of these lengths (half-knot) is also marked by a cord with one knot. It follows that, if, say, five knots of the line run out in 28 seconds, the ship has gone 5 × 47¼ ft. in that time, or is moving at the rate of 5 × 6080 ft. (= five nautical miles) an hour; hence the common use of knot as equivalent to a nautical mile. In the log-glass the time is measured by running sand, which, however, is apt to be affected by the

humidity of the atmosphere. Sometimes a 30-second glass is used instead of a 28-second one, and the intervals between the knots on the log-line are then made 50 ft. 7 in. instead of 47 ft. 3 in. For speeds over six knots a 14-second glass is employed, and the speed indicated by the log-line is doubled.

The log-line, after being well soaked, stretched and marked with knots, is wound uniformly on the log-reel, to which its inner end is securely fastened. To "heave the log," a man holds the log-reel over his head (at high speeds the man and portable reel are superseded by a fixed reel and a winch fitted with a brake), and the officer places the peg in the log-ship, which he then throws clear and to windward of the ship, allowing the line to run freely out. When the bunting at the end of the stray line passes his hand, he calls to his assistant to turn the glass, and allows the line to pay out freely. When all the sand has run through, the assistant calls "Stop!" when the log-line is quickly nipped, the knots counted, and the intermediate portion estimated. The strain on the log-ship when the log-line is nipped, causes the peg to be withdrawn from it, and the log-ship is readily hauled in. In normal circumstances, the log is hove every hour. In a steam vessel running at high speed on an ocean route, with engines working smoothly and uniformly, a careful officer with correct line and glass can obtain very accurate results with the common log.

Ground Log.—In the deltas of shoal rivers, with a strong tide or current and no land visible, a 5 lb lead is substituted for the log-ship; the lead rests on the bottom, and the speed is obtained in a manner similar to that previously described. Such a "ground-log" indicates the actual speed over the ground, and in addition, when the log-line is being hauled in, it will show the real course the ship is making over the ground.

Patent Log.—The screw or rotatory log of Edward Massey, invented in 1802, came into general use in 1836 and continued until

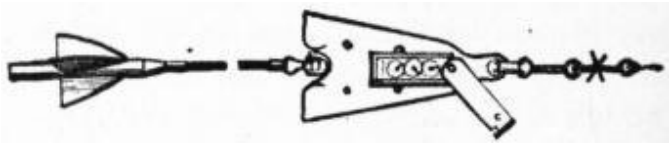

FIG. 2.

1861. The registering wheelwork was contained in a shallow rectangular box (fig. 2), with a float plate on its upper side, carrying three indicating dials, recording respectively fractions, units and tens of miles (up to a hundred). The rotator was connected to the log by a rope 6 ft. in length, actuating a universal joint on the first spindle of the register; it consisted of an air-tight thin metal tube with a coned fore-end, carrying flat metal vanes set at an angle. Alexander Bain in 1846 suggested enclosing the wheelwork in the rotator. In Thomas Walker's harpoon or frictionless log, introduced in 1861, the wheelwork was enclosed in a cylindrical case of the same diameter as the body of the rotator or fan, and the latter was brought close up to the register, forming a compact machine and avoiding the use of the 6-ft. line. Two years later a heart-shaped float plate was attached to the case, and the log called the A1 Harpoon ship log (fig. 3). The log should be washed in fresh water when practicable, to prevent oxidization of the wheels, and be lubricated with suitable oil through a hole in the case.

FIG. 3.—The A1 Harpoon Ship Log.

