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# Food, Farmer and Future

"Considering *Punch* as the expression of the popular voice . . . is it not also surely some overruling power in the nature of things, quite other than the desire of his readers, which compels him, when the squire, the colonel and the admiral are to be at once expressed, together with all that they legislate or fight for, in the symbolic figure of the nation, to represent the incarnate John Bull always as a farmer—never as a manufacturer or shopkeeper and to conceive and exhibit him rather as paymaster for the faults of his neighbours, than as watching for opportunity to gain out of their follies."—John Ruskin. Lecture at Oxford. Nov. 1883. (Cook and Wedderburn ed. Vol. 33, p. 365.)

SIGNS are everywhere to-day that the desire is growing in us to put the house social more under considered control: we see that the happy-go-lucky individualism of the past must give way to a well-thought-out system, which will be to the greater good of a greater number; we see the need to infuse a greater share of human sympathy into commerce and industry, in place of the unbridled spirit of competition that has too long prevailed: in other words, there is an obvious desire to introduce scientific practice into our affairs, so that we may work with calculated effect.

*Life is so complex that we have forgotten how entirely food is its foundation and mainstay.* We have taken what is provided as a matter of course, with little thought for the stomach: too easily assuming that nothing unwholesome would be offered, scant allowance has been made for commercial greed. The use of crude fuels, such as coal and oil, has led us to overlook our own need of carefully chosen fuels of altogether special quality: in fact, twenty years ago, when the War began, we had but a few rough rules to guide us. The rapidly growing science of dietetics has been developed almost entirely since the War. We now know that Nature exerts her control by homœopathic means: that our gross foods are assimilated under the influence of indispensable very small proportions of a large number of accessory agents, in balance, each of which apparently serves the special ends of some one or other of the many separate, departmental activities of the human system. A trace of iodine may shift the balance from idiocy to sanity. No factory is in any way an approach to our bodies in complexity and perfection of organisation. Not a few of us look forward with comfortable assurance to a time when present-day curative medicine will give way to a preventive medicine which will all but insure health, through proper feeding. An Erewhonian situation will then prevail: disease will be punishable—because it will be admitted that it is mainly due to misfeeding and malnutrition.

Once established, this attitude towards health must affect our policy in every direction. In asking for a national stock-taking, Mr. Lloyd George has shown that he already has a dim notion of the coming state of affairs—when official ignorance will be overcome by constructive knowledge, broadly spread throughout the community, not localised in a bureaucratic service. We have to define an agricultural policy without further delay.

*Milk will be our mainstay and primary care,* being Nature's ideal food, the food of infancy. As a nation, we have yet to recognise the general value of milk; that the Milk Marketing Board should feel called upon to press it upon the attention of the medical profession, by a weekly advertisement in the *Lancet*, is not merely farcical but little short of a tragedy. We have to create a milk conscience in all concerned with its production. Proper conditions of cow-keeping must be enforced, throughout the country; we must not allow the trade to be in ignorant hands. If rigid count can be kept of publicans, control of dairymen should not be impossible. Maybe, if it

were taxed, as dear as beer, milk would be more valued and more popular. Everything has yet to be learnt about milk. Certain deficiencies are to be recognised even in the best product. Whether these are innate or the consequence of long continued malnutrition, due to exhaustion of our soils, is a question.

If cows came "from out the East", originally they will have been exposed to a fuller measure of sunlight than are our cows to-day; if so, their output of the much belauded D advitant may have been greater, particularly if better feeding put more ergot-sterol into the hides of the Eden herd. Eve, noticing that the animals generally ate it, may have been led to give a bite of grass or of some water weed to her infants with her milk; civilisation has made modern mothers less considerate, though I hear of my Californian great-grandson being given spinach from early infancy. In fact, we do not yet know what milk is, might be or should be. A vast field of scientifically directed, experimental inquiry lies open—real inquiry, not randomised re-search.

The inquiry into milk will involve no mere study of milk but also of the animals producing it and of the foods from which it is made. We may say already, that we know—some few of us feel it in our bones—that, like ourselves, when properly fed, cattle will be free from disease. Grass hitherto has scarcely been a cultivated crop—we have to study its cultivation, under the various conditions of soil and climate which prevail in our islands; this applies equally to other crops used in feeding farm animals. Milk will surely be found to vary in quality—eventually the districts producing it will be graded and specially named, as vineyards are in France and Germany: *Liebfraumilch* will not be the only brand: *Milch, Weib und Gesang* will be our modern *Sprichwort*. Our Wine and Food Society will have its milk tasters who will vie with Mr. André Simon as a wine taster; a Marcel Boulestin–Ambrose Heath combine will act as grass tasters to cow herds, as well as in testing our salads.

A problem to be inquired into is the cyclic variation with the year in grass and other green foods supplied to cattle. The plant must change its character in passing up to the climax of its growth and thence down to maturity. Milk must be correspondingly affected. At present, all that we know is, that some of the shortcomings in winter food may be met by rationing cattle with summer-grown grass, cut young and immediately dried with special care. In an experiment which I was instrumental in starting at Christ's Hospital, three winters ago, six cows out of a herd of thirty-six were fed with such grass, grown, cut and dried under the superintendence of Sir Frederick Keeble, at the Jealotts' Hill Farm of Imperial Chemical Industries, Ltd. Throughout the winter, the six remained sleek and gave a milk of summer character, whilst the rest of the herd fell off as usual, giving an ordinary poor winter milk. Similar results have since been obtained elsewhere. We may hope that, some day, winter conditions may be overcome by justifying the practice of the Laputan philosophers.

To produce grass of the right quality, the growing plant must be sprayed with water and even with fertilising solutions, at the expedient moment. The supply of water, therefore, must be taken into account and due provision made. Ultimately, it will be found that only certain districts are suitable for the production of a standard article—these will be definitely earmarked for the purpose and supply regulated to meet the demand.

In connexion with milk, butter and cheese will need special consideration—to what extent we are to supply ourselves with these. We are so ill-supplied now that the public is losing all sense of quality in cheese—the gullible housewife will take anything, provided it be in wedges wrapped in tin-foil, paying through the nose for it. Each county should have a cream cheese of note: dairymaids generally should be called upon to show that they have the imagination to produce distinctive articles: of what use are the bacteriologists if they cannot provide each county with its special cheese-bug, to be brandished against all comers from outside?

Our milk production should be strictly correlated with and regulate our output of meat—of veal, beef and pork, even of poultry and eggs. Butter involves butter-milk and its use in pig and poultry keeping: not an ounce should be wasted. That Rothamsted should spend time and money in showing how it may be made harmless before turning it into a stream is nothing short of criminal condonation of manufacturers' ignorance. Verily is milk a dainty dish to set before king and nation!

Sugar may come next. We shall have to take this seriously, not as mere sweetness. In Europe it can only be produced at an economic loss; it has always been bounty fed. It may have agricultural advantages and suit our farmers under present conditions—but Peter is robbed to pay Paul, the community bears the brunt. Sugar can be made from sugar cane, at half the cost of

beet sugar, in the West Indies, Java, etc. We cannot but purchase some foreign goods in exchange for our manufactured goods—is not sugar one of the articles we should agree *to purchase*, on this account? There is no question of sweated labour to be considered: sunlight and the associated conditions in tropical countries all prevail against the economic cultivation of sugar here.

Maybe we shall soon be led to discourage the consumption of sugar and reduce its use to a minimum. Evidence is accumulating that it is an undesirable, if not a bad food, except when used to meet the strain of extreme muscular exertion, as in racing or climbing. The rise in the consumption of sugar, in modern times, is remarkable, especially in the United States; coincidently, there has been a marked fall in the amount of bread eaten. Americans are directing attention to a surprising change in national type—to the growth of obesity and even flabbiness in character. Are we not also losing character and becoming sugary in outlook? Sugar definitely spares fat—women are right in avoiding it, on this account. Worst of all, we starve ourselves in eating sugar in any quantity: it carries nothing with it—no mineral matter, nothing that is body-building. On this account it is bad for children. Finally, it is probable that resistance of infectious disease is lowered by an excess of sugar in the blood.

Follows bread. Society has a heavy indictment to bring against the medical profession in particular, in that it has so long allowed the use of white wheaten flour as bread—that it has not insisted on as much as possible of the whole grain being eaten. The faults of white flour are those of sugar—it is mainly of use as fuel and has little nutritive value. It is truly a whited sepulchre! Nearly the whole of the mineral matter and the vital components—the germ—are removed in the bran, which is not eaten but sold as offal, for use by animals; these get the best of the bargain. The use of such flour is traceable to American laziness, to the desire to avoid hard labour by the use of machinery, also the desire to do big business and supply the world—without counting the loss to American soil or European farmers. Wholemeal flour cannot be kept more than a few weeks, as the oil in the germ becomes rancid; white flour, being free from the germ, may be stored over long periods—it therefore suits the milling and baking trades. Canadian hard wheats have also an unfair advantage, in that the flour will carry more water: the baker can make more loaves from the sackful. Bread to-day is made *en bloc*—by machine: it is crustless and uninviting, as well as of minimum nutritive value. We need to go back to the local mill and the local baker—who together can give us a seemly loaf, of a bread containing as much of the cereal grain as may be eaten profitably. Maybe as good, if not better, breads may be made from home-grown than from imported wheats—putting aside all question of their water-carrying power.

Although Rothamsted has grown wheat on the same land, under like conditions, during more than ninety years, with great show of statistics, nothing has been learnt of the nutritive value of the grain. In any case, not a sack of flour should be allowed to come into the country—only grain, to be ground here. Our present fiscal policy will need drastic revision, if our knowledge of food be allowed to play any part in determining its character and scope. So will our agricultural research.

Last, but not least, "'tis but the means to do ill deeds that makes deeds ill done". This applies equally to the good deed of growing high quality crops: to water and manures, without which, in due season, nothing is possible. Agriculture has two great problems to consider—that of water-supply and that of waste-disposal. Neither can be discussed here. Suffice it to say, we cannot afford, any longer, *to waste organic matter:* we must have humus manures, if we are to put quality into agricultural produce, especially into table vegetables. All town waste must be collected and specially treated: Sir Albert Howard and others working in India, have shown how this can be accomplished. Our people will perish, not from lack of knowledge but of organic manure, if this be not soon done. In addition, we cannot any longer allow sewage to go to sea: we must in some way recover from it both potash and phosphate, of which the natural stores are very limited. China calls to us, offering an example of thriftiness that we shall be compelled to follow. Our agricultural research stations fail us, not only in this particular but generally in matters of food production. They offer us only bare figures. Man unfortunately lives not by statistics.

A great renascence awaits us. We have to brush the pedant aside and make our universities of avail in the service of the nation. Education at the present day is worthless for all practical purposes; its fulcrum, in future, must be the belly through favour of the farmer.

HENRY E. ARMSTRONG.

# Stability of Structures*

By J. S. Wilson

THE meaning of stability is not easy to define. In dynamics and mechanics we have stability of steady motion and stability of equilibrium, of position and of friction. To the civil engineer the word is usually applied to the power of a structure to withstand for an indefinite time all the loads and forces that may be brought to bear on it.

The most stable structure ever built is probably the Great Pyramid of Egypt. It consists of large blocks of limestone carefully shaped and piled together to the height of 480 ft. on a base measuring 830 ft. square. Another example of a great pile : a pile of bricks laid one on another, was a tall chimney such as the celebrated one at St. Rollox in Glasgow. This had a height of 435 ft., and at its base a diameter of 40 ft. It was pulled down a few years ago after having stood since 1842. A masonry dam built across a valley to impound water is a form of structure the stability of which must be beyond question, as failure would lead to disastrous flooding. Then we have the arch, the most beautiful and fascinating form of construction invented by man. In its simple form we have arches of imposing size and graceful stability across rivers, while in cathedrals and other great buildings we have it in the groin, dome and buttress.

In each of these examples, strength and stability depend mainly on the resistance to compression offered by stone or brick. A complementary form of structure, dependent on the resistance to rupture by the pulling asunder of its parts, is the suspension bridge, the stability of which depends almost entirely on the tensile resistance of the chains or cables. The greatest structure of this form is undoubtedly the George Washington Bridge over the Hudson River, New York, with its span of 3,400 ft.

In most iron and steel structures the resistance of the material to both tension and compression contributes to their stability in equal proportions, as is found in the great girder and cantilever bridges. Reinforced concrete, in which the great strength of concrete to resist compression is combined with the power of steel to resist tension, owes its development largely to the facility with which it can be built and shaped. Tunnels of masonry or brickwork, and cast-iron lined tube tunnels, subject to the pressure of great depths of earth, are forms of structure the stabilities of which are not easy to calculate.

* From the presidential address to Section G (Engineering) of the British Association delivered at Norwich on September 5.

There are two sides to all problems in stability; the first depends on applied mechanics, the second on the regulation of stresses to get an economical use of material. Progress in the second during the last fifty years has not been so great as in the first, to which my remarks refer more particularly. To fix the directions of, and arrange for the balance of, loads and forces, the conception of action along lines was introduced at an early stage. The position of such a line, with respect to the boundary of a member offering resistance, governs the distribution and intensity of stresses in the material. In estimating the intensity of stress, the position of the line in a lamina of the part under consideration is usually considered, and in it the distribution of the stress follows the 'trapezium law', which is a particular case of Galileo's solution of the beam problem. Thus if the line representing the centre of action of the load or thrust is on the centre of the section of the member, the stress intensity would be the same throughout the section. If the line of action is off the centre, then the intensity is increased on the side towards which the line has moved. The diagram representing the distribution of stress is a trapezium, the centre of gravity of which is on the line of action.

In a pier or buttress which supports and at the same time resists the thrust of an arch, the line representing the resultant of the weight and thrust of the arch is deflected downwards by the weight of the buttress, and the buttress may be so shaped that the deflected line is everywhere near the centre giving a uniform intensity of stress in the masonry, and uniform pressure on the ground below the foundations. On the other hand, the balance may not be so good, and the line may be towards the outer side of the buttress, giving high concentration in the masonry and ground.

Historically, the problem of the masonry arch is extremely interesting. The arch form of construction has been known for thousands of years, and several magnificent arches built by the Romans are still in a very good state. Real progress in the theory of the design and strength of the arch is comparatively recent.

In a masonry arch the line of thrust might occupy one of a variety of positions any of which would satisfy the requirements of equilibrium. For the purposes of design or estimating stability, some particular line must be chosen, and this can only be done by making assumptions, the validity

of which must have regard to the method of construction and the probable conditions of stress in the masonry. One assumption relates to the position of the line of thrust at the crown or springings. Since 1870, one of the advances made has been the introduction of definite hinges, at the crown or at the springing level, or at both places, to ensure the line of thrust passing through those points. These hinges render the problem of strength and stability much more definite, but with respect to arches without hinges the position is unchanged, although much has been done by comparing and analysing existing structures. In the monumental work by Séjourné[1], particulars are given of all arches of appreciable size throughout the world: details of construction are given, and the proportions are analysed and compared.

Up to the first half of the nineteenth century, knowledge of the strengths and characteristics of materials, and of the branch of engineering science now known as 'applied mechanics', was not sufficient to establish or disprove the accuracy of various theories relating to the design or stability of a masonry arch then in vogue or from time to time propounded; efforts to make progress in the problem depended almost as much on dialectics as on mechanical principles.

Throughout a long period in the eighteenth and nineteenth centuries, mathematicians and others applied themselves to finding the exact form of the line of thrust that would ensure equilibrium in a mass of masonry bridging a void. The upper boundary of the mass was a horizontal surface representing the road surface and the lower one the intrados of the arch, shaped to conform to the line sought.

The shape of this arch of equilibrium was compared in great detail with those of the ellipse, cycloid, parabola, catenery and semi-circle or segment of a circle. Different writers strongly advocated one or other of these curves as being the true curve for an arch. The elaboration with which this was done seems remarkable, for many must have known that to build an arch to conform to a particular curve with the exactitude suggested is practically impossible. When the centering on which an arch is built is removed and the arch supports itself, the compression of the mortar in the joints and of the voissoir stones allows the arch to drop an amount which is quite sufficient to alter the shape appreciably; thus the arches of Perronet's famous bridge at Neuilly dropped, on decentering, enough to alter the radius curvature at the crown from 150 ft. to 244 ft., and if intended to be elliptical, it might have conformed actually more closely to a cycloid.

For the longest spans, reinforced concrete has now superseded masonry; but fine masonry arches of 300-ft. span have been built. The construction of spans of increasing length has been made possible by improved technique in building. To avoid high stresses arising at the springing and key stone, as a result of the settlement or elastic deformation of the centering, as weight is added during building, and as a consequence of the initial deformation of the arch itself when the centering is removed, gaps are left in the arch, and special forms of construction are now introduced to act as temporary hinges, so that when the bridge is completed and the gaps filled in, the position of the line of thrust is fairly definitely known. In reinforced concrete arches, either permanent hinges of steel are introduced or else all the reinforcing bars are drawn together at the critical points to form a temporary hinge, and the surrounding concrete is filled in only on completion. Reinforced concrete arches with spans as great as 590 ft. have been constructed.

The stability of a masonry dam is a problem that has exercised the minds of engineers and mathematicians for many years. The failure of the Bouzey dam in France in 1895 gave prominence to the problem. The Bouzey dam was straight with a length of 1,720 ft., and the water held up had a maximum depth of about 40 ft. When the dam failed, the upper 30 or 35 ft. of its height for a length of 560 ft. was swept away, and the flood, passing down the valley, caused great havoc, and eighty-six people lost their lives.

Investigations after the disaster revealed many points of interest. In the original design, the maximum pressure on the masonry was the only factor considered in calculating its proportions. In the course of the investigations after the disaster it was shown that the resultant of the thrust combined with the weight of the masonry was so placed that a tensile stress of 1·3 tons per sq. ft. must have been imposed on the masonry. Laboratory tests proved that the maximum tensile strength of the masonry was only 60 per cent higher. In opposition to the theory that the parts that failed had overturned by virtue of this weakness, it was held by some that failure was by shearing; the shearing stress being calculated as 1·32 tons per sq. ft. by some, and as 3·2 tons per sq. ft. by others.

Rankine, in 1871, had recommended that no horizontal joint in a dam should be expected to withstand any tensile stress; in other words, there should be no uplifting tendency. After the Bouzey disaster it was considered advisable that at the upstream face there must always be a definite compressive stress, and the French Government introduced the regulation that on horizontal joints there should be a vertical compressive stress at the water face equal to not less than the water pressure at the

joint. Such compression in the masonry would tend to prevent access of water to any joint or crack.

The late Sir Benjamin Baker, in 1904–5, at the time when I was his chief assistant, was faced with the problem of raising the Assuan dam. (At present the dam is being raised a second time.) The investigations after the disaster in France had shaken confidence in the accepted method of gauging the stability of a dam, and in 1904 a memoir was published entitled "Some Disregarded Points in the Stability of Masonry Dams", by Prof. Karl Pearson and Mr. Atcherley. By mathematical investigation, the authors concluded that although a dam might satisfy the usual conditions regarding the stresses on horizontal planes, it might still be subjected to dangerous tensile stresses on vertical planes in the vicinity of the downstream toe. That conclusion seemed most unlikely to engineers interested in the subject, but however incredible it might seem, it demanded attention as coming from so eminent a mathematician. In arriving at their results, the authors of the memoir based their calculations on an assumed law governing the distribution of shearing stress across the base. The unsatisfactory state of affairs could only be cleared up by determining the distribution of sheer and other stresses.

Jointly with my friend the late William Gore, I made an attempt to do this, and we embarked on a series of elaborate experiments with india-rubber models.

Our investigations were described and discussed at the time at the Institution of Civil Engineers[2] and in *Engineering*[3], in which journal there was correspondence on the subject.

The models were made of slabs of rubber 1 in. thick with a smooth white surface, and shaped to represent the transverse section of a dam. The model was strained by weights carefully adjusted to represent the water pressure against the face and the weight of the masonry, on the assumption that the masonry had a specific gravity of 2·25. The model was divided into sections, and the 'masonry weights' were hung on transverse pins put through the rubber. Plates pulled by cords against the water face represented the water pressure. To ensure the exact relative positions of the loads, the model was so shaped that when fully strained it had the correct profile. A network of lines was ruled on the rubber, and large-sized photographs on plate-glass were taken under the strained and unstrained conditions. Corresponding lengths on the two negatives could be measured accurately, and from them the strains and stresses were calculated. The intensity of shear at various points was measured by comparing angles on the two plates. Our investigations enabled us to plot curves of stress-distribution on section lines at various heights. The curves were of quite definite shape. We found no evidence of the reputed tensile stress at the downstream toe. The shear stress diagram was practically a triangle with the maximum at the downstream edge, and the vertical stress distribution agreed substantially with the 'trapezium law'.

These experiments helped materially to clear up the situation and to re-establish confidence in the method that had been in general use for estimating the stability of masonry dams.

During the last few years, investigations of problems relating to the design of large concrete dams and curved dams have been made in the United States. The influence of heat, both natural and that generated by the setting of cement, on stresses and stability, has received much attention. In these gigantic structures, monolithic construction and the use of too large masses of concrete has been found accountable for serious cracking.

The suspension-bridge or 'philosopher's bridge', as it has been called, is a fascinating type of structure. In the course of the development of its design and stability there have been some astonishing occurrences. In its most elementary form, the suspension-bridge formed of strong flexible climbing stems or roots has been used by primitive peoples for centuries. Examples made of wrought iron appear to have been in existence in the eighteenth century. At the beginning of the nineteenth century the chains, which were made up with several links side by side, connected with common hinge pins, were of uniform strength throughout their length, and the road or platform was suspended by vertical rods. Within its limitations, this was a satisfactory form of construction. In a bridge which carries a series of loads on a flexible chain, the loads and the chains are only in equilibrium when the chain assumes an appropriate shape, and to support any additional weight or rearrangement of weights the chain changes its shape slightly. With a moving load, the tendency of the platform of a suspension-bridge to undulate with the passage of the load has handicapped the development of this type of bridge. An early attempt to use it for a railway proved a complete failure.

Telford's famous bridge across the Menai Straits, with a span of 570 ft., completed in 1826, is of the simple suspension type. At first the platform was too flexible and caused anxiety, but that part was altered and made stiffer. The bridge is still in service, and is standing proof that in principle and construction it was sound. A few years later, a supposed improvement, the 'taper chain' bridge, was introduced with the object of reducing the amount of iron required. The principle was unsound, and failures led to the suspension type of

bridge being regarded with suspicion for many years.

Several suspension-bridges, built before 1836, are still in use. In all these the chains are of uniform strength throughout, and the whole weight of the bridge is suspended from them.

The flexibility of these bridges under heavy moving loads is a source of trouble, and of wear and tear of the platforms. Nevertheless, when the chains are pulled by the loads into a line of equilibrium, so long as the anchorages are secure and the towers are sound, the stability depends solely on the tensile strength of the chain, and under these conditions almost all suspension-bridges have a substantial margin of strength or stability.

One of the early suspension-bridges still in use is that across the Thames at Marlow, built by W. Tierney Clark, in 1829. I examined and reported on this bridge some years ago and found it in a remarkably good state. In the development of the stability of suspension-bridges this one is of particular interest, for it was the first built with stiffening girders. The ends of the cross girders in this bridge are all stiffly connected by parapets made in the form of girders, and any cross girders on which a heavy load might rest cannot deflect the suspension chain, as it would do if the parapet girders were not there.

In the modern suspension-bridge the stiffening girder is as important a feature as the chain or cable, and its introduction has made it possible to construct the gigantic bridges in the United States. The interaction of the stiffness or flexibility of the girder with the curvature of the suspension cable is the governing factor in the stability of the modern suspension-bridge.

The latest example of suspension-bridge with its span of 3,400 ft. and others of more than 1,500 ft. compare with Telford's of 570 ft. and the others of 50–200 ft. Cables composed of thousands of steel wires, four times as strong as iron, laid side by side to form cables 3 ft. in diameter, take the place of the iron chains ; and the flexible timber platform, so easily deformed by moderate moving loads, is now replaced by deep steel stiffening girders with upper and lower decks providing double tracks for both electric railways and street trams and road width for many cars.

[1] Paul Séjourné, "Grandes Voutes", 1913–1916.
[2] *Minutes of Proceedings Inst. C.E.*, **172**; 1907–8.
[3] *Engineering*, 1905, 1907. Also NATURE, Jan. 30, 1908.

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# International Physiological Congress

## MEETING IN THE U.S.S.R.

THE fifteenth International Physiological Congress met, under the presidential direction of Prof. I. P. Pavlov, in Leningrad and Moscow on August 8–18. The gathering proved of unusual interest, especially from the social point of view. The members, numbering more than eight hundred foreigners and about five hundred Russians, were given an opportunity to see something of the mechanism of the communistic regime. The several receptions and banquets in the old royal palaces gave the members a glimpse of the almost oriental splendour which surrounded the ruling class under the Czars.

The Russian National Committee and the Soviet Government treated the Congress with unique hospitality. From the initial, informal reception in the magnificent Marble Hall of the Ethnographical Museum in Leningrad, to the final banquet in the Grand Palace of the Kremlin, and the aviation display on the outskirts of Moscow, the entertainments arranged for the Congress were consistently lavish.

The three plenary sessions, at which five scientific papers were read by well-known physiologists, were the outstanding occasions of the Congress. The first plenary session was opened by Prof. Pavlov, who gave the Congress a stirring welcome. The paper delivered at this time by Prof. Walter B. Cannon (Boston) was entitled "Some Implications of the Evidence for Chemical Transmission of Nerve Impulses". It constituted an outline of present knowledge in the field of neurohumours. Both the sympathetic nervous system and its chemical representative, adrenalin, act in a widespread manner. Acetylcholine is the chemical representative of the parasympathetic nervous system. Unlike adrenalin, acetylcholine is very unstable. Thus its action is limited to the region in which it is produced. The action of the parasympathetic nervous system is similarly localised.

The evidence for the existence of two adrenalin-like or adrenergic neurohumours was cited. These were named sympathin E (excitatory) and sympathin I (inhibitory). Langley suggested this concept in 1905. He further believed that the differentiation probably takes place in the effector cells, and this is to-day unrefuted but unproved. Possibly the sympathetic mediator, acetylcholine, has excitatory and inhibitory forms. At present,

however, this substance has never been obtained in a specific form. The action is always either excitatory or inhibitory, depending on the function of the parasympathetic nervous system in the organ involved.

The evidence for the chemical mediation of autonomic nerve impulses at the periphery is convincing in the cases of non-striated and cardiac muscle, digestive and sweat glands. There is certainly suggestive evidence for a chemical mediator, acetylcholine, of motor nerve impulses to striated muscle. The recent work on non-striated and cardiac muscle, showing spatial and temporal summation of nerve impulses, gives strong support for the theory of the quantal production of chemical mediator by each nerve impulse.

The evidence for chemical mediation between neurones is quite convincing in the case of sympathetic ganglia. Synaptic transmission in the central nervous system may be by neurohumours although the evidence for this is meagre as yet. Prof. Cannon ended by commenting on the fact that progress in this field is so rapid that his treatment of the subject was probably not strictly up-to-date.

The secondary plenary session opened with a paper by Prof. L. A. Orbeli (Leningrad) on "Pain and its Physiological Effects". A detailed account of the work of the British neurologist, Henry Head, on the problems of pain was given. Much of Head's work, performed in 1905, has been repeated and verified quite recently in the Soviet laboratories. Orbeli believes that he has shown that sympathetic nerve distribution is regional. Thus one nerve cell branches to give fibres to skin, muscles and internal organs of a given cross-section of the body. He believes that 'referred pain' operates through this sympathetic mechanism.

When a visceral organ is diseased, sympathetic impulses are set up which, travelling to the skin, alter the degree of excitability of the sensory endings there, giving hyperæsthesia or pain.

Sir Joseph Barcroft (Cambridge) presented, also at the second plenary session, a paper on "The Velocities of some Physiological Processes". Dealing chiefly with respiratory mechanisms, he pointed out the necessity of comparing the velocities of the chemical and the physical processes involved. In the ordinary loading and unloading of oxygen the chemical events take place so much more rapidly than the physical that only the rates of the latter need be considered. However, the chemical velocities assume special importance in some cases. Hæmoglobin takes several hundred times as long to part with carbon monoxide as with oxygen. This fact is of prime importance in the study of carbon monoxide poisoning.

Chemical velocities in respiration become specially important in muscles which act rhythmically over long periods of time. In these places oxygen transport from capillaries to tissue cells is accomplished by muscle hæmoglobin (myoglobin), and in some species by cytochrome. Myoglobin is six times as fast as hæmoglobin in its reactions with oxygen. Cytochrome is even faster. This velocity assumes real importance in certain cases, as in the hearts of small mammals and birds, where the heart rate may approach one thousand beats a minute.

The velocities of intracellular oxidations and the catalysts involved were discussed at some length. One molecule of oxygenase, probably the chief intracellular oxidative enzyme, can deal with one hundred thousand molecules of oxygen per second at 10° C. If the molecules are dealt with one after another, the interval between molecules will not be more than ten millionths of a second. Assuming an adequate concentration of the enzyme, this velocity would not constitute a limiting factor for even the fastest physiological process.

The velocity of the chemical process involved in the dissipation of carbon dioxide in the lungs is very slow. Between the breaking up of sodium bicarbonate in the body and the evolution of carbon dioxide there is the slow formation of carbon dioxide and water from unionised carbonic acid. Recently it has been shown that the latter process is speeded up by an enzyme, carbonic anhydrase, which is found in the red blood corpuscles. The bicarbonate obtains access to the enzyme through exchange with the chloride ions inside the corpuscles.

Sir Joseph Barcroft ended by pointing out an interesting discovery resulting from the study of chemical velocities. Consideration of the rate of evolution of carbon dioxide has led the Cambridge group of workers to the conclusion that 2–10 per cent of the carbon dioxide in the blood is present, not as bicarbonate, but in the more active carbamino form.

Prof. L. Lapicque (Paris) delivered the first paper of the third plenary session, held in Moscow, on "Some Recent Advances in the Knowledge of the Nervous Mechanism". The well-known concepts of chronaxie, isochronism and heterochronism were treated. New experimental material was brought forward in support of the speaker's disputed views on these subjects. Lapicque and his colleagues have found that muscles which work together have the same chronaxie; antagonistic groups have different chronaxies. He also finds changes in the chronaxie of peripheral nerves following central nervous activity. Indeed, when a conditioned reflex is elicited it is claimed that the peripheral portions of the pathway undergo a change in chronaxie due to the central activity.

The final paper of the third plenary session was given by Prof. A. A. Ukhtomsky (Leningrad) on "Physiological Lability and the Act of Inhibition". An account was given of the research work conducted in the Russian laboratories in an attempt to show the relation between chronaxie and what they term "functional lability". This "functional lability" is defined as the factor limiting the conduction of impulses in any excitable tissue. It determines whether a tissue is excited or inhibited by a stimulating agent. Both processes, they intimate, are active, and both must be initiated by stimulation.

The general meetings were divided into thirty sections according to subject, five sections usually operating at one time. At these meetings, 485 papers were presented. In the appended table the papers are grouped under twelve subject headings. This table gives some indication of the interests of physiologists in the countries represented at the Congress. The body of material presented was so large and varied, and the time so short, that many members found it difficult to glean much of value from these meetings. An attempt will probably be made, at the next Congress, to rectify this weakness in the programme arrangements.

CLASSIFICATION OF PAPERS PRESENTED TO "THE 15TH INTERNATIONAL PHYSIOLOGICAL CONGRESS"

| Subject | Number of Papers Presented From U.S.S.R. | From other Countries |
|---|---|---|
| Applied Physiology (industrial) | 8 | 4 |
| Biochemistry | 20 | 69 |
| Circulation and Heart | 4 | 19 |
| Excretion | 2 | 9 |
| General and Cellular Physiology | 24 | 51 |
| Internal Secretion | 8 | 25 |
| Metabolism, Nutrition and Vitamins | 4 | 28 |
| Nervous System and Nerve-Muscle Physiology | 65 | 59 |
| Pharmacology | 15 | 19 |
| Physical Factors in Biology | 5 | 8 |
| Sense Organs | 11 | 13 |
| Sexual Cycle | 4 | 11 |
| Totals | 170 | 315 |
| Total Number of Papers | 485 | |

The U.S.S.R. research centres provided a notable group of permanent demonstrations. In part, these served to show the type of experimental work in progress. The Soviet physiologists are chiefly occupied in researches on the nervous system with special reference to conditioned reflexes, researches in the industrial aspects of work, and researches into the special physiology of the woman and the child. The table summarising the types of papers presented at the general meetings gives further indication of the trend of physiological investigation in the U.S.S.R.