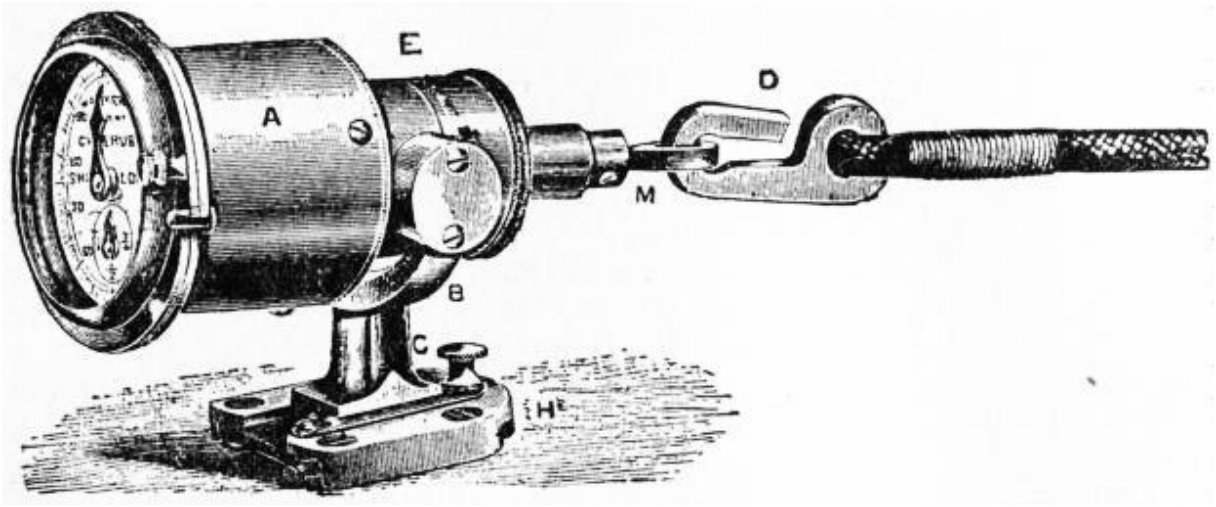

FIG. 4.—The Cherub Log.

These logs were towed from the ship, but with quick passages and well surveyed coasts, the need arose for a patent log which could be readily consulted from the deck, and from which the distance run under varying speeds could be quickly ascertained. To meet this requirement, Walker in 1878 introduced the Cherub log (fig. 4), a taffrail one, which, however, is not as a rule used for speeds over 18 knots. Owing to the increased friction produced by a rotator making approximately 900 revolutions per mile, towed at the end of a line varying from 40 fathoms for a 12-knot speed to 60 fathoms for 20 knots, the pull of the line and rotator is borne by coned rollers, having their outlines tapering to a common point in their rotation, thus giving a broad rolling surface. Strong worms and wheels are substituted for the light clockwork. In fig. 4 the shoe H is secured to the taffrail, and the rotator in the water is hooked to the eye of the spindle M by the hook D. The case A contains the registering wheelwork and a sounding bell. The half gimbal B pivoting in the socket of the base C allows the register to receive the strain in the direct line. The bearings and rollers are lubricated with castor oil every twelve hours through holes in the sliding case E, and can be examined by unscrewing the case E and the eye M. When not in use, the register is removed from the shoe by lifting a small screw button near C. The tow line is usually plaited, and to avoid a knot close to the rotator, the latter is secured to the former by a knot inside an egg-shaped shell (fig. 5, Neptune pattern).

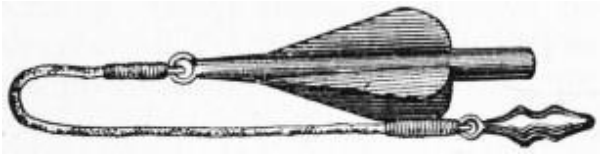

FIG. 5.—Neptune Pattern for securing Rotator.