To a large extent, the aim of the permanent demonstrations was to show the expansion of scientific laboratories and personnel under the Soviet regime. This aspect was further stressed when the delegates were taken to visit the various laboratories. The expansion has been amazing. In the days before the revolution there were 24 institutions carrying on physiological research. To-day there are said to be 380 such institutions. The increase in personnel has been correspondingly great. Scientific people cannot but applaud the attitude of a State which so generously supports scientific endeavour. One wonders, however, if such expansion can be altogether sound. The All-Union Institute of Experimental Medicine (VIEM) had a staff of 393 in 1931 which has been increased to 2,200 for 1935 ; the increase in monetary grant has been commensurate. Expansion of this nature is to be found on all sides in the biological and medical sciences. It is a rate of expansion which would hopelessly overtax the highly developed educational facilities of either Great Britain or the United States of America. Just how well the less extensive Soviet educational system equips its scientific workers is a matter for conjecture. It is certain that the body of Soviet scientists know too little about what is going on outside the U.S.S.R. Practically none of them has studied abroad. Foreign scientific journals are scarce. Although the U.S.A. and the U.S.S.R. are comparable countries from the point of view of numbers of workers in biochemistry and physiology, the *Biochemical Journal* has 346 subscribers in the U.S.A. and only 46 in the U.S.S.R., the *Journal of Physiology* has 211 subscribers in the U.S.A. and only 26 in the U.S.S.R. The scarcity of periodicals in foreign languages other than English is apparently even more serious.

There is certainly no lack of interest in the work and opinions of foreign scientists. A well-known English monograph on a physiological subject was recently translated into Russian and printed by the Soviet authorities. Three thousand copies were sold in about a month, a remarkable sale for a scientific monograph in any language. The young Soviet scientist is enthusiastic and eager for knowledge. It is to be hoped that the international attitude shown by the Soviet Government in its treatment of, and its speeches to, the Congress will be extended to the training of its own scientists.

One of the most important features of the Congress was the report of the Permanent International Committee, delivered to the third plenary session in Moscow by its secretary, Prof. A. V. Hill. The Committee regretted the retirement of W. H. Howell (Baltimore) and J. E. Johansson (Stockholm). W. B. Cannon (Boston) and G. Liljestrand (Stockholm) were elected in their places. The other members are F. Bottazzi (Naples), O. Frank (Munich), A. V. Hill (London), L. Lapicque (Paris) and I. P. Pavlov (Leningrad).

The 1938 Congress was invited, by Prof. Hess and the Society of Swiss Physiologists, to meet in Zurich. This invitation, on the recommendation

of the Committee, was accepted by the Congress. Since 1938 is the Jubilee of the suggestion of the Physiological Society that an International Congress should be founded, and since the first Congress was held in Switzerland in 1889, the choice of Zurich is particularly suitable. The Committee, however, was sympathetic to the wish of the Hungarian Physiological Society that the Congress should meet some time in Hungary, possibly in 1941.

The International Committee suggested to the Swiss National Committee that applications for membership in the Congress be not accepted, except in special circumstances, from individuals, but only through national physiological organisations. It further advised the National Committee that, for the sake of economy, the programme, particularly in respect of entertainments, should be simplified.

The International Committee had the support of the Congress in recommending certain changes in programme arrangements. It advised that any registered member be entitled to submit a communication for printing, and that such communications should be circulated to all members some time before the Congress. Any member desiring to discuss any communication should then inform the officers of the Congress. The papers thus chosen for their general interest should be grouped, so that each meeting may form a co-ordinated discussion on a certain subject. There should be no actual presentation of individual papers.

At this third plenary session, the closing scientific meeting of the Congress, the International Committee expressed itself as deeply grateful to their Soviet colleagues for the welcome they had extended to the Congress. Prof. G. Barger (Edinburgh), speaking in eight languages, on behalf of members of the Congress, admirably expressed the general appreciation. D. Y. SOLANDT.

# The Species Problem

KING CHARLES'S head was a less recrudescent topic than the species problem, which was recently the theme of the presidential address to the Zoological Section of the British Association, and the text of a symposium occupying most of a morning session. The reason for the perennial airing of the problem is not far to seek; for it is fundamental to all biological science. Taxonomy, begun in the good old days when species *were* species, has to adapt itself to the sliding scale of evolution; and phylogeny and genetics have to attempt to account for the phenomena that once made the Linnean system appear reasonable. Zoology has been driven by the concept of evolution into its proper role of a science that transcends mere description; while palæontology has developed beyond its erstwhile function as a handmaid of geology into an essential part of biological science.

In this inquiry, zoology, labouring under the disadvantage of its ephemeral scope, is concerned mainly with the causes of variation; while palæontology records the effects, as best it may, from fragmentary evidence in which causative processes are matters of inference or speculation. The two sciences have a common aim, but widely contrasted outlook and methods. In the past, they have too often followed their own devices, the zoologist looking askance at the imperfection of fossil evidence and the palæontologist deriding phylogenetic speculations hopelessly at variance with his small, but definite, knowledge.

The problem is summarised in the question: What is a species? All biologists are agreed that a species is an abstract conception; for in real life there is no fixity. If a species is to be adequately defined, the definition must include an account of its birth and breeding as well as of its present state. Hence the answer to the question can be found only in the solution of the wider mystery of the 'origin of species'.

Variability is an essential attribute of organisms, and sexual reproduction merely develops permutations and combinations of differences already present in the parents. If this be granted, the problem is reduced (but scarcely simplified) into that of the causes of variation. Here evidently is a question for the geneticist; although it is doubtful if his experiments, carried out under some measure of artificial control, can give a true picture of natural causes. Zoologists and palæontologists can record the cumulative effects of untrammelled variation, and the truth can perhaps be approached most nearly by deduction from their observations.

Variation may be traced in space and time. The occurrence of local races in geographically separate areas is analogous with the succession of changes which give to fossils their value as zonal indices. But whereas the area of any one type of environment is necessarily much less than the already limited area of the surface of the globe, the time during which such an environment may persist, in one part of the world or another,

is almost inconceivably great. It is possible to argue that a species whose variability can produce nothing more than local races during the period of its dispersion will, in the course of geological time, give rise to differences of specific or even greater significance. Such an argument, while bringing us no nearer to the root of the problem, serves to emphasise the importance of the time-element.

Many, but not all, of the differences shown by local races can be correlated with the conditions of their habitat, so that the direct influence of environment on the trend of variation becomes conceivable. Almost the same generalisation can be applied to palæontological 'lineages', with the same reservation. In both cases, any influence due to environment must be slight, and within the capacity of the organism; the alternative is extinction.

In this connexion, it is salutary to remember that almost every conceivable kind of environment exists somewhere on the globe; and, for many types of organisms, is not wholly inaccessible. When viewed in geological perspective, this condition is just as true, and its implications seem clear. An episode in the history of the sea-urchins may be cited in illustration.

So far as can be determined, the earliest sea-urchins lived quietly on the silt of sheltered lagoons; throughout the Palæozoic era they remained for the most part content with this kind of environment. But near the beginning of Mesozoic time a strange 'wanderlust' seems to have overcome some of these sea-urchins, evoking rock-dwelling types of which *Echinus* is a familiar representative. There must have been wave-swept rocks around Palæozoic seas; and there are plenty of areas of sheltered water to-day. *Cidaris* (by conservatism) and the heart-urchins (by reversion) still frequent the traditional quiet places; but *Echinus* and its relatives prefer the buffeting of the surge. The adaptation of each type to its habitat is almost teleologically perfect. But which came first, the habitat or the structures to fit it? Herein lies the dilemma. We must envisage either a gradual migration of successive generations of selected Triassic sea-urchins, travelling further into rough water as their variations permitted; or an almost infinitely slow invasion of some lagoons by the breakers. Both explanations seem to the last degree improbable.

An impasse of this kind can only mean that an essential factor has been left out of the calculation. In his laudable endeavour to avoid crediting lower types of organisms with attributes that belong to himself, the biologist has perhaps gone too far, and has treated his subjects as if they were as passive as inorganic matter.

To be alive is to be in active revolt against the cruder physical laws. Without the instinctive urge that is expressed among mankind in pioneering exploits, all protoplasm might still be content to remain amœboid.

This contention does not in any way solve the mystery of variation; but it widens the scope of the inquiry. For living beings, the attributes of variability and 'choice' must be stronger influences than the impact of inanimate environment. Every organism must triumph over its environment, find a new one, or perish in the attempt.

HERBERT L. HAWKINS.

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# Obituary

## Mr. E. Thurston, C.I.E.

WE regret to record the death of Mr. Edgar Thurston, formerly superintendent of the Government Museum, Madras, which took place at Penzance on October 5 at the age of eighty years.

Edgar Thurston, the second son of Charles Bosworth Thurston, was born at Kew and educated at Eton and the medical school of King's College, London, qualifying as L.R.C.P. in 1877. He was appointed superintendent of the Government Museum, Madras, in 1885, retaining that position until his retirement just under twenty-five years later, when he was made C.I.E. He had already received the award of the Kaisar-i-Hind gold medal in 1902. After his retirement he returned to England, and continued to devote himself to research. He was much interested in the study of the Cornish flora, publishing "British and Foreign Trees and Shrubs in Cornwall" in 1930.

As superintendent of the Madras Museum, Thurston took an active interest in all the branches of scientific study in the Presidency which came within the purview of his duties; but as was shown by his numerous contributions to the official publication of the Museum, his main preoccupation lay with anthropology. Here he took the broadest view of the functions of the museum man, and by no means confined his attention to material culture and its contributory research. He acquired a knowledge of the mentality of the varied peoples of the Presidency and a keen appreciation of their differences, which at times was little short of surprising. The results of his earlier studies were embodied in "Ethnographic Studies in Southern India"; but his

wide and detailed knowledge of social institutions, customs and beliefs, enriched by the information collected in an ethnographical survey, which he conducted in 1902–9, appeared to advantage in his "Castes and Tribes of Southern India" (1909), in which he added to his own observations a digest of a vast amount of other material. No less remarkable in the character of its observations and its originality was "Omens and Superstitions of Southern India", a book which has proved of the greatest interest and value to students of folklore and religion.

Thurston was ever generous in placing his material at the disposal of others. Not only were his researches of the greatest utility to Sir Herbert Risley in his ethnographic survey work in India, but also it was largely owing to Thurston's assistance, which extended from the organisation of transport to counsel and information in matters of ethnographic detail, that the late Dr. W. H. R. Rivers owed, as he himself acknowledged, the remarkable achievement of his anthropological investigations among the Todas of the Nilgiri Hills. Thurston's retirement was a loss to anthropological studies in the Madras Presidency, of which the effect is still apparent. No one has quite taken his place.

WE regret to announce the following deaths:

Prof. G. Buchböck, professor of chemistry in the University of Budapest, aged sixty-six years.

Dr. H. W. Dudley, O.B.E., F.R.S., of the National Institute for Medical Research, known for his work in biochemistry, on October 3, aged forty-seven years.

Prof. Rhoda Erdmann, director of the Institute for Experimental Cytology in the University of Berlin, and editor of the *Archiv für Experimentelle Zellforschung*, on August 23, aged sixty-four years.

Mr. G. H. Hamilton, official astronomer in the Jamaica branch of the Harvard Observatory in 1922–24, and since 1924 astronomer of the Hamilton Observatory, Mandeville, Jamaica, on August 6, aged fifty-one years.

Mr. W. K. Laurie-Dickson, who was associated with Mr. Edison in studies of the Edison effect, and for many years superintendent of the Edison Electrical Works, on September 28, aged seventy-five years.

Major R. F. Stirling, director of veterinary services, Central Provinces, India, known for his work on animal diseases, especially rinderpest, on August 16, aged forty-eight years.

# News and Views

### Safeguarding of Peace

"COLLECTIVE Security" is a problem which to-day is thrust upon the notice of every newspaper reader. Few of them are aware that to the scientific investigation of this same problem in international relations two whole years have just been devoted by a score of national groups and institutions affiliated to the Permanent International Studies Conference. At the London session of the Conference, held last June, the investigations culminated in a discussion directed more particularly to four essential aspects of the subject: the notion of collective security, the prevention of war, determination of the aggressor and sanctions, and the question of neutrality. The major portion of the deliberations was devoted to the principle of the organisation of pacific systems destined to eliminate the causes of war to the fullest possible extent. In connexion with the repression of war, the discussion turned on regional agreements and the relative value of various forms of sanctions, notably economic and military. There followed an examination of the notion of neutrality and the different forms it may assume when the collective machinery set up for the safeguarding of peace has to be put into operation. The subject chosen for the next Study Conference to be held in 1937 is 'Peaceful Change', with special reference to questions of (*a*) population, migration and colonisation, and (*b*) markets and the distribution of raw materials. The proceedings of the London session are summarised in Appendix 6 to the Report of the International Committee on Intellectual Co-operation (League of Nations Publications, 1935, **12**, *A*2. Allen and Unwin, 2*s*. 6*d*). The same report outlines definite proposals submitted by M. Jean Gérard, secretary-general of the International Union of Pure and Applied Chemistry, for establishing closer collaboration between the International Committee on Intellectual Co-operation and the International Council of Scientific Unions. The proposals are to be laid before a special committee of this Council, appointed to deal with the subject.

### New Commission of the R.R.S. *Discovery II*

THE Royal Research Ship *Discovery II* left London on October 3 on her fourth Antarctic commission. The voyage is expected to last for some twenty months, and, as on former occasions, the work is primarily concerned with observations on the distribution and environment of the whales which form the basis of the southern whaling industry. According to the programme which has been arranged, the ship, after calling at Cape Town, will circumnavigate the Antarctic continent, returning to South Africa in June 1936. The distribution of whales near the ice edge will be examined in each sector of the Antarctic, and series of stations with full observations on the hydrology and plankton will be taken on lines extending from the pack ice to the warmer waters north of the Antarctic convergence. This circumnavigation is being made in the summer months, and will be complementary to that undertaken in the winter of 1932. The work is controlled by the *Discovery* Committee

acting under the instructions of the Secretary of State for the Colonies. The present voyage is under the leadership of Mr. G. E. R. Deacon, with Lieut. L. C. Hill, R.N.R., in executive command. The other members of the scientific staff are Mr. J. W. S. Marr and Dr. F. D. Ommanney, with Mr. A. Saunders as laboratory assistant and photographer.

### Racial Studies

A NEW publication devoted to racial studies may count with certainty on an interested audience at the present moment, when racial questions have come to have an outstanding importance in international and national affairs. Racial characters have ceased to be regarded as of purely academic interest; but since they have been made the pivotal factor in nationalist propaganda, the public, bewildered by conflicting statements as to the meaning and province of 'race' in the modern world, welcomes an impartial and scientific examination of both general and specific problems. The *Zeitschrift für Rassenkund und ihre Nachbargebiete*, which has completed its first volume by the issue of a third part in May last, has been founded for the purpose of examining problems of race on scientific lines, dealing not only with broader issues, but also investigating racial problems as they arise in defined areas and specific groups. The treatment of the subject is not confined to discussion of physical characters alone, but will take into account the evidence of psychology and social anthropology, prehistory and linguistics. It is proposed thus to cover the whole field of the racial problems which arise in the study of the development of man in time and space. The editor is Egon, Freiherr von Eickstedt, director of the Anthropological and Ethnological Institute of Breslau; and he has secured a promise of co-operation and collaboration from a large and representative body of anthropologists from all over the world. Two volumes of three parts each will be published annually at a subscription price of 22 gold marks for each volume. The first part of the second volume appeared in July.

### Food of Peking Man

AN interesting light is thrown on the mode of life of Peking man in a communication by Dr. Ralph W. Chaney, of the Department of Palæontology, University of California, and research associate of the Carnegie Institution of Washington, D.C., which is issued in the *News Service Bulletin* of the Institution. It would appear that Peking man supplemented the meat diet provided by the game animals of the hills and plains by vegetable food, which he obtained as a 'food-gatherer'. About twenty feet above the lowest level of human occupation in the Chou-kou-tien cave and in a breccia containing numerous quartz artefacts and bone fragments, there is a layer several inches thick, made up of thousands of fragments of the shells of seeds. The markings on the shells indicate that they are hackberry seeds, globular bodies smaller than peas. The modern hackberry (*Celtis*) occurs as a small tree in the forests both of North America and Asia, but is most characteristic as a shrub on semi-arid slopes and stream borders. As it is improbable that they could have been introduced into the cave by any other agency than animals or man, it may safely be assumed that they formed part of the food of one or the other, their shells having been crushed while being eaten. In the United States the berries are extensively used as food by birds, rodents and the Indians, especially in the south-west. The most common use is as a flavouring for meat or bread. In order to eliminate the possibility of these seeds having been introduced into the cave by rodents, experimental observations have been made in which it was found that monkeys alone broke up the shells in a manner corresponding to that in which the shells in the cave had been broken. It is, therefore, more than probable that the seeds were brought to the cave by human agency and that the hackberry seeds afford the earliest known example of a vegetable food used by primitive man.