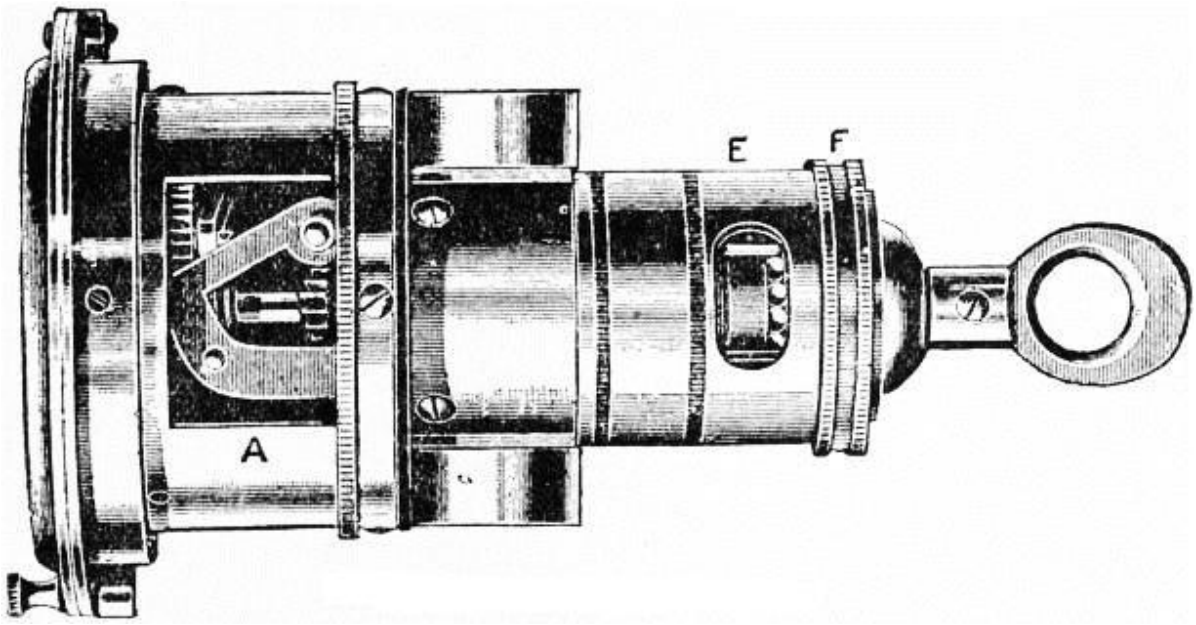

FIG. 6.—Walker's Neptune Log.

Walker's Neptune log (fig. 6) is used for vessels of high speed. Case A contains the wheelwork, and case E the spindle and steel ball bearings; in each case are openings, closed by sliding tubes, for examination and lubrication. In fig. 6 the cases A and E are shown open. Fig. 7 shows the dial plate. In fig. 8 the ball bearings are shown unscrewed from the body of the log, with eye, cap and spindle. They consist of two rows of balls rolling in two pairs of V races or grooves. The outer pair receive the strain of the rotator, and the inner are for adjustment and to prevent lateral movement. The balls and races are enclosed in a skeleton cage (fig. 9) unscrewing from the cap F (fig. 6) for cleaning or renewal; the adjustment of the bearings is made by screwing up the cage cap *b*, locked by a special washer and the two screws *a*, *a* (figs. 8, 9). If the outer races become worn, the complete cage and bearings are reversed; the strain of the line is then transferred to what had previously been the inner with practically unworn balls and races. It is for this purpose that the skeleton cage is screwed internally at both ends, fitting a screwed ring inside the cap F (fig. 6). To enable the indications of the log

register on the taffrail to be recorded in the chart room or any other part of the vessel as desired, a chart room electric register has been introduced. By means of an electric installation between the log register aft and the electric register in the chart room, every tenth of a mile indicated by the former is recorded by the latter.

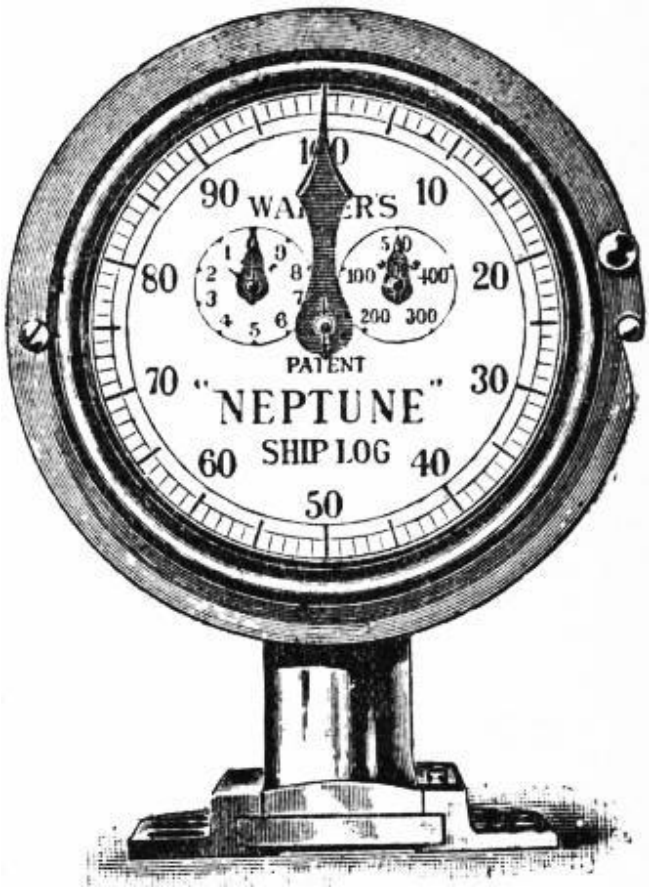

FIG. 7.—Dial-plate of Neptune Log.

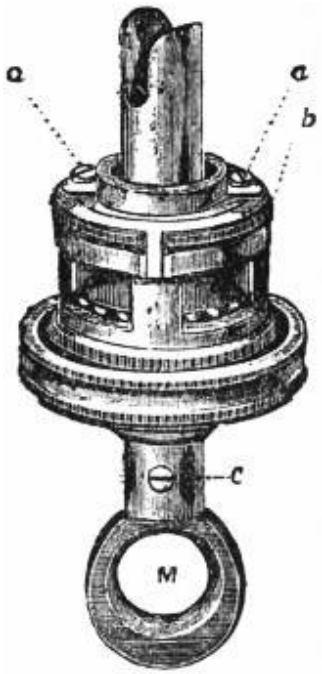

FIG. 8.—Ball Bearings of Neptune Log.

Walker's Rocket log (fig. 10) is a taffrail one, with bearings of hardened steel, and is intended to be slung or secured to the taffrail by a line; the gimbal pattern has a fitting for the deck. In taffrail logs, the movement of the line owing to its length becomes spasmodic and jerky, increasing the vibration and

friction; to obviate this a governor or fly-wheel is introduced, the hook of the tow line K (fig. 11) and the eye of the register M being attached to the governor. Fig. 11 represents the arrangement fitted to the Neptune log; with the Cherub log, a small piece of line is introduced between the governor and the eye of the register. The two principal American taffrail logs are the Negus and Bliss (Messrs Norie and Wilson). The former bears a general resemblance to the Cherub log, but the dial plate is horizontal and the faces turn upwards. The main shaft bearings are in two sets and composed of steel balls running in steel cones and cups; the governor is an iron rod about 16 in. long, with 1 in. balls at the extremities. The Bliss resembles the Rocket log in shape, and is secured to the taffrail by a rope or sling. A governor is not employed. The blades of the rotator are adjustable, being fitted into its tube or body by slits and holes and then soldered. The outer ends of the blades are slit (fig. 12) to form two tongues, and with the wrench (fig. 12) the angle of the pitch can be altered.

All patent logs have errors, the amounts of which should be ascertained by shore observations when passing a well surveyed coast in tideless waters on a calm day. Constant use, increased friction (more especially at high speeds), and damage to the rotator will alter an ascertained log error; head or following seas, strong winds, currents and tidal streams also affect the correctness.

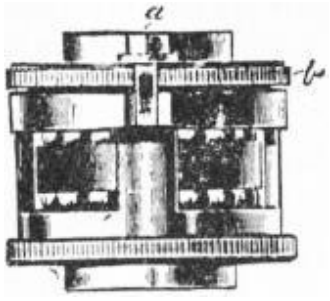

FIG. 9.—Ball Bearings of Neptune Log in Skeleton Case.

FIG. 10.—Rocket Log.