### New Flying Boats for British Empire Air Lines

IT is announced that Imperial Airways have placed an order with Messrs. Short Bros., Ltd., of Rochester, for a fleet of flying boats specified to be both larger and faster than any of a similar class now in existence. The order provides several innovations, the most startling of which is that the type of engine will not be decided until absolutely necessary for the completion of the design. It will thus be possible to take advantage of accumulating experience in the use of several different types, some of which are as yet not very thoroughly tried out under such conditions. It is also understood that the number of machines to be ordered is not yet settled, but will depend upon their suitability for the varying conditions in the different Empire routes. The new boats are to be high-wing monoplanes, without external bracing, and carrying wing tip floats. These will be the first marine aircraft in Imperial Airways fleet to depart from the more usual biplane construction. The size of the hull is such that the forepart can be given two decks, the upper one for the crew, ship's offices, and cargo, and the lower one for passengers. Their total loaded weight will be 17½ tons, about 30 per cent increase upon the present largest boat in Imperial Airways service, of which 3½–5 tons is available for paying load, depending upon the length of the flight between refuellings. The estimated speed is nearly 200 miles per hour, with a range of up to 1,500 miles. This allows them to undertake the two longest stages on the all-Empire route (except the Atlantic), that is, between England and Gibraltar, and Australia and New Zealand.

### History of Medicine Congress at Madrid

AT the International Congress of the History of Medicine, held at Madrid on September 23–29, under the patronage of the President of the Spanish Republic, there was an exhibition of medical manuscripts, documents, instruments, etc. The Wellcome Historical Medical Museum contributed some interesting

illustrations and objects to this exhibition. Among these were illustrations of Arabian surgical instruments from early fourteenth century manuscripts ; examples of the medical and other works of Maimonides, the Hispano-Jewish philosopher and physician of the twelfth century ; replicas of the earliest MSS. of the life of Andres Laguna, physician to Charles V and Pope Julian III ; Roman, medieval, Hindu and modern surgical instruments ; historical objects such as Egyptian artificial eyes, anatomical models, and a special section devoted to the evolution of spectacles. Part of the Museum's exhibit comprised interesting dioramas including Nicholas Monardes of Seville (1512–88) depicted working in his private museum of curiosities ; a historic incident connected with the discovery of cinchona bark as a remedy for malaria (1630) ; a thirteenth century apothecary's shop in Cordova (Fig. 1) ; and an interior view of the hospital of Santa Cruz at Toledo as it appeared in the sixteenth century.

FIG. 1. Diorama of a Hispano-Moresque apothecary's shop.
Copyright: The Wellcome Historical Medical Museum (The Wellcome Foundation, Ltd.).

### Scientific Control of Road Traffic

ON September 10, at the British Association meeting in Norwich, Mr. A. T. V. Robinson opened a joint discussion in Sections G (Engineering) and J (Psychology) on the control of road traffic. He said that the question is far wider than merely the prevention of accidents ; that it is how to move with a minimum of delay, discomfort and damage a system consisting of heterogeneous units of passengers and goods travelling for industry and pleasure in all directions. Of the year's total of 7,000 fatal accidents, about 2 per cent were due to the defects of the vehicle, somewhat less than 2 per cent to defects of the road, and the remaining 96 per cent were due to the personal equation. Engineers study either the roads or the vehicles, and the psychologist studies the drivers and pedestrians. Mr. Robinson emphasised the importance of the colourisation of the 'carpeting' of the road, and said we ought to endeavour to get road carpeting of a lighter hue. In the future it is possible that on all the busy roads lights on the vehicles may be unnecessary and the approaching driver will see the oncoming vehicle, not as a couple of spots of dazzling light on a black background, but as a dark silhouette against an adequately illuminated road. The improvements in vehicles, especially the introduction of four-wheeled brakes, has greatly facilitated free movement of traffic on the streets, and the compulsory test for every new driver has worked admirably, about 12 per cent being rejected. It is recognised that certain drivers are 'accident prone', and these must be eliminated as soon as possible. Science may help us to keep the demonstrably unfit off the road, but until science, and not a human driver, assumes control of the vehicle, occasional breakdowns in traffic control are bound to occur.

### Fewer Accidents in Well-Lighted Streets

ACCORDING to the *Electrician* of September 20 the first accident statistics for the section of the highway between Versailles and Ville d'Avray have been published. This road has recently been lighted with sodium vapour lamps (discharge tube lamps), and the statistics show a reduction of 74 per cent in the number of accidents, none of which was of a serious nature. Local authorities should consider these figures, which prove that lives can be saved by the proper lighting of rural roads.

### Closing Down of Private Electric Generating Stations

SEVERAL of the large factories in Great Britain have been considering whether it is an economical proposition to close down their generating stations and take their electric supply from the Grid. As the facilities offered by the public supply increase and the price diminishes, the advantages in its favour are rapidly increasing. Messrs. Lever Bros., of Port Sunlight, who were well known to have one of the largest and most efficient private plants in the country, have now entered into an arrangement whereby their power station becomes associated with the Grid, and will, under the direction of the Central Board, be operated by the Birkenhead Station. The load taken will be 40 million units a year, which is equivalent to the needs of a large town. The consumption of Birkenhead itself is 41 million units and the consumption of towns such as Oxford, Peterborough and Plymouth are less than 40 million units. Port Sunlight, the centre of the great soap and similar products manufacturing business, has an area of about 2,000 acres, and several other firms have established factories on the estate. The demand is likely to increase in the future. Among other large firms which have recently changed over from a private to

a public supply are the steelworks of Stewarts and Lloyds at Corby, those of Firth Brown at Sheffield and the thread mills of J. and P. Coats at Paisley.

### High-Definition Television Transmission

IN connexion with the high-definition television transmissions which will be radiated from the Alexandra Palace, the British Broadcasting Corporation has requested Baird Television, Ltd., and Marconi-E.M.I. Television Co., Ltd., to send to manufacturers a complete specification of the wave-form which they will radiate in their television transmissions from the palace. We have received from each of the companies their specifications, which are highly technical and will be mainly of interest to manufacturers. The ratio of the horizontal to the vertical breadth of the pictures is four to three for the Baird transmissions and five to four for the E.M.I. transmissions. The latter system transmits 25 complete pictures per second each of 405 total lines. These lines are 'interlaced' so that the frame and flicker frequency is 50 per second. It is claimed that good pictures can be received, although only a fraction of the radiated band is used ; but the greater the width of the transmitted band utilised the better the received picture.

### High Pressure Turbine Practice

IMPORTANT developments are taking place in the large power stations of electric supply companies. In the *Electrical Times* of September 19 there is an interesting account of the Loëffler boilers, which will supply steam turbines at the enormous pressure of 2,000 pounds per square inch. The exhaust steam from the high-pressure turbine is at a pressure of about 195 pounds per sq. in. and is reheated by steam from the boilers before passing into the low-pressure turbine. The North Metropolitan Supply Co. has two stations at Brimsdown called *A* and *B*. In the old station *A* the conditions were unfavourable to economical generation as the turbine pressure was only 150 lb. per sq. in. Owing to the favourable economic possibilities offered by the Loëffler boiler the station is being altered ; two boilers each having a capacity of 210,000 lb. per hour, each operating at a pressure of 2,000 lb. per sq. in. and at a total temperature of 940° F., have been ordered from the Mitchell Engineering Co., Ltd., which has acquired the British rights from the well-known firm of Vitcovice. If petrol drops on the steam pipes at these high temperatures it bursts into flame. About twenty of these boilers are used abroad in Czechoslovakia, Germany and Russia. To get the best results it was necessary to have a set of 50,000 kilowatts. As a machine of this size could not be fitted into Brimsdown *A* it was divided into two. The high-pressure part has a power of 20,000 kw. and the low-pressure part has a power of 30,000 kw. It is claimed that certain advantages will accrue from running the machines in series.

### The Lower Yield Point of Stress

THE report of the British Association (Section G), Committee on Stresses in Overstrained Materials, presented at Norwich, states that particular consideration has been given to the requirements of the engineering profession and industry in view of present and future developments. By the increasing use of electric and other methods of welding in structural work, the problem of plastic overstrain has reached such high importance as to become one of the determining factors in design, and the Committee puts forward the considered view that the so-called 'lower yield point' affords the most satisfactory and reliable basis for the comparison of structural steels. The several advantages attached to its adoption are set forth seriatim, and a draft specification is submitted. The Committee, of which the chairman is Sir Henry Fowler, expresses the opinion that the lower yield point should be included in the British Standard Specifications, and recommends that the desirability of its addition be brought to the notice of the British Standards Institution.

### Publication of Scientific Literature

THE projects for scientific publication and bibliography (cf. NATURE, **133**, 641 ; 1934) have been implemented by a grant of 15,000 dollars from Chemical Foundation. As a result, a new Documentation Division of Science Service has been initiated in furtherance of activities in this field which were considered at a conference called by Science Service on July 11 and July 29. The immediate objectives being attempted under the grant are the development of camera, projection pointer, reading machine for microphotographs and other means for photographic reproduction, and the establishment of a project for the photographic publication of papers which at present cannot be published promptly or in full. This undertaking will be carried out with the co-operation of existing scientific journals and societies. The plans of the new division are outlined in a paper read by Mr. Watson Davis, director of Science Service, before the thirteenth Conference of the Institut International de Documentation at Copenhagen, September 9–14. It is considered that the scheme for the publication of scientific papers by microphotographic or similar methods should be self-supporting from the start. Possibilities of increasing the availability of existing literature by such methods are to be explored and the broad problem of scientific bibliography is also to be studied.

### San Diego Natural History

SEVERAL papers recording new work have been published recently in the *Transactions of the San Diego Society of Natural History*. Vol. 8 (Nos. 6, 7, 8, 9), March 1935, contains a paper on new marine mollusca of West Mexico by Herbert N. Lowe, a description of a new trilobite from Northern California by Harry E. Wheeler, a revision of some Californian *Astrodapsis* by George L. Richards and some new species of molluscs of the genus *Triphora* by Fred Baker and V. D. P. Spicer. Both the mollusc papers deal with the shells alone, but there is in the first a good annotated list of shells collected at Punta Penasco, Sonora, Mexico. The trilobites include a very well preserved specimen

of a new *Griffithides* from the Permian Nosoni formation, its nearest known relative being *G. acanthiceps* from the Carboniferous limestone of England. A second paper by the same author discusses and redescribes the original type specimen of Vogdes' *Phillipsia* (*Griffithides*) *ornatus* from the Lower Coal measures, Conway County, Arkansas, renaming it *Griffithides conwayensis*.

### Bird Sanctuaries in London

THE industry of the voluntary observers who report to the Committee on Bird Sanctuaries in the Royal Parks (England) gives a wonderfully full picture of bird-life in Greater London (Report of Committee for 1934. London: H.M. Stationery Office. 6*d*. net.). In Richmond Park, 56 species bred, and 38 other species were seen or heard; in Bushey and Hampton Court Parks, 52 species nested, including kingfisher and nightingale, and 26 others were seen. But the surprising thing is that, in the midst of the commotion of London itself—in Hyde Park and Kensington Gardens—there should appear visitors like the red-throated diver, the Slavonian grebe, and the golden-eye duck, all of them recorded for the first time in that area. It is said also that the Scandinavian form of the lesser black-backed gull appeared on the Serpentine in the autumn of 1933. Curious diversity in choice of roosting sites is shown by starlings and wood-pigeons: every evening about sunset, during autumn and winter, the latter leave St. James's Park, where there are plenty of suitable roosts, to spend the night in Battersea Park; and they make use of the very trees which some of the 2,000 starlings have sampled and abandoned before they continue their journey to roost in St. James's Park, which the pigeons have just left.

### Research in the Tortugas Laboratory

THE section in the Year Book, No. 33 (1934) of the Carnegie Institution of Washington dealing with this station reports a number of workers during the season and a great variety of subjects. Although much work is done in the field, there is a notable increase from year to year in the use of apparatus requiring electric current. This will pobably necessitate the installation of a power plant of greater capacity in the future. Dr. Alan Boyden, continuing his serological studies of invertebrates, has used examples from many different phyla, including 7 molluscs, 4 arthropods, 8 echinoderms and 5 chordates. The results have been very satisfactory, and will enable light to be shed upon some of the more obscure relationships between the major groups of animals. Other researches include a study of the ecology and physiology of corals by Prof. C. M. Yonge, who found that the opportunity to examine the reefs in detail was of special value in view of his previous experience with Pacific coral reefs, and Mr. J. E. Harris's observations on the swimming movements of fishes, which embrace work on the fishes in their natural surroundings besides cinematographic experiments with special relation to their fins, whilst Prof. W. H. Longley's subject is the systematics of the Tortugas fishes.

### Marine Research at Cullercoats

THE Report for the year ending July 31, 1934, of the Dove Marine Laboratory, Cullercoats, Northumberland (Armstrong College), published by the Marine Laboratory Committee and drawn up by the director, Prof. A. D. Hobson, shows it was a period of expansion of the activities of the Laboratory. The research work of the staff has been well maintained and there has been an increase in the number of outside workers. A number of alterations have been made in the building, including the conversion of a little-used lecture room into a new laboratory in which about a dozen students can be accommodated, or five research workers. This can be used for experimental and chemical work for which the main laboratory is not suitable. The work on herring has been continued as agreed with the Ministry of Agriculture and Fisheries, samples from the catches from the local shoals landed at North Shields during the season of 1933 being duly examined. Further investigations on the shoals from other parts of the coast have been continued. In Dr. Bull's work on conditioned responses in fishes, special attention is being paid to temperature, and it is found that teleostean fishes generally are extremely sensitive to temperature and that they can react to it purposively. Experiments on the perception of changes in salinity are now progressing satisfactorily. An excellent paper on the British Sphæromatidæ (Crustacea Isopoda) by Joseph Omer-Cooper and J. Hedley Rawson is included in this report. One of the species (*Limnoria lignorum*) is of economic importance as it is a wood-boring form and very widely distributed. A detailed discussion on the distribution of the Sphæromatidæ is included. In his aquarium observations Dr. Bull makes some important observations on the enemies of the common star-fish *Asterias rubens*, and shows that it is the only food eaten readily by the sun-stars *Solaster papposus* and *S. endica* and the northern stone-crab *Lithodes maia*. Adult specimens of all three can be maintained in captivity for long periods on such a diet.

### British Association Mathematical Tables

PROGRESS in the publication of these tables has been rather slower than was anticipated, chiefly owing to the great labour required in correcting the proofs. Vol. 5, containing the prime factors of all numbers up to 100,000, has now been passed for printing. Tables for cyclotomy and trinomial congruences, offered by Prof. L. E. Dickson, have been accepted for publication. With regard to Bessel functions, at least three volumes will be required. The first of these (forming vol. 6 of the Tables) is now in the press, and will be published shortly. The calculations for the other volumes will absorb the greater part of the Committee's time and money during the next year.

### German Chemical Industry

SHORT summaries of papers delivered at the conference of the Deutsche Gesellschaft für Chemisches

(*Continued on page* 601.)

Supplement to "NATURE"

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# An Interpretation of Social Institutions

**The Primordial Ocean: an Introductory Contribution to Social Psychology**
By Dr. W. J. Perry. Pp. xi+380. (London: Methuen and Co., Ltd., 1935.) 15*s*. net.

DR. PERRY has made a study of some of the general principles underlying the development of human society, as he regards the most pressing need of the moment to be not the accumulation of facts, but the gaining of insight into their meaning and relationships. Every man is born as a member of a community, and cannot be considered apart from his social surroundings; by virtue of his 'innate' equipment or 'biological inheritance' he reacts in certain ways to his surroundings, but he has also a 'social inheritance'.

The initial function of intelligence in the formation of society must have been closely bound up with the innate side of behaviour. Once this has been accounted for it is possible to proceed to study man's institutional behaviour and the reactions of individual qualities and behaviour to these. Dr. Perry's first inquiry is what social activities are common to the whole of mankind and what are due to special circumstances. To elucidate the first problem, he studies the food-gatherers, as representing the most primitive conditions available to us, but even among these "there are practically no social institutions", and those they have adopted from the food-producers. Many characteristics that the food-gatherers may possess in common do not depend on ethnic affinities or environment, but appear to be common to mankind.

Early food-producing was largely organised round agriculture and the domestication of animals, but accurate information is lacking how these two industries came about. Although various simple traits were carried over from the earlier condition, it was agriculture, and to a less extent the keeping of domestic animals, that led to more or less stationary groups and to living in stable communities. Hence arose the complications due to social relationships and to ritual and ceremonial observances and out of these developed religion as organised by priests. The high priests of the State cults became kings, and the royal families strove to control the whole organisation of the States. Food-production has enabled mankind to multiply enormously and has involved man in all sorts of new activities. Many social institutions have been based upon it, or greatly influenced by it. The organisation of the State, the functions of the kingship, religious ceremonial, magic, all these, according to Dr. Perry, have become associated with the great food quest.