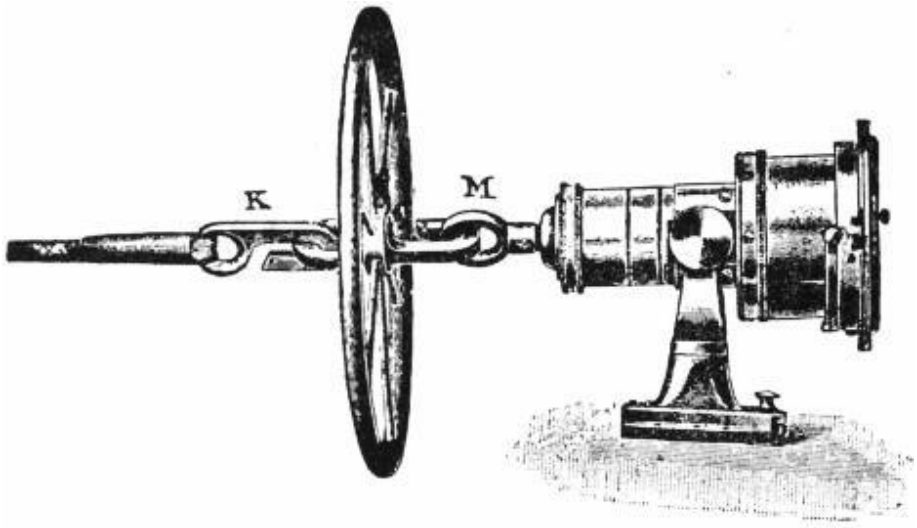

FIG. 11.—Neptune Log fitted with Governor.

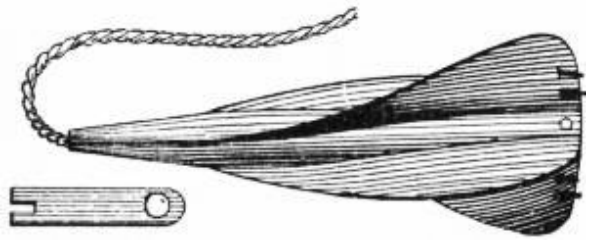

FIG. 12.—Bliss Log.

A *Log Book* is a marine or sea journal, containing, in the British navy, the speed, course, leeway, direction and force of the wind, state of the weather, and barometric and thermometric observations. Under the heading "Remarks" are noted (for vessels with sail power) making, shortening and trimming sails; and (for all ships) employment of crew, times of passing prominent landmarks, altering of course, and any subject of interest and importance. The deck log book, kept by the officers of the watch, is copied into the ship's log book by the navigating officer, and the latter is an official journal. In steam vessels a rough and fair engine room register are kept, giving information with regard to the engines and boilers. In the British mercantile marine all ships (except those employed exclusively in trading between ports on the coasts of Scotland) are compelled to keep an official log book in a form approved by the Board of Trade. A mate's log book and engine room register are not compulsory, but are usually kept.

(J. W. D.)

LOGAN, JOHN (*c.* 1725-1780), also known as TAHGAHJUTÉ, American Indian chief, a Cayuga by birth, was the son of Shikellamy, a white man who had been captured when a child by the Indians, had been reared among them, and had become chief of the Indians living on the Shamokin Creek in what is now Northumberland county, Pennsylvania. The name Logan was given to the son in honour of James Logan (1674-1751), secretary of William Penn and a steadfast friend of the Indians. John Logan lived for some time near Reedsville, Penn., and removed to the banks of the Ohio river about 1770. He was not technically a chief, but acquired great influence among the Shawnees, into which tribe he married. He was on good terms with the whites until April 1774, when, friction having arisen between the Indians and the whites, a band of marauders, led by one Greathouse, attacked and murdered several Indians, including, it appears, Logan's sister and possibly one or more other relatives. Believing that Captain Michael Cresap was responsible for this murder, Logan sent him a declaration of hostilities, the result of which was the bloody conflict known as Lord Dunmore's war. Logan refused to join the Shawnee chief, Cornstalk, in meeting Governor Dunmore in a peace council after the battle of Point Pleasant, but sent him a message which has become famous as an example of Indian eloquence. The message seems to have been given by Logan to Colonel John Gibson, by whom it was delivered to Lord Dunmore. Thomas Jefferson first called general attention to it in his *Notes on Virginia* (1787), where he quoted it and added: "I may challenge the whole orations of Demosthenes and Cicero, and of any more

eminent orator, if Europe has furnished more eminent, to produce a single passage superior to it." Logan became a victim of drink, and in 1780 was killed near Lake Erie by his nephew whom he had attacked. There is a monument to him in Fair Hill Cemetery, near Auburn, New York.

Brantz Mayer's *Tahgahjuté, or Logan the Indian and Captain Michael Cresap* (Baltimore, 1851, 2nd ed., Albany, 1867) defends Captain Cresap against Jefferson's charges, and also questions the authenticity of Logan's message, about which there has been considerable controversy, though its actual wording seems to be that of Gibson rather than of Logan.

LOGAN, JOHN (1748-1788), Scottish poet, was born at Soutra, Midlothian, in 1748. His father, George Logan, was a farmer and a member of the Burgher sect of the Secession church. John Logan was sent to Musselburgh grammar school, and in 1762 to the university of Edinburgh. In 1768-1769 he was tutor to John, afterwards Sir John, Sinclair, at Ulbster, Caithness, and in 1770, having left the Secession church, he was licensed as a preacher by the presbytery of Haddington. In 1771 he was presented to the charge of South Leith, but was not ordained till two years later. On the death of Michael Bruce (*q.v.*) he obtained that poet's MSS. with a view to publication. In 1770 he published *Poems on Several Occasions, by Michael Bruce* with a preface, in which, after eulogizing Bruce, who had been a fellow student of his, he remarked that "to make up a miscellany some poems wrote by different authors are inserted, all of them originals, and none of them destitute of merit. The reader of taste will easily distinguish them from those

of Mr Bruce, without their being particularized by any mark." Logan was an active member of the committee of the General Assembly of the Church of Scotland which worked from 1775 to 1781 at revising the "Translations and Paraphrases" for public worship, in which many of his hymns are printed. In 1779-1781 he delivered a course of lectures on the philosophy of history at St Mary's Chapel, Edinburgh. An analysis of these lectures, *Elements of the Philosophy of History* (1781), bears striking resemblance to *A View of Ancient History* (1787), printed as the work of Dr W. Rutherford, but thought by Logan's friends to be his. In 1781 he published his own *Poems*, including the "Ode to the Cuckoo" and some other poems which had appeared in his volume of Michael Bruce's poems, and also his own contributions to the Paraphrases. His other publications were *An Essay on the Manners and Governments of Asia* (1782), *Runnamede, a tragedy* (1783), and *A Review of the Principal Charges against Warren Hastings* (1788). His connexion with the theatre gave offence to his congregation at South Leith; he was intemperate in his habits, and there was some local scandal attached to his name. He resigned his charge in 1786, retaining part of his stipend, and proceeded to London, where he became a writer for the *English Review*. He died on the 28th of December 1788. Two posthumous volumes of sermons appeared in 1790 and 1791. They were very popular, and were reprinted in 1810. His *Poetical Works* were printed in Dr Robert Anderson's *British Poets* (vol. xi., 1795), with a life of the author. They were reprinted in similar collections, and separately in 1805.

Logan was accused of having appropriated in his *Poems* (1781) verses written by Michael Bruce. The statements of John Birrell and David Pearson on behalf of Bruce were included in Dr Anderson's *Life of Logan*. The charge of plagiarism has been revived from time to time, notably by Dr W. Mackelvie (1837) and Mr James Mackenzie (1905). The whole controversy has been marked by strong partisanship. The chief points against Logan are the suppression of the major portion of Bruce's MSS. and some proved cases of plagiarism in his sermons and hymns. Even in the beautiful "Braes of

Yarrow" one of the verses is borrowed direct from an old border ballad. The traditional evidence in favour of Bruce's authorship of the "Ode to the Cuckoo" can hardly be set aside, but Dr Robertson of Dalmeny, who was Logan's literary executor, stated that he had gone over the MSS. procured at Kinnesswood with Logan.

Logan's authorship of the poems in dispute is defended by David Laing, *Ode to the Cuckoo with remarks on its authorship, in a letter to J. C. Shairp, LL.D.* (1873); by John Small in the *British and Foreign Evangelical Review* (July, 1877, April and October, 1879); and by R. Small in two papers (*ibid.*, 1878). See also BRUCE, MICHAEL.