A social institution comes into being for some definite reason: it persists for reasons that may be very different, and then a process of action and interaction is set up between it and other social institutions—human sacrifice and the wearing of clothes are examples. Painting, dancing, the drama, games, all appear to us to be 'natural', to spring immediately from innate tendencies. But the study of these activities shows that this conjecture is false. They came into play for some definite purpose, though afterwards they were practised for their own sakes.

The accumulation of possessions is not a characteristic of food-gatherers, it could scarcely be so from the nature of their life, though it is of food-producers as it emphasises status and self-esteem.

Violence is claimed to be an abnormal form of behaviour among food-gatherers: and where, as in Australia, it occurs between the moieties of a dual organisation it is assumed that the organisation has been introduced; the dual division of society is accompanied from India to eastern Polynesia by a continued hostility between moieties. The earliest food-producing communities had their violent forms of behaviour strictly canalised. This violence is centred round the ruling groups, human sacrifice and associated institutions; naturally, head-hunting and human sacrifice produce feelings of revenge which leads to further bloodshed. It is asserted that it can be shown that the intensified warfare of peoples of low culture has been the result of contact with civilised people.

These are some of the themes dealt with by Dr. Perry. He also draws examples of the getting

of life, the age of the gods, the four quarters in heaven and earth, the immortal gods, and other high matters from peoples all over the world and from savage or barbarian conditions to the high cultures of the East, all of which originally were derived from Egypt. Even in Egypt no fundamental advance was made after the formulation of the propositions of the pyramid texts. Later developments in Egyptian theology consist of an elaboration of ideas already in circulation, but even with this apparent paucity of invention in later times, Egyptian religious thought seems to have dominated that of other peoples throughout the ages.

The activities of mankind are usually dominated by tradition, and this preserves the continuity of social institutions; but it does not occur to mankind as a whole to inquire into the reasons for social institutions, even when they are disassociated from practical utility or operate to the detriment of many members of the community. Tradition often blinds men to the obvious, and perverts their intelligence. Perhaps Dr. Perry has some excuse in adding that even scientific views are often accepted because they come from a trusted source, and it requires a stubborn spirit to maintain intellectual integrity.

A. C. Haddon.

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# Non-Religion of the Future

**Psychology and Religion:**
a Study by a Medical Psychologist. By Dr. David Forsyth. Pp. ix+221. (London: Watts and Co., 1935.) 7*s*. 6*d*. net.

THE opinions of a distinguished psychiatrist upon the relations of psychology and religion are of great interest and importance. Dr. Forsyth's views are quite definite: religion and science, whether psychological or other, are quite incompatible with one another, because they involve two entirely different points of view. Religion is based on 'pleasure thinking', that is, on fantasy, while science is based on 'reality thinking'. Religion in short is concerned with illusions and not with reality, and belongs, properly speaking, to the infancy of our race, and not to its maturity, and so 'should be superseded in the present stage of civilisation'.

Dr. Forsyth holds that much of the imaginative power of individuals is at present wasted in the unprofitable 'pleasure thinking' associated with religion, and that if it were not dissipated in this way, but 'purposely linked to science', it might be far more beneficial to humanity. Though at the same time he would allow this imaginative power, as at present, to be devoted to the creative arts. "Science alone does not fully satisfy, and few are not the happier and better by turning from it at times, to passively enjoy the creative activities of others in books, music, and other forms of art".

It is to be doubted whether artists and those seriously interested in their work would agree to this relegation of art to the status of a recreation provider for tired men of science and professional or business men. The artist, no less than the scientific student, regards himself as establishing contact with truth; his primary function is not to amuse people, but to enlarge their perceptions of reality.

Dr. Forsyth raises many interesting questions, and is perhaps on occasion too optimistic about the benefits that science is likely to bestow. It is indeed true that a world *wholly* guided by science would be "free from intolerance such as has marred the old religions". But when will the world be so guided, and not by the economic and political prejudices which have displaced religious? It is a bad sign that though religion has declined, intolerance in Europe has increased.

Dr. Forsyth adumbrates the revolutionising not only of our educational system, but also of the relations of parents and children, by the new psychological knowledge. The patriarchal basis of our culture does indeed seem to be giving way. Dr. Forsyth is no sentimentalist, and it would have been interesting to hear from him what is the particular neurosis lurking behind the unbalanced child-worship which has now become common. Is it failure to face the problems of maturity, and a consequent flight back to childhood?

Quite half of Dr. Forsyth's book is taken up with an examination of the relations between traditional Christianity and science. His analysis, both historical and psychological, is certainly very damaging to the traditional position. But is religion necessarily to be identified with a supernatural revelation, any more than art or science —which in primitive times were both regarded in that light, but are so no longer? And cannot psychology be used to 'debunk' science and art as well as religion?

But these are big questions. Within the limits he has set himself, Dr. Forsyth has written a very useful book.

J. C. H.

# The Interpretation of Science

(1) Science in the Making
By Gerald Heard. Pp. 267. (London: Faber and Faber, Ltd., 1935.) 7*s*. 6*d*. net.

(2) Science and the Public Mind
By Benjamin C. Gruenberg. Pp. xiii+196. (New York and London: McGraw-Hill Book Co., Inc., 1935.) 12*s*. net.

IT has become clear to most thoughtful observers that science itself has reached a crisis no less pregnant than the crisis which developed in the world at large in great measure as the culmination of the rapid and uncontrolled application of mechanical invention and discoveries in physical science. Science is being driven to help to work out a broader philosophy and to combine to make a whole of life or to accept limitations on its own restricted fields of inquiry. The restrictions being imposed under modern dictatorship are merely a foretaste of what will develop more generally, if science does not support reason and assist the other faculties which are needed to establish reason and elaborate a philosophy in which reason is not merely an accident, and understanding, judgment, impartiality, charity as well as tolerance, insight as well as analysis, are absolutely valid.

On the other side, science continues to change our lives and transform almost every condition of living. New forces are continually being released, and unless we can reach an adequate understanding of the new focus science has given us, civilisation will be smashed because we continue to use the new powers for old aims. Only the discovery of superhuman purpose can make man safe against himself when armed with his present superhuman powers.

The closing, in this way, of the gap between our rapid scientific advance and our moral and ethical development demands two things. First, the breakdown of the barriers between the different sciences so as to facilitate co-ordination and secure advance where it is most needed in the interest of the whole race. Secondly, the interpretation of science to the general citizen so that he can visualise scientific advance as a whole and understand its bearing upon the other values and activities of life upon which it impinges and with which he is engaged.

(1) Both tasks demand interpreters and it is the merit of Mr. Gerald Heard's book that, although addressing himself primarily to the layman, he to some extent performs the first task also. In fact, whatever claims the original broadcast talks, on which the book is based, may have had to the title "Science in the Making", in their expanded form, the title is clearly a misnomer. There are no descriptions of technique and singularly little indication of the way in which science is built up; the book would have been more happily entitled "The Interpretation of Science". Despite a style which some will find mildly irritating, Mr. Heard has done his work well, though his references to Leakey's theories might have been more guarded. He has at any rate pointed the way, and the book may well inspire some scientific specialists to take a greater interest in science as a whole and in a scientific attitude to life in general. Is it too much to hope that it may induce others to consider more closely the social consequences of their work and to attempt its interpretation?

(2) "If society is to maintain its health and sanity, the public at large must either be trained to accept the guidance and direction of a special class . . . or else it must be trained to take part in the knowledge, the culture, the thought, the concepts upon which its civilisation rests." In these words, Dr. Gruenberg indicates the real choice before us in regard to educational policy and his own reason for presenting his study of the place of science in relation to adult education.

Although much of the material is drawn from American sources, the breadth of vision and the extent of the survey give this book real value to all who are concerned with the problems arising out of the impact of scientific discovery on society and our ability to master the new forces placed at our disposal. Dr. Gruenberg gives an admirable and concise statement of the problems which are involved in the education of society as a whole as to the value of science and its true contribution in thought and life. Whatever may be the fate of democratic government, its fullest possibilities can only be realised through a community thinking continuously and effectively according to the essential scientific method, with all that it implies of wide and clear vision, the recognition of the need for inquiry upon great questions and the settlement of problems upon the basis of facts and logic.

Scientific workers who have any concern with the interpretation of the results of scientific investigations to the community or with the consequences of their own discoveries cannot fail to find Dr. Gruenberg's analysis of the situation highly suggestive whether in treating of the failure of science to reach the public, the means and methods of bringing science before the public, or in his recommendations for future efforts in this field.

R. Brightman.

# Sociology in the United States

## Race and Culture Contacts

Editor: E. B. Reuter. Contributors: Romanzo Adams, W. O. Brown, E. Franklin Frazier, Max Handman, Asael T. Hansen, J. O. Hertzler, Charles S. Johnson, Andrew W. Lind, R. D. McKenzie, Robert E. Park, John A. Rademaker, Edward B. Reuter, Jesse Frederick Steiner, Clark Wissler. Pp. viii+253. (New York and London: McGraw-Hill Book Co., Inc., 1934.) 18*s*. net.

IN the United States, students of racial questions have the advantage—or disadvantage according as it is regarded—of finding their problems very much at their doors. This undoubtedly is responsible for a characteristic realism in approach, which finds extreme expression in a marked addiction to questionnaires, but, at the same time, is not always conducive to academic calm and detachment in discussion. As might be expected, however, anything in the nature of racial feeling is commendably absent from the papers which compose this volume. On the other hand, more than half the contents is taken up with the consideration of conditions which directly affect the United States, specific problems in the social structure of to-day. This is not without significance in a book which is intended for a wider public than the professional audience to which the papers were originally addressed.

Prof. Reuter has selected for inclusion in his volume fourteen of the papers which were presented at the twenty-eighth annual meeting of the American Sociological Society, prefacing them with an introductory chapter in which he outlines for his non-professional readers certain general considerations. In his selection, he has been influenced by the fact that most of the communications which follow—in fact all with one exception—are descriptive and historical, rather than theoretical, in character. They are arranged in a logical order, which follows the sociological argument of equilibrium—contact—maladjustment—equilibrium. Hence the papers fall more or less into two groups, an earlier which covers the beginnings of racial contact and conflict and is concerned largely with Old World conditions, and a second in which, as already mentioned, are described the adjustments partial or complete of American contacts—Negroes, Orientals settled in America and Hawaiians; Prof. Clark Wissler, in an able analysis of development in pioneer days affecting the culture and status of the American Indian, occupying something in the nature of an intermediate position.

In the first and more general section, it must not be held invidious to select for mention two papers, one a general survey of conditions in three continents by Mr. Robert E. Park, which is of especial interest to British readers for what it has to say of South Africa and India, and a study by Dr. Max Handman of adjustments between conflicting elements as exemplified in Transylvania.

Turning to the papers dealing with problems directly affecting the United States, English readers will find much here to interest them, written from an intimate point of view and with authority. One fact immediately calls for notice. That is the effect of the common school system. Both Mr. J. F. Steiner and Mr. John A. Rademaker, who deal with the settlement of Orientals in the United States, agree that, notwithstanding the difference in attitude of the first generation of Chinese and Japanese, the former still clinging to the tie of their native land, the racial barriers between American and Oriental tends to break down in the second generation under the influence of the association in early life at school.

Educational influence is also affecting the Negro problem, though in a different way. Mr. C. S. Johnson points out how the rising generation is now bringing about a modification in the Negro outlook, and it is probable that this is the influence which is largely responsible for the grades into which Mr. E. Franklin Frazier classifies the types of Negro family. His paper is a very interesting study of what is in effect a society within American society, which is governed by an entirely different social code. Mr. Frazier finds four types of Negro family organisation, of which, that which for purposes of distinction might be called the primary form, is purely matriarchal on primitive lines, the man being entirely absent or unimportant. This, however, is not a relic of an African matriarchal system inherited from slave ancestors, but a survival of pre-emancipation days, in which conditions, economic and social, favoured and tended to stabilise the position of the woman in independence of her male Negro consort. Post-emancipation conditions perpetuated this state of affairs, except in the case of the more skilled or well-to-do men.

The volume closes with a contribution by Mr. A. W. Lind on Hawaii, carrying further evidence in an earlier essay by Mr. Romanzo Adams. Both point to the conclusion that in Hawaii racial contacts have reached a phase of equilibrium,

although not without a note of warning that naval and other professional or official gradings may introduce a note of disharmony. Historical causes, which are here ably analysed, have brought it about that in all personal associations racial feeling is entirely absent. Americans, Hawaiians and Orientals associate on equal terms and without afterthought. Thus the book closes with the comforting thought for the practical sociologist that in one spot, at least, in a world-wide survey, a solution of the racial problem seems to have been attained.

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# A Psychology of Conduct

The Psychology of Wants, Interests and Attitudes By Edward L. Thorndike, and the Staff of the Division of Psychology of the Institute of Educational Research, Teachers College, Columbia University. (Century Psychology Series.) Pp. x+301. (New York and London: D. Appleton-Century Co., Inc., 1935.) 10*s*. 6*d*. net.

IT seems perfectly obvious that factors which in common conversation are called wants, interests, attitudes, desires, motives, tendencies and feelings influence human action, and perhaps the behaviour of all animals, more powerfully than any others. For many reasons, however, factors of this kind are not easy to study experimentally in an adequately controlled manner, and comparatively little is known definitely about the ways in which they operate. Many years ago, Prof. E. L. Thorndike began to develop an experimental technique for studying these 'satisfiers' of action, as he now calls them, and he soon arrived at the view that they operate, not only in a prospective manner, tending to establish connexions between particular reactions in a series, but also, retrospectively, strengthening or weakening connexions once set up. In this book he, and a number of his students, present and discuss the results of their most recent studies of the general problem of the effects of specific tendencies upon behaviour.

A want may lead a person to act in a specialised manner the very first time it is aroused. But when the same want has been aroused a hundred times, the resulting action may be very different. This difference, Thorndike says, is due to two things: the backward influence of the want, and changes in the wants, and connexions of wants, themselves. These are his two main problems: how can wants, interests and attitudes act in a backward way upon the series of acts which satisfy them? Also how are they "strengthened, weakened, and shifted in their attachments"?

It is not possible, in a brief notice, to describe in any detail the mass of ingenious experimental dodges used by Thorndike and his collaborators. All of them in this book concern human action, and particular questions asked and answered are: How does a want determine what response a situation is going to evoke? How does it settle what response is going to survive? What is the precise influence of reward and punishment? Is there any real difference between learning to know or to do things that are valuable and things that are useless? It is now regarded as more than ever certain that wants, and the like factors, do somehow work backward, strengthening the bonds between acts that lead to their satisfaction. Further, some progress is made with the job of saying in detail how they do this, though the physiological mechanism involved—and Thorndike is quite sure that there is one—remains obscure. Apparently punishments are not of vast direct significance, though they can turn aside the agent to some course of action that is a genuine 'satisfier'. The experiments on the direct influence of interests on learning and doing are perhaps a little less convincing than some of the others, but from them it appears that the common belief that interest aids both is justified, but exaggerated; while if interest is present, whether what has to be learned is useful or not seems to make very little difference indeed.

The second part of the volume, dealing with the changes that may take place in wants, interests and attitudes in the course of experience, is not less important than the first. Again, rewards bulk largely in the discussion. What is the effect of a reward, near, or remote, emphatic, or weak? How are wants affected by being tied up with particular stimuli and situations by a conditioned reflex method? What precisely happens when a stimulus, being unpleasant, is nevertheless often repeated? A final chapter discusses difficulties in the education of wants, interests and attitudes, and appendixes give adequate samples of the experimental methods used throughout, and their results.

The volume as a whole is an extraordinarily interesting piece of pioneering work. It is original, both in design and in execution. It should point the way to a host of investigations, by relatively controlled methods, of intensely important theoretical and practical questions which hitherto have been mainly merely a field for conflicting speculations.

F. C. B.

# Fracastor's Poem on Syphilis

**Fracastor: Syphilis, or the French Disease; a Poem in Latin Hexameters**
By Girolamo Fracastoro. With a Translation, Notes and Appendix by Heneage Wynne-Finch. Pp. vii+253+4 plates. (London: William Heinemann (Medical Books), Ltd., 1935.) 10*s*. 6*d*. net.

IN the introduction to this scholarly work, which admirably illustrates the close relation of medicine with literature, Mr. James Johnston Abraham, who is not only a well-known specialist in venereal diseases but also a writer of distinction, gives a short sketch of the life and times of Fracastor, and the origin and treatment of syphilis from the time of Fracastor until the present day.

In the preface to his translation, Mr. Heneage Wynne-Finch lays stress on the literary charm of the poem, which he declares has lately been neglected or obscured, though he admits that Fracastor occasionally indulges in tedious repetitions and redundancies. The poem, however, received the highest praise from contemporary writers such as Cardinal Bembo, the Venetian poet, to whom it is dedicated. Moreover, the popularity of the poem is shown by the fact that after its first appearance in 1530 at Verona, thirteen editions were published in the course of the sixteenth century.