LOGAN, JOHN ALEXANDER (1826-1886), American soldier and political leader, was born in what is now Murphysborough, Jackson county, Illinois, on the 9th of February 1826. He had no schooling until he was fourteen; he then studied for three years in Shiloh College, served in the Mexican war as a lieutenant of volunteers, studied law in the office of an uncle, graduated from the Law Department of Louisville University in 1851, and practised law with success. He entered politics as a Douglas Democrat, was elected county clerk in 1849, served in the State House of Representatives in 1853-1854 and in 1857, and for a time, during the interval, was prosecuting attorney of the Third Judicial District of Illinois. In 1858 and 1860 he was elected as a Democrat to the National House of Representatives. Though unattached and unenlisted, he fought at Bull Run, and then returned to Washington, resigned his seat, and entered the Union

army as colonel of the 31st Illinois Volunteers, which he organized. He was regarded as one of the ablest officers who entered the army from civil life. In Grant's campaigns terminating in the capture of Vicksburg, which city Logan's division was the first to enter and of which he was military governor, he rose to the rank of major-general of volunteers; in November 1863 he succeeded Sherman in command of the XV. Army Corps; and after the death of McPherson he was in command of the Army of the Tennessee at the battle of Atlanta. When the war closed, Logan resumed his political career as a Republican, and was a member of the National House of Representatives from 1867 to 1871, and of the United States Senate from 1871 until 1877 and again from 1879 until his death, which took place at Washington, D.C., on the 26th of December 1886. He was always a violent partisan, and was identified with the radical wing of the Republican party. In 1868 he was one of the managers in the impeachment of President Johnson. His war record and his great personal following, especially in the Grand Army of the Republic, contributed to his nomination for Vice-President in 1884 on the ticket with James G. Blaine, but he was not elected. His impetuous oratory, popular on the platform, was less adapted to the halls of legislation. He was commander-in-chief of the Grand Army of the Republic from 1868 to 1871, and in this position successfully urged the observance of Memorial or Decoration Day, an idea which probably originated with him. He was the author of *The Great Conspiracy: Its Origin and History* (1886), a partisan account of the Civil war, and of *The Volunteer Soldier of America* (1887). There is a fine statue of him by St Gaudens in Chicago.

The best biography is that by George F. Dawson, *The Life and Services of Gen. John A. Logan, as Soldier and Statesman* (Chicago and New York, 1887).

LOGAN, SIR WILLIAM EDMOND (1798-1875), British geologist, was born in Montreal on the 20th of April 1798, of Scottish parents. He was educated partly in Montreal, and subsequently at the High School and university of Edinburgh, where Robert Jameson did much to excite his interest in geology. He was in a business house in London from 1817 to 1830. In 1831 he settled in Swansea to take charge of a colliery and some copper-smelting works, and here his interest in geology found abundant scope. He collected a great amount of information respecting the South Wales coal-field; and his data, which he had depicted on the 1-in. ordnance survey map, were generously placed at the disposal of the geological survey under Sir H. T. de la Beche and fully utilized. In 1840 Logan brought before the Geological Society of London his celebrated paper “On the character of the beds of clay lying immediately below the coal-seams of South Wales, and on the occurrence of coal-boulders in the Pennant Grit of that district.” He then pointed out that each coal-seam rests on an under-clay with rootlets of *Stigmaria*, and he expressed his opinion that the under-clay was the old soil in which grew the plants from which the coal was formed. To confirm this observation he visited America in 1841 and examined the coal-fields of Pennsylvania and Nova Scotia, where he found the under-clay almost invariably present beneath the seams of coal. In 1842 he was appointed to take charge of the newly established geological survey in Canada, and he continued as director until 1869. During the earlier years of the survey he had many difficulties to surmount and

privations to undergo, but the work was carried on with great tact and energy, and he spared no pains to make his reports trustworthy. He described the Laurentian rocks of the Laurentian mountains in Canada and of the Adirondacks in the state of New York, pointing out that they comprised an immense series of crystalline rocks, gneiss, mica-schist, quartzite and limestone, more than 30,000 ft. in thickness. The series was rightly recognized as representing the oldest type of rocks on the globe, but it is now known to be a complex of highly altered sedimentary and intrusive rocks; and the supposed oldest known fossil, the *Eozoon* described by Sir J. W. Dawson, is now regarded as a mineral structure. Logan was elected F.R.S. in 1851, and in 1856 was knighted. In the same year he was awarded the Wollaston medal by the Geological Society of London for his researches on the coal-strata, and for his excellent geological map of Canada. After his retirement in 1869, he returned to England, and eventually settled in South Wales. He died at Castle Malgwyn in Pembrokeshire, on the 22nd of June 1875.