Of Mr. Wynne-Finch's translation, which, unlike Natum Tate's verse rendering of 1686 is in prose, it may be said that he has admirably succeeded in his aim of retaining the grace and charm of the original, while keeping fidelity to the text.

The poem, which consists of three books, relates how a shepherd named Syphilus incurred the wrath of Apollo, who punished him by the infliction of a highly contagious and terrible new disease. A vivid description of the hideous sores and deformities of the unhappy victims is given in the first book, while the last two are mainly devoted to treatment, particularly by guiacum, on which Ulrich von Hutten had lavished such undeserved praise, and mercury.

The translation is followed by an essay on Fracastor and Virgil by Mr. Vernon Rendall, who illustrates by numerous examples Fracastor's use of Virgilian idiom and language as well as his resemblance to his master in his appreciation of the beautiful Italian country. Like Mr. Wynne-Finch, however, Mr. Rendall is not blind to Fracastor's shortcomings, and notes particularly the servile manner in which he takes incident and detail as well as words and phrases from the "Æneid". Mr. Rendall has also assisted Mr. Wynne-Finch in the preparation of copious notes on the poem, which include an abridged translation of the chapters on syphilis in Fracastor's other most important work, "De Contagione".

The book, which should appeal to all who are interested in the history of medicine or literature, is illustrated by portraits of Fracastor, facsimiles of pages from the first edition and first English translation and woodcuts of fifteenth century works on syphilis.

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# Penetrating Ocean Depths

**Half Mile Down**
By Dr. William Beebe. Pp. xix+344+88 plates. (London: John Lane, The Bodley Head, Ltd., 1935.) 18*s*. net.

DR. WILLIAM BEEBE is the born adventurer. To him the thrill of arriving where man has never arrived before is an unfailing stimulus to further exploits. When he turns from the tropical jungle and the desert to the ocean he does not rest until, inside a hollow steel ball, he has penetrated its depths to a distance of 3,028 feet beneath the surface. Even as he is making his hazardous journey down into the unknown the messages he sends along the telephone line to the surface reveal the driving spirit of the venture:

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| "We have just splashed below the surface." | |
| "We are at our deepest helmet dive." | 60 ft. |
| "The *Lusitania* is resting at this level." | 285 ft. |
| "This is the greatest depth reached in a regulation suit by Navy divers." | 306 ft. |
| "We are passing the deepest submarine record." | 383 ft. |
| "The *Egypt* was found at this level by divers in rigid shells." | 500 ft. |
| "A diver in an armoured suit descended this far into a Bavarian lake—the deepest point which a live human has ever reached." | 525 ft. |
| "Only dead men have sunk below this." | 600 ft. |
| "We are still alive and one-quarter of a mile down." | 1,426 ft. |

Dr. Beebe is also a talented writer, so that when he comes to record his experiences, his free and personal style of presentation ensures the production of a readable narrative. There are few who cannot enjoy a well-told story of adventure.

In his latest book, "Half Mile Down", however, Dr. Beebe would seem to wish to draw the reader aside from the material facts of scientific adventure under sea in order to contemplate the æsthetic delight of such work. He therefore starts with an extract from William Morton Wheeler's "Entomologist in Hades" as his Apologia, in which the 'correct' investigator with his constant striving to solve 'problems' is contrasted with the amateur who is "permitted to roam at will among the fragrant asphodels of the Elysian meadows, netting gorgeous, ghostly butterflies until the end of time". And in the arrangement of the text he creates four divisions, the first of which is entitled "Emotional", and the last "Technical". Even so, before seven pages of the text are completed, the uncontrollable spirit of the real adventurer breaks out once more and Beebe is telling us that "in my present existence there is only one experience left which can transcend that of living for a time under the sea—and that is a trip to Mars".

In these circumstances the book is a difficult one for the reviewer. For it is neither a straight story of adventure under sea, nor a scientific manual, but rather an odd admixture of fact and imagination. Nevertheless, it may be said to consist of a popular narrative, complete in the first 225 pages, and a series of technical appendixes, filling the remaining one hundred or so pages to which the student may turn for the more prosaic scientific data of exploration. There is much to interest everyone in the narrative, including a history of deep-sea diving from ancient times to the present day, and there are many fine illustrations and reprints. The eight technical appendixes deal with the construction of Mr. Barton's original bathysphere of 1930 and its modifications in 1934; a bibliography of the history of diving; a catalogue of unedited telephone observations made during actual dives of the bathysphere; a classified résumé of organisms observed; and a final summary of conclusions relating to physical conditions at the greatest depths, temperature, pressure, clarity of observation, and biological observations on the abundance, illumination, activity, size and vertical distribution of oceanic organisms.

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# A Modern Description of World Vegetation

**Pflanzengeographie auf physiologischer Grundlage**

Von Prof. Dr. A. F. W. Schimper. Dritte, neubearbeitete und wesentlich erweiterte Auflage, herausgegeben von Prof. Dr. F. C. von Faber. Band 1. Pp. xx+588. Band 2. Pp. xvi+589–1612. (Jena: Gustav Fischer, 1935.) 90 gold marks.

TWO books published at the end of last century undoubtedly laid the foundations of modern plant ecology—Warming's "Plantesamfund", made available to the majority of international readers through Knoblauch's German translation published as "Lehrbuch der Oekologischen Pflanzengeographie" in 1896, not appearing in English until much later (1909) in an enlarged but not nearly so satisfactory a form; and the original edition of the work under review, Schimper's "Pflanzengeographie auf physiologischer Grundlage" (1898), which was fortunately translated into English with less delay (1903). The two authors presented their material from somewhat different points of view, but both were masters of their subject, both had travelled widely in the tropics as well as in temperate regions, and both gave thorough systematic accounts of what was then known of the field. Warming's book was quite short, unillustrated and adopted a somewhat limited, though thoroughly instructive, guiding principle. Schimper's was much longer, more discursive, illustrated by a great number of excellent photographs of vegetation and drawings of characteristic plants, and was indeed at the time of its publication a veritable mine of information previously unavailable to the student. It was somewhat vitiated, however, by certain physiological theories which have proved untenable in the light of later research.

It would be difficult, and not relevant here, to attempt to estimate the relative influence of these two books on the subsequent development of the subject. Together they have stimulated innumerable investigations, and have formed worthy foundations for the immense, though still rather inchoate, superstructure that has been built upon them during the last thirty-five years. There have also, of course, been other creative influences at work, of which the most important has been the increasing conviction of the universal validity and fundamental importance of the 'succession' or 'development' of vegetation, which we owe mainly to the work of the American ecologists, Cowles

and Clements. At present, there is great activity over the whole field almost throughout the world, not least in the Continental countries, in almost all of which there has been a notable revival of interest since the War, largely due to the influence of Braun-Blanquet.

The fundamental value of the modern type of work for application to the great practical problems of land utilisation, recognised many years ago in some countries, for example, the United States and New Zealand, is being slowly—much too slowly—appreciated in the British Empire. It is not too much to say that if this kind of work were adequately endowed, actively prosecuted and the results properly applied, the avoidance of wasteful exploitation of land in 'new' countries would eventually represent a stupendous saving in money alone. Ecological survey is in fact the pre-requisite of that intelligent 'planning' on a large scale which is becoming more and more urgently necessary in the modern world.

Prof. von Faber has now presented us with a new, greatly enlarged, and almost completely rewritten edition of Schimper's great work, taking into account the immense number of investigations which have been carried out during the present century. He has maintained the general plan of the original book, beginning with a description of 'ecological factors', to which 260 pages are devoted. This is a good and fairly thorough, if rather pedestrian, account, in which the more modern work is adequately treated. The author then proceeds to consider the major units of vegetation, the so-called 'plant formations'. Here he maintains Schimper's distinction between climatic and edaphic formations, and ignores the views of Clements, who considers that edaphic formations are always stages in the development, or modifications, of the climatic formations. Prof. von Faber says that the controversies about the units of vegetation and their terminology are mainly controversies about names. That is partly, but not wholly, true: some of the differences arise from real differences of interpretation due to our still inadequate knowledge of the facts. The author's very brief treatment of succession, sound so far as it goes, is quite inadequate.

The third and much the longest section of the book, occupying no less than 1,200 pages, is devoted to a systematic description of the vegetation of the world and the factors which determine its multiform variations. Beginning with the tropics, of the vegetation of which Schimper's original work was the first general scientific treatment, and to which Prof. von Faber's own observations have contributed considerably, we pass to the temperate and finally to the arctic and alpine regions. Though we are still extremely ignorant of the detailed ecology of tropical vegetation, our knowledge, particularly of the physiology of tropical plants, has very greatly increased in recent years, and the author's account, both of this and of the general relations of vegetation to the characteristic tropical climates, is by far the best which has appeared. Our actual knowledge of the detailed constitution of the most characteristic of all—the equatorial rain forest—is now being put on a firm basis by the work of Mr. Paul Richards, who is at present following up his thorough investigations of small samples in British Guiana and Sarawak by studies in West Africa.

When we turn to the vegetation of temperate regions, we find Prof. von Faber's account, as was almost inevitable, far less satisfactory, though it includes a number of valuable discussions and summaries. An adequate handling of the enormous quantity of material provided by the studies of innumerable observers in Europe and North America is very nearly an impossible task, not merely on account of its sheer bulk, but also mainly because the observations have been made from so many different points of view, with widely varying accuracy, thoroughness and technique, so that very many of the results cannot be correlated and unified. We cannot complain that the author has neglected the literature. Though his citations are necessarily and confessedly far from being exhaustive, he has referred to a great range of representative work in all the principal countries. But the result leaves a somewhat confused and chaotic impression on the mind, and that is not surprising. Probably the only effective way to write a scientific description of world vegetation would be to adopt a specific point of view, and to neglect all work which did not provide data suitable for its elaboration. The active and widespread work of Braun-Blanquet's school is in this direction, though some of us may be a little sceptical as to the complete soundness of its foundations.

With minor mistakes and misapprehensions in so large a book—and many such the most indefatigable and accomplished author could scarcely be expected to avoid—it is naturally impossible to deal, but we regret to see that in the world map showing the distribution of the main types of vegetation the British Isles is even more fantastically divided than in most of the maps published by Continental authors. The book is illustrated by three folding maps and 613 figures, mostly beautiful photographs of typical vegetation excellently reproduced. When all criticisms have been made, Prof. von Faber's edition of Schimper remains an exceedingly valuable work, which will be indispensable to all students of the subject.

A. G. Tansley.

# Shellac

Shellac: its Production, Manufacture, Chemistry, Analysis, Commerce and Uses
By Ernest J. Parry. Pp. xi+240. (London: Sir Isaac Pitman and Sons, Ltd., 1935.) 12*s*. 6*d*. net.

THE insect that produces the resinous material which is called shellac takes little heed of the notoriety with which its product is now invested. Financial crises of considerable magnitude have attended the failure of speculative attempts to corner the market in it, and the word has been in the mouths of thousands who have little, if any, knowledge about the material, its manufacture or its uses. It is permissible to comment on the fact that most raw materials, the production of which is limited, are liable to have the supplies cornered by vested interests and their price to the user raised accordingly. Once, however, a chemical synthesis of such materials or of a substitute for them has been achieved, the danger of a monopoly is at an end and the product can be produced in quantity without restraint, except such as arises from patent laws, and sold at a cost which bears close relation to the cost of manufacture. The urge to make synthetic products is thus a proper one economically, though, alas, the competitive struggle between natural and synthetic has often resulted in the ruin of an industry and much unemployment.

The lac industry began with the demand for the dye, the crimson lake or cochineal of commerce. Coal tar dyes superseded this; but fortunately the resin was found to be valuable first as a varnish, then as an electrical insulating material, and later for gramophone records.

Mr. Parry, who is an analyst of repute, has given us a book of wide interest covering the whole of the divarications of his subject. Starting with the origin, a full account is next given of the practical production, the enemies of the lac insect and the manufacture of shellac. These sections are well illustrated.

When shellac has reached the market, the question arises of its evaluation by analysis, and it is only in quite recent years that this has been possible. Mr. Parry now treats the question at considerable length, indicating a procedure for the commercial analysis. When it comes to the chemistry of shellac, we are on less certain ground, particularly as it is a mixture, being said to consist of two parts of shellolic acid, five parts of aleuritic acid and seven parts of amorphous acids. Formulæ have been suggested, particularly by Harries and Nagel, for these two acids.

The chapter on the commerce of lac introduces a number of subjects, such as the rights of landowners in India, marketing up to the Calcutta merchant shippers, the London trade, contracts: the expert must know something of all these. In an appendix, the author's original papers are included, largely dealing with adulteration, also the United States standards and methods of analysis, and finally a glossary of native terms.

Information is thus provided for every branch of the industry, and the seeker for knowledge about shellac is well cared for: he will, or should be, properly grateful to Mr. Parry for the trouble he has taken in making his own unique store of knowledge generally available. E. F. A.

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# Photoelectricity and Surface Chemistry

Electron Emission and Adsorption Phenomena
By J. H. de Boer. Translated from the manuscript by Mrs. H. E. Teves-Acly. (Cambridge Series of Physical Chemistry.) Pp. xi+398. (Cambridge: At the University Press, 1935.) 21*s*. net.

IT is surprising that there are so few books in English which deal with photoelectric phenomena. Hughes and Du Bridge's book, which made a welcome appearance three years ago, deals mainly with those aspects which are of special importance to physicists, and the only other book which has appeared recently concerning this or related subjects is Reimann's "Thermionic Emission". Dr. de Boer is therefore to be congratulated on giving us another account of this interesting subject from a novel point of view.

The object of this book is the interrelation of the adsorption of atoms on solids and the photoelectric and thermionic emission of electrons. The first two chapters are introductory, and give a short summary of the fundamental phenomena. The next part of the book is concerned with the effect of adsorbed layers on the emission from metal surfaces, while the last part deals with the photoelectric effect in insulators.

The change in the work function due to adsorbed layers is familiar ground, and Dr. de Boer has covered it well. The use of potential curves greatly

simplifies the presentation, though there is always the danger that one is tempted to seek explanations by drawing suitable potential curves instead of performing calculations, especially when the calculations are difficult. The advantages of such curves do, however, outweigh any disadvantages which their abuse might bring. This section of the book closes with discussions of the absorption of light by matter in the adsorbed state and of the selective photoelectric effect. Both these chapters are well and critically written, but occasionally one meets categorical statements on questions which are still undecided. For example, it is stated two or three times that the selective effect is an atomic effect, due to the absorption of light by the adsorbed atoms, and it is not until § 71 is read that one realises that this is merely the author's own opinion. Admittedly nearly everyone would agree that the selective effect is to be explained in this way, but this is not because the explanation fits all the facts, but because no other hypothesis seems tenable. At the moment, it is difficult to understand the enormous difference in the action of light polarised in, and perpendicular to, the plane of incidence. If the selective effect is an atomic photoelectric effect there should be no such great difference, and, on the other hand, if it is caused in any other way, it is not easy to explain the high yield of electrons.

There are three very readable chapters on photoconductivity in insulators. This difficult subject seems to become more complicated every year, and it is extremely useful to have an up-to-date account. The author takes a rather optimistic view of the subject, which is only natural in an experimental physicist. There is bound to be a certain amount of chaos when the phenomenon depends on the presence of small quantities of impurities, and perhaps the experimenter sees more of the order, while the theorist sees more of the chaos. The last three chapters discuss rectifiers and the photoelectric and thermionic properties of surfaces covered with thick layers of dielectric.

The book is a stimulating one, and should help those working on one of the subjects to appreciate what information other lines of attack can yield. The translation has been carried out adequately.

A. H. Wilson.

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# Binary Stars

## The Binary Stars

By Robert Grant Aitken. (McGraw-Hill Astronomical Series.) Second edition. Pp. xii+309. (New York and London : McGraw-Hill Book Co., Inc., 1935.) 21*s*. net.

When, a few months ago, Dr. Aitken retired from the directorship of the Lick Observatory and from active observational work, he had completed forty years of observation and study of binary stars. During this time he had carried to completion a survey, commenced in conjunction with Prof. Hussey, but carried on single-handed from 1905, of all stars down to magnitude 9·0 on the B.D. scale and north of 18° south declination, for the discovery of double stars ; he had discovered more than 3,000 double stars with a separation not exceeding five seconds of arc ; he had remeasured most of these stars, after suitable intervals, at two later epochs for the discovery of orbital motion, and had also made a considerable number of measures of known binaries. In addition, he had computed many orbits and had completed the preparation of a new general catalogue of double stars. Seldom can the energies of a lifetime have been devoted more continuously and enthusiastically to the advancement of one chosen branch of astronomy.

It is appropriate that almost the last work of Dr. Aitken before his retirement was to pass the proofs of the second edition of his monograph on the binary stars. The first edition had long been out of print, and the large amount of observational and other work in double star astronomy had made it in large part out of date. This work is well known as an authoritative and comprehensive account of all aspects of the subject. The new edition follows closely along the lines of the original edition, which has been thoroughly revised and brought up to date. The historical account of the subject is of great value and of general interest, whilst the chapter on observing methods is full of sound advice for double-star observers. Emphasis is placed on one precaution that has characterised Dr. Aitken's own observing and that has application outside this particular field : "The most important precaution to be taken in double-star observing is quite independent of instrumental adjustments. It is *to make measures only on nights when the observing conditions are good*. . . . I make this statement with all possible emphasis." Methods of orbit computation, not only of usual binary systems, but also of spectroscopic and eclipsing binary systems are described. Of special value for purposes of reference are two tables containing the elements of determined

orbits of both visual and spectroscopic systems, the authority for each set of elements being given, with a reference to the original publication.

The extensive double star surveys in both hemispheres have provided material for statistical discussion much more complete than when the first edition was published. It must have been with considerable satisfaction that Dr. Aitken was able to repeat without essential alteration the general summary given in the first edition of the more important conclusions to be drawn from the statistical material. One conclusion is of particular interest in connexion with the origin of binary systems: that there is an unbroken progression of series of orbits from systems with a period of less than a day, revolving about each other almost in contact in circular orbits to systems with periods of hundreds or thousands of years, moving in highly eccentric orbits with axes many hundreds of times the distance of the earth from the sun. The inference is that a common origin must be sought for all binary systems, and that no theory yet advanced to account for the origin and subsequent development of binary systems can be regarded as satisfactory. Down to the magnitude limit of Aitken's survey, about one star in eighteen is seen as a visual binary with the 36-inch telescope; of the naked eye stars, about one star in seven is a spectroscopic binary. The properties of binary systems is thus so high that the formulation of a satisfactory theory of their origin is one of the most important unsolved problems of cosmogony.

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# Short Notices

## Archæology and Ethnology

### The Folklore of Morocco

By Dr. Françoise Legey. Translated from the French by Lucy Hotz. Pp. 277+25 plates. (London: George Allen and Unwin, Ltd., 1935.) 12*s*. 6*d*. net.

Moroccan folklore, as Dr. Westermarck has shown us, is essentially a composite product. A veneer of the Moslem creed overlies a solid body of Berber magical practice and belief, in which survivals from the old Roman province are embedded like plums in a pudding. The genie, whether good or bad, common to the whole Moslem world, claims attention equally with the mysterious *baraka*, the mystic individual power of the animate and inanimate world, which is characteristic of Morocco, while in the ever-present fear of the evil eye the inhabitants affirm their Mediterranean descent.

This composite character of Moroccan belief is well illustrated in the material collected by Mme. Legey during the thirteen years of her acquaintance with Morocco, although she purposely refrains from comment on comparable beliefs and the like elsewhere. As a medical officer of the French administration, her duties and her sex have given her access to sources of information from which the ordinary observer is barred. Her record of the beliefs and practices connected with disease and its treatment and the feminine province in matters affecting birth, infancy, adolescence, marriage and its ceremonial, will be found especially valuable.

Although Mme. Legey covers the whole field of belief from ideas relating to the creation and character of the cosmos to the reverence paid to the deceased holy man at his burial-place, her contribution to the subject is most considerable in medical matters and in what is specifically the woman's world. The index, unfortunately, is not adequate to the subject-matter.

### The Hill Bhūiyās of Ōrissā: with Comparative Notes on the Plains Bhūiyās

By Sarat Chandra Roy. Pp. v+320+xxxviii+17 plates. (Ranchi: *Man in India* Office, 1935.) 8 rupees.

This is the fifth volume in a series of monographs on the aboriginal tribes of India, which Sarat Chandra Roy has in course of preparation, on a foundation of twenty-five years experience of the peoples of the central hill belt. The present volume is concerned with one of the few tribes which show in their different branches all the various stages of evolution from the wild tribes of the hills to the thoroughly Hinduised *zamindars* of the plains, some of whom have now progressed so far as to claim Rajput or Kshatriya descent. They are distributed widely over half a dozen provinces—Bengal, Bihar, Orissa, Chota Nagpur, Assam, the United Provinces, Central Provinces and Madras. Here, however, the author deals mainly with the hill tribes who, as he notes, are correctly classified in the last census as Kolarian. Culturally, they are Pre-Dravidian.

## Biology

### (1) Living Things: an Introduction to Biology

By Richard Palmer. Pp. 400. (London: George Allen and Unwin, Ltd., 1935.) 7*s*. 6*d*. net.

### (2) The World of Nature

By H. C. Knapp-Fisher. Pp. iv+512. (London: Victor Gollancz, Ltd., 1935.) 6*s*. net.

(1) In being a true biology, "Living Things" makes a definite claim to freshness, and thus commands the attention of teachers. Animals and plants are in close conjunction with each other, and the author makes no attempt to segregate them artificially. Of course, this is how they should be treated:

nevertheless, the author is to be congratulated in having done what many biological authors have neglected to do.

Another fresh note is the chapter on the methods of science, which, if read by the discriminating student before and after reading the rest of the book, will prove invaluable in giving the reader the most desirable outlook on the subject. Apart from this common-sense, and therefore correct, method of treatment, it may be said that the book has an attractive style and is comparatively well illustrated. It can be whole-heartedly recommended to students up to matriculation standard.

(2) "The World of Nature" makes a different appeal: but its standard is equally high. It is more a natural history than a biology, and is written to make the world of Nature "intelligible to the ordinary educated person". We venture to say that it will not only do this, but it will also prove to the sceptical and disinterested what a fascinating field for cultural interest lies around them. There is only one criticism —a selfish one perhaps—that is, we would wish to see more of the unique but brilliantly executed illustrations.

### The Botanist in Ireland

By Dr. Robert Lloyd Praeger. Pp. xii+497+44 plates. (Dublin: Hodges, Figgis and Co., 1934.) **12*s.* 6*d.***

THIS volume is difficult to classify. It is not a Flora; it is not a guide book; it is not a scientific treatise on Irish phytogeography; yet it combines features of all these into a homogeneous whole and provides those interested in the Irish flora with an ideal guide and companion for their studies and their travels. No one but Dr. Praeger could have written such a work, and it is indeed a fitting crown to his life-long labours on the flora of his native land.

The work is divided into four parts. The first comprises sections on the physiography, geology, topography and climate of Ireland, each a model of compression and clear statement. The second contains notes on various miscellaneous aspects of the flora, including topographical and ecological distribution, and an invaluable list of rare or interesting Irish plants, in which information hitherto scattered in periodicals has been brought together.

The main part of the book is devoted to a topographical survey of the whole country, with a full description of the flora of each area. Dr. Praeger's intimate knowledge of every square yard that he describes gives to these pages a remarkable vividness which must be unique in botanical literature.

The concluding section consists of a census list of the flora, with the distribution of each species indicated by numbers referring to the counties in which it occurs. There is an excellent index.

The whole volume is copiously illustrated with maps, diagrams and photographs of individual plants and botanical localities. The photographs, most of which were taken by Mr. R. Welch, are extraordinarily beautiful, and add greatly to the value of the book.

### Elementary Microtechnique

By H. Alan Peacock. Pp. vii+200. (London: Edward Arnold and Co., 1935.) 5*s.* 6*d.* net.

THIS small book should prove of value to the amateur and elementary biologist, and the more advanced student and laboratory worker may well add it to his reference library, for it contains a number of practical hints and useful dodges and recipes. The matter presented is concisely given, largely in tabular form. After some introductory remarks on protoplasm and cytology, the processes and principles of microtechnique and methods for making microscopical preparations are considered. A chapter follows on technique, including fixing, hardening, embedding and sectioning, staining, and mounting, with a section on bulk staining. The next chapter deals in alphabetical order with methods for specific purposes for animal and plant organisms and tissues, and contains a surprising number of headings, ranging from acarine disease of bees and annelids to *Vorticella* and yeast (rotifers do not seem to be mentioned here). The next chapter gives the use of stains, followed by one containing the formulæ.

Ink for writing on glass is not given, while grease pencils are so easily obtained that the method for making them might well be omitted. Similarly, such agents as Farrant and glycerin jelly are probably better purchased than made, and the same applies to eyepiece scales and micrometers. The remarks on numerical aperture may give rise to confusion, as the term "definition" is used, instead of the correct one, "resolution". A most useful appendix gives the sources from which the organisms and tissues mentioned may be obtained, and their preservation is dealt with in another appendix.

R. T. H.

## Chemistry

### Organic Syntheses:

an Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Carl R. Noller, Editor-in-Chief. Vol. 15. Pp. v+104. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 8*s.* 6*d.* net.

THIRTY substances are included in the current volume of this welcome annual. Among acyclic compounds with long carbon chains are *n*-dodecyl bromide (made from *n*-dodecyl alcohol), *n*-hexadecane (from cetyl alcohol, via cetyl iodide), and oleyl alcohol (from butyl oleate, prepared from olive oil by alcoholysis). Simple open-chain compounds include trichloroethyl alcohol, which is readily prepared by treating chloral with aluminium ethoxide in presence of anhydrous alcohol. In the aromatic series, a simple method is given for converting 2,4-dinitrochlorobenzene into 2,4-dinitroaniline by treatment with ammonium acetate and ammonia gas at 170° in an open vessel; further, an example of oxidation with selenium dioxide is provided by the preparation of phenylglyoxal from acetophenone. In the heterocyclic series, Hans Fischer submits details of the preparation of 2,4-dimethyl-3,5-dicarbethoxypyrrole and its conversion into 2,4-dimethylpyrrole,

by means of processes based upon the original procedure of Knorr.

Improved methods of making two simple reagents of wide use in organic chemistry are also included. There is, in the first place, an illustrated description of a useful laboratory apparatus capable of producing 300 grams of anhydrous hydrogen bromide per hour by the direct combination of hydrogen and bromine. Secondly, an account of Arndt's recent method for preparing diazomethane will be of service to users of this valuable synthetic reagent. Methyl urea is made from methylamine hydrochloride and potassium cyanate; alternatively, aqueous ammonia and dimethyl sulphate may replace the methylamine hydrochloride. Treatment with nitrous acid furnishes nitrosomethyl urea, which is then subjected to the action of aqueous potassium hydroxide in presence of ether. It is rightly emphasised that diazomethane is an especially insidious poison, the careless manipulation of which may induce a super-sensitive condition rendering the subject liable to attacks of asthma or fever. An appendix contains later references to preparations given in the preceding volumes. The subject index covers vols. 10–15 of the series.

J. R.

### Van Nostrand's Chemical Annual:

a Hand-Book of Useful Data for Analytical, Manufacturing and Investigating Chemists, Chemical Engineers and Students. Edited by Prof. John C. Olsen. Seventh Issue. Pp. xvii+1029. (London: Chapman and Hall, Ltd., 1935.) 25*s*. net.

In the preparation of the new edition, the editor has compared the data given in the previous edition with the "International Critical Tables", and in some cases later data than those given in this publication have been used. In all cases, critically selected values are given instead of all the values published. Many new tables appear, including those of physico-chemical data, boiling points, vapour pressures and latent heats, and tables for thermal observations and calculations.

The information contained in the book is such as will normally be required in the chemical laboratory and by the chemical engineer, and the revision appears to have been thorough and satisfactory. The manual is one which may be recommended as likely to be extremely useful, and its relatively small size will enable the user to have at his command in a very convenient form a large range of material, which otherwise would have to be sought in bulky and expensive volumes not always at hand when a figure is urgently required. It is strongly bound and should stand use in the laboratory and works.

### Colloidal Electrolytes:

a General Discussion held by the Faraday Society. Pp. iv+422+6 plates. (London and Edinburgh: Gurney and Jackson, 1935.) 18*s*. 6*d*. net.

The report on the Faraday Society's general discussion on "Colloidal Electrolytes", held in London on September 27–29, 1934, is noteworthy for its very wide scope, since it includes no less than 36 papers, with discussions to which a large number of speakers contributed. Attention may also be directed to an improved binding, which appears to have been rendered necessary by the expansion of the report to more than four hundred pages (as compared with about forty pages for the first of these discussions in 1907), and to the very modest price at which it has been issued. In view of the importance of the subject with which it deals, its authoritative character, and the very favourable conditions under which it is available, it may be anticipated that the report will have a wide circulation beyond the boundaries of the Society to which the credit for its publication belongs.

### The Teaching of Chemistry

By N. F. Newbury. Pp. xii+247. (London: William Heinemann, Ltd., 1934.) 6*s*. net.

The young graduate who is taking up his duties in a school will be grateful to the author for the information provided in this book, and even the experienced teacher will find something useful in it. Not all the recommendations will meet with approval, and a good deal of space is taken up by statistical information which will rapidly become obsolete. The author's recommendation that the young teacher should discard his university lecture notes and rely on elementary textbooks for his material is one which should not be followed, since in this way he is likely to use a good deal of old-fashioned and obsolete material which is perpetuated in many books.

The author, like most teachers, has his preferences, and the use of microchemical methods seems to be one. He is not always consistent: on p. 140 he says the use of formulæ and equations should be "discouraged" in the first year, whilst on p. 166 he gives a "model" answer in which a formula is used by a boy who had studied chemistry only eight weeks. These are minor points of criticism. The book is on the whole a good one, and should be found useful. The lists of books recommended, however, seem to require some extension, since some popular and successful books are conspicuous by their absence.

## Engineering

### Piles and Pile Driving

By A. C. Dean. Pp. x+221. (London: Crosby Lockwood and Son, Ltd., 1935.) 42*s*. net.

In his introduction to this book, the author points out that the use of piles for foundations is a practice of great antiquity. Although he does not allude to prehistoric times, it may even be claimed that it dates back to the remote period of lake-dwellers who perched their habitations on props driven into the beds of lakes. Yet, however ancient in origin, piling continues in vogue at the present day as one of the most serviceable methods of providing underground or subaqueous support for structures. At the same time, it is a branch of engineering which admits of considerable diversity of practice and opinion. Piles

are varied in character, and formulæ for driving them are numerous, with results that are oftentimes conflicting. A handbook, therefore, which brings together, for comparison, data relating to the varied forms taken by piles and the rules governing their use is a useful *vade mecum* for the engineer.

The author has covered the ground very fairly, and though in some directions, perhaps, his survey might have been amplified with advantage, yet, on the whole, it is reasonably comprehensive. It covers a brief description of timber piles, with notes on their durability and treatment, and then, at greater length, deals with the numerous varieties of reinforced concrete and steel piles, both for bearing and sheeting. There are chapters on pile-driving and the handling of disc and screw piles, followed by an informative section on the theoretical carrying capacity of piles and the stability of walls and cofferdams, in which the mathematical treatment of the subject is well set out. The book concludes with several tabular appendixes and an index. It is well printed, and the illustrations and diagrams are clear.

B. C.

### Theory of Alternating Current Wave-Forms

By Philip Kemp. (A Series of Monographs on Electrical Engineering, Vol. 1.) Pp. ix+218. (London: Chapman and Hall, Ltd., 1934.) 15*s*. net.

The invention of the oscillograph enabled electrical engineers to gain a further insight into many curious electrical phenomena. Some of these had been investigated mathematically previously, and in most cases the instrument gave a complete verification of the mathematical theory. The author begins by explaining how a periodic wave can be resolved into its harmonics. He then gives many useful mathematical theorems. He proves, for example, the conditions that the current and voltage waves must fulfil in order that the average power expended may equal the product of the effective volts by the effective amperes.

Several methods are given for harmonic analysis. Some of them assume that the function can be expanded in a finite number of sine and cosine terms having frequencies in the ratio of 1, 2, 3, etc. In fact, they give a method of interpolation that was used by Clairaut and Lagrange seventy years before Fourier published his theorem. We doubt whether it is possible to compute the amplitude of the 25th harmonic when the half base is divided into only twenty-six parts and the ordinates measured. Using Lagrange's solution and applying it to a rectangular wave, we find that the computed value of the amplitude of the eleventh ordinate when the half base is divided into twelve equal parts is only one fifth of the true value. Applying Hardy's rule directly to Fourier's solution in this case, the error in the amplitude of the eleventh harmonic found is less than three per cent. We think that by far the best and least laborious method of finding the amplitudes and the phases of the various harmonics is to apply some of the known methods of graphical integration to Fourier's solutions.

### Problems in Electrical Engineering, with Answers

Edited by Prof. S. Parker Smith. Second edition, revised and enlarged. Pp. xiv+210. (London: Constable and Co., Ltd., 1935.) 5*s*. net.