See the *Life*, by B. J. Harrington (1883).

(H. B. Wo.)

LOGAN, a city and the county-seat of Cache county, Utah, U.S.A., on the Logan river, about 70 m. N. of Salt Lake City. Pop. (1900) 5451 (1440 foreign-born); (1910) 7522. It is served by the Oregon Short Line railroad. It lies at the mouth of Logan Cañon, about 4500 ft. above the sea, and commands magnificent views of the Wasatch Mountains and the fertile

Cache Valley. At Logan is a temple of the Latter-Day Saints (or Mormons), built in 1883, and the city is the seat of the Agricultural College of Utah, of Brigham Young College, and of New Jersey Academy (1878), erected by the women of the Synod of New Jersey and managed by the Woman's Board of Home Missions of the Presbyterian Church. The Agricultural College was founded in 1888 and opened in 1890; an agricultural experiment station is connected with it and the institution comprises schools of agriculture, domestic science and arts, commerce, mechanic arts and general science. Six experiment stations in different parts of the state and a central experimental farm near St George, Washington county, were in 1908 under the direction of the experiment station in Logan. Brigham Young College was endowed by Brigham Young in 1877 and was opened in 1878; it offers courses in the arts, theology, civil engineering, music, physical culture, domestic science, nurse training and manual training. Logan has various manufactures, and is the trade centre for a fertile farming region. The municipality owns and operates its water works and its electric lighting plant. Logan was settled in 1859 and first incorporated in 1866.

LOGANSPORT, a city and the county-seat of Cass county, Indiana, U.S.A., on the Wabash river, at the mouth of the Eel river, about 67 m. N. by W. of Indianapolis and 117 m. S. by E. of Chicago. Pop. (1900) 16,204, of whom 1432 were foreign-born, (1910 census) 19,050. It is served by six divisions of the Pittsburg, Cincinnati, Chicago & St Louis, two divisions of the Vandalia (Pennsylvania Lines), and the Wabash

railways, and by electric interurban lines. The city is the seat of the Northern Indiana Hospital for the Insane (1888), and has a public library, and a hospital (conducted by the Sisters of St Joseph). Among the principal buildings are the court house, a Masonic temple, an Odd Fellows' temple, and buildings of the Order of Elks, of the Knights of Pythias, and of the fraternal order of Eagles. Situated in the centre of a rich agricultural region, Logansport is one of the most important grain and produce markets in the state. The Wabash and the Eel rivers provide good water power, and the city has various manufactures, besides the railway repair shops of the Vandalia and of the Pittsburg, Cincinnati, Chicago & St Louis railways. The value of the city's factory product increased from $2,100,394 in 1900 to $2,955,921 in 1905, or 40.7%. Limestone, for use in the manufacture of iron, is quarried in the vicinity. The city owns and operates the water works and the electric-lighting plant. Logansport was platted in 1828, was probably named in honour of a Shawnee chief, Captain Logan (d. 1812), became the county-seat of Cass county in 1829, and was chartered as a city in 1838.

LOGAR, a river and valley of Afghanistan. The Logar river drains a wide tract of country, rising in the southern slopes of the Sanglakh range and receiving affluents from the Kharwar hills, N.E. of Ghazni. It joins the Kabul river a few miles below the city of Kabul. The Logar valley, which is watered by its southern affluents, is rich and beautiful, about 40 m. long by 12 wide, and highly irrigated throughout. Lying in the vicinity of the

capital, the district contributes largely to its food-supply. The valley was traversed in 1879 by a brigade under Sir F. (afterwards Lord) Roberts.

*** END OF THE PROJECT GUTENBERG EBOOK ENCYCLOPAEDIA BRITANNICA, 11TH EDITION, "LIQUID GASES" TO "LOGAR" ***

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