A book containing more than a thousand somewhat difficult problems, the answers to which are all given, represents a great deal of labour. It also shows that, to a first approximation, electrical engineering has become an exact science. This book will be a help to all teachers of electrical engineering, especially in their exercise classes. The students attempt the examples which have been set and the teacher goes round the class and helps them individually. The examples are suitable for a three years college or university course. As a guide to the students, the easier examples are marked with an asterisk. We congratulate the editor on having produced such a useful book.

## Geography

### The Fiord Region of East Greenland

By Louise A. Boyd, with Contributions by J. Harlen Bretz, O. M. Miller, Walter A. Wood, William B. Drew, Charles B. Hitchcock and John K. Wright. (American Geographical Society, Special Publication No. 18.) Pp. xii+369+14 plates. (New York: American Geographical Society, 1935.) 4 dollars.

Miss L. A. Boyd, with the help of the American Geographical Society, organised and led an expedition to the Franz Josef and King Oscar fjord regions of East Greenland in 1933. The primary object was the study of fjord formation. This composite volume gives the important results of the work.

After Miss Boyd's narrative, with much good descriptive work, comes a study of the origin of the fjords by Prof. J. H. Bretz. He finds them to be stream-eroded valleys modified by glacial action, and in only one valley does he find clear evidence of fault action. Post-glacial frost action is very marked but not more on the coast than elsewhere, which possibly may be explained by the constant rising of the land. There is no strand flat in Greenland, but nevertheless Prof. Bretz believes that Nansen's theory of the strand flat formation by the product of wave action and frost action receives some support from Greenland.

The volume contains several new maps, many oceanographical data and a large collection of superb illustrations. A chapter on the botany of the region, as well as Jan Mayen, is important. R. N. R. B.

### World Sugar Production and Consumption: an Economic-Geographical Survey

By Dr. C. J. Robertson. Pp. vii+142. (London: John Bale, Sons and Danielsson, Ltd., 1934.) 5*s*. net.

Dr. Robertson's present association with the International Institute of Agriculture at Rome has ensured an adequate use of statistics in this book whilst his training in the University of London has given it a viewpoint which will render it of considerable value, as a convenient summary, to economists and geographers. After reviewing the general conditions of

cane and beet-sugar production, he treats each major producing area in turn, stressing the variations in unit-yields from one area to another. The huge expansion in consumption which is considered possible could largely be met by increasing the yields in Cuba (2–3 tons per acre) or India to those of Java which have risen from 1·1 to 6·5 tons in the last century. The Indian statistics cease with 1932–33, but the recent expansion is predicted. It is considered that if protection were removed, beet-sugar would practically disappear. L. D. S.

### Europe: a Regional Geography

By Margaret Reid Shackleton. (University Geographical Series.) Pp. xvi+430. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1934.) 15*s*. net.

Behind the freshness of the writing and the sometimes almost casual treatment of a wide field there is evidence of extensive reading, a sympathetic understanding and not infrequently of an acute perception reminiscent of L. W. Lyde at his best. This is not a school book, nor is it an adequate university textbook, but it may be cordially recommended to all who have been accustomed to, and have perhaps tired of, the formal presentation of the facts of European geography and who seek a broader view in the understanding of current problems. Britain is excluded from consideration.

## Mathematics

### The Differential Calculus

By Theodore Chaundy. Pp. xiv+460. (Oxford: Clarendon Press; London: Oxford University Press, 1935.) 35*s*. net.

There has long been a need for a modern English textbook on the advanced parts of differential and integral calculus. The older books were comprehensive in scope, but deficient in rigour; the newer ones give a careful discussion of limits and continuity, but they ignore such topics as Jacobians and maxima and minima of functions of two independent variables. Many years ago, Mr. Chaundy started to write a differential calculus which should combine the English plan with Continental rigour, but in the course of time it has developed into something rather difficult to classify.

The book is intended to be a complete and self-contained treatment of the differential calculus so far as it concerns the real variable, excluding applications to geometry and mechanics. It would have been more convenient to students if the author had abandoned his attempt to be self-contained, an ideal not fully attained, as on p. 14 a rather difficult theorem on limits is quoted from Bromwich's "Infinite Series". The contents of Hardy's "Pure Mathematics" might reasonably have been assumed to be known to every student of higher mathematics; by taking this as a starting point, Mr. Chaundy could have made his book much shorter and cheaper.

There are fourteen chapters, dealing respectively with functional dependence, the continuous function (two), the derived function, higher derivatives, partial differentiation, indeterminate forms, analytic functions, maxima and minima (two), implicit functions, Jacobians and Hessians, differential operators, and expansions in power series. Many parts are of great interest, and some of these contain information difficult to find elsewhere. New terms are introduced, such as "vanishingly uniform convergence", and "umbral derivative", and there are several variations from the orthodox notation, some of which seem to be improvements. There are about four hundred carefully chosen examples, and a detailed index.

### Lectures on Matrices

By J. H. M. Wedderburn. (American Mathematical Society Colloquium Publications, Vol. 17.) Pp. vii+200. (New York: American Mathematical Society; Cambridge: Bowes and Bowes, 1934.) 3 dollars.

The calculus of matrices has had a curious history. It was first used by Hamilton in 1853 under the name of "Linear and Vector Functions". Cayley used the term matrix in 1854, and developed the basic notions of the theory in 1858 without recognising the relation of his work to that of Hamilton. The algebra of matrices was rediscovered by Laguerre in 1867 and by Frobenius in 1878. Sylvester wrote a large number of papers on matrices, especially in the years 1882–84. After this, although the subject was never entirely dropped, it certainly seemed for many years to be regarded as of little interest to mathematicians in general. Then suddenly came a change. In 1925 Heisenberg's quantum mechanics created a widespread interest in matrices among physicists and applied mathematicians. It is significant that in the bibliography given at the end of the book under review, the average number of entries for 1853–1924 is 5·3 a year, rising to 18·3 for the years 1925–33, although the basis of selection has been narrowed for the later years.

Dr. Wedderburn's book is founded on lectures given at Princeton University at various times since 1920. It contains ten chapters, dealing respectively with matrices and vectors, the characteristic equation, invariant factors, vector polynomials, compound matrices, Hermitian matrices, commutative matrices, functions of matrices, automorphic transformations, and linear associative algebras. The subject is treated from the point of view of pure mathematics, without any explicit reference to physics, but some of the topics may easily be recognised as those which are of great importance in quantum mechanics.

### Generalized Hypergeometric Series

By Dr. W. N. Bailey. (Cambridge Tracts in Mathematics and Mathematical Physics, No. 32.) Pp. vi+108. (Cambridge: At the University Press, 1935.) 6*s*. 6*d*. net.

The ordinary hypergeometric series, discussed by Gauss about a century ago, is well known; it is a function of three parameters, of which two occur in the numerator and one in the denominator. In the

generalised series, the number of the parameters in the numerator and denominator may be anything we please. Until comparatively recently, it was difficult to obtain anything like a complete grasp of the scattered work on these series. Cayley, in 1858, published, without proof, a theorem which he had inferred from considerations of planetary theory, and it was not until forty-one years later that a proof was discovered (by W. McF. Orr). Ramanujan rediscovered for himself many results already known but not accessible to him. The first systematic account of the subject was contained in Hardy's paper, "A Chapter from Ramanujan's Note-book" (1923). Since then numerous papers have been published, and at the suggestion of Prof. L. J. Mordell this tract, dealing largely with recent work, has been prepared by Dr. Bailey, who has himself played a leading part in the development of the subject.

At a meeting of the Mathematical Association some years ago a speaker introduced the terms 'purist' and 'fusionist'. Dr. Bailey is evidently a purist, who keeps to the straight and narrow path of his subject, and sternly resists the temptation to stray into attractive cross-roads. As the preface points out, "all parts of the subject, such as asymptotic expansions, which definitely belong to function theory, have been deliberately ignored". It is difficult for a reviewer with fusionist prejudices to approve of this policy, but in all other respects the tract may be commended. H. T. H. P.

## Miscellany

### The Subject Index to Periodicals, 1934

Issued by the Library Association. Pp. xii+283. (London : The Library Association, 1935.) 70*s*.

THE editor, Mr. Rowland Powel, and his voluntary contributors, are to be congratulated on having succeeded in publishing this subject index to the contents of periodicals that appeared in 1934 some six weeks earlier than was the case with the corresponding volume last year.

The entries in the index are taken from 539 English and American, 26 French and Belgian, 21 German and 2 Italian periodicals. In the list of periodicals indexed, fuller bibliographical information is now given, including name and address of the publishers, frequency of publication and price (where possible). It is hoped that these details will enable those who make use of this subject index to procure a copy of any particular paper they may wish to possess.

Since last year, the selection of French and German periodicals indexed has been carefully revised, with the object of making the list more useful and comprehensive.

With few exceptions, no attempt has been made to index periodicals covered by the following publications : *Agricultural Index*, *Engineering Abstracts*, *Engineering Index*, *Index Medicus*, *Journal of the Society of Dyers and Colorists*, *Photographic Abstracts*, *Revue de Géologie*, *Royal Meteorological Society*, *Science Abstracts*, *Textile Institute Journal*.

The fact that this is the ninth year of the publication of this subject index in its present form is evidence that the index is widely recognised as an aid in the difficult process of finding what has already been published on any particular subject. We hope, indeed, that the Library Association will make this index a permanent feature of its activities.

### Fifty Years in Public Health :

a Personal Narrative with Comments. By Sir Arthur Newsholme. Pp. 415+11 plates. (London : George Allen and Unwin, Ltd., 1935.) 15*s*. net.

IN this volume, Sir Arthur Newsholme records his recollections, mainly limited to occurrences bearing on public health, from childhood down to the year 1908, when he was appointed to the Local Government Board, as it then was. This period, covering the time when he was in general practice and later medical officer of health of Brighton, was one of great development in preventive medicine, for it witnessed the growth of the science of bacteriology from the beginning, the institution of important administrative measures in public health, and profound changes in epidemiological theory.

Sir Arthur Newsholme's birthplace and home for many years was the village of Haworth, where the Brontës lived, and of whom he has some stories to tell, for some of his friends had known them, and his father had been the Rev. Patrick Brontë's churchwarden. In his student days at St. Thomas's Hospital, he came under the spell of John Syer Bristowe and Charles Murchison, notable physicians of the period, and was an onlooker on Ord's clinical researches upon myxœdema. Sir Arthur was also a spectator of the introduction of antiseptic surgery, and had the opportunity of contrasting surgical work carried out on old-fashioned lines with Listerian methods ; altogether, his student days happened at a vital transition period of medical practice.

Some of the pioneers in State medicine are next considered—John Simon, Edwin Chadwick, William Farr, Benjamin Ward Richardson and others—and an outline of their work is given. Further on, we find illuminating chapters on the prevention of milk epidemics, and the control of diphtheria, typhoid fever and tuberculosis, and this interesting and inspiring volume concludes with remarks on the care of infancy and childhood, and the control of some of the diseases of the young. The book is illustrated with a number of charts, and with plates of the outstanding figures in preventive medicine of the period. R. T. H.

### This English

By Sir Richard Paget. Pp. xii+118. (London : Kegan Paul and Co., Ltd., 1935.) 4*s*. 6*d*. net.

"GENETIC, as distinguished from a purely historical, philology," says Dr. Marett in his preface to this book, "can never hope to verify its guesses." Yet, as he goes on to add that Sir Richard Paget at the close of a lecture at Oxford was successful in identifying the meaning of fifty per cent of Chinese words in a test, it is evident that if his theory of the origin of language cannot be proved, it has some measure of experimental support, resting on a basis more

substantial than that subjective conviction, which is the best, as a rule, that most theories on this subject can produce.

During the last ten years, Sir Richard Paget has been engaged in elaborating a theory of the origin of language, and in collecting evidence from a wide variety of languages in support of his view that the movements of the tongue in producing certain sounds determine the meaning of the words they compose. To put it rather differently, the movements of the tongue are a variety of the sign language once widely used between primitive peoples and still, or at least until recently, surviving among, for example, the Indians of America. In this book, this principle is applied in some detail to the sounds of spoken English. One example will suffice. The sound *Sp*, corresponding with the motions of mouth and tongue in making it, expresses the meaning of a fine point as in 'spear', 'spin', 'asp' or 'wasp'.

It may be doubted how much of the author's interpretation is subjective, notwithstanding his many striking examples. This feeling grows when it is found that such terms as 'wellington' (boot), 'kit-kat' (picture) and others of a like derivation are found to fall in with the author's theories. He would explain them as a species of philological survival of the fittest.

## Philosophy and Psychology

### On Dreams

By William Archer. Edited by Theodore Besterman. Pp. xv+215. (London: Methuen and Co., Ltd., 1935.) 7*s*. 6*d*. net.

William Archer is best known to us as a very loyal disciple of Henrik Ibsen and the editor of the English edition of his plays. It is therefore interesting to hear his views on dreams. He is not a disciple of Freud—indeed he thoroughly disagrees with a great deal of Freudian doctrine. It is, however, often difficult to accept Freud without being analysed.

To say that Freud is "misled by three influences; first, by a love of sweeping statements, with its correlative hatred of exceptions and reservations; secondly by a very natural tendency to forget that the great mass of his evidence is gathered from more or less brainsick people; thirdly, by an unfortunate obsession, which might very properly be made the subject of study by his own methods" is, we feel, not at all an accurate criticism. We have no evidence that Freud suffers from an obsessional neurosis; if he did, he would have been analysed and cured of it while Archer was still a young man.

The author gives us, among others, chapters dealing with visions and dreams, wish fulfilment, moral sense in dreams, sources of dreams and physically stimulated dreams. He then provides us with more than sixty dreams of his own which are very interesting. Throughout the book we are constantly reminded of the fact that for a layman, however erudite, to attempt to solve psychological problems without years of training in normal and abnormal psychology is little short of sheer waste of time.

### God and Creation: God, a Cosmic Philosophy of Religion

By Prof. John Elof Boodin. Pp. 240. 8*s*. 6*d*. net.

### God and Creation: Three Interpretations of the Universe

By Prof. John Elof Boodin. Pp. 519. 12*s*. 6*d*. net. (New York: The Macmillan Co., 1934.)

With these two volumes, Prof. Boodin's world-philosophy takes shape definitely. His idealism, which has a strong taste of pragmatism in his earlier works, asserts itself more and more in the traditional vein inspired by Plato. The "Three Interpretations of the Universe" is a learned treatise of critical cosmology, while 'God' makes a more direct appeal to reason and the heart, in favour of a comprehensive idealist view of the universe and of Deity. In both works, Prof. Boodin shows a great earnestness of purpose, the more so as he believes that Protestantism will go on decaying theologically, unless it establishes its national foundations on the solid ground of an idealist philosophy. Even one who does not share the philosophical beliefs of the author has to acknowledge with satisfaction the masterly contribution of Prof. Boodin to the solutions of the higher riddles of the universe. T. G.

### L'Année psychologique

Publiée par Prof. Henri Piéron. (Bibliothèque de philosophie contemporaine.) Année 34 (1933). Vol. 1. Pp. xxvii+432. Vol. 2. Pp. 433–1167. (Paris: Félix Alcan, 1934.) 120 francs.

We can do no more than bring to the notice of our readers this important annual publication, which gives a short but most helpful summary of all the works and memoirs on psychology published during the preceding year. The first volume contains also nine original memoirs on various problems of experimental psychology by H. Piéron, R. H. Gault, M. Foucault, C. Durup, R. Dellaert, P. Kucharski, A. Zaganczyk, S. Korngold and A. Lévy.

## Physics

### The Diffraction of Light, X-Rays and Material Particles:

an Introductory Treatment. By Prof. Charles F. Meyer. Pp. xiv+473. (Chicago: University of Chicago Press; London: Cambridge University Press, 1934.) 22*s*. 6*d*. net.

A proper understanding of the principles of diffraction has never been so important to the student of physics as it is at the present time, and, with this in mind, Prof. C. F. Meyer has written a useful introductory work. That portion of the book which deals with the diffraction of light is indeed an excellent example of the treatment of problems in wave optics by the graphical method of the phase-amplitude diagram. Prof. Meyer uses this elegant geometrical method almost exclusively, and succeeds in giving a very lucid, and, within the limits of the method, which in his skilful hands are wide, a very detailed account of the various types of diffraction phenomena.

The sections on the rectilinear propagation of light, and on the Fresnel and Fraunhofer diffraction phenomena follow lines which are on the whole familiar, but they gain greatly from the many excellent diagrams with which they are illustrated. Enough distinction is not, however, made between the diffraction curves giving intensity and amplitude. In several cases, for example in Fig. 83, the amplitude curve is shown as having minima of zero slope at the points of zero amplitude. The slope is as a matter of fact a maximum at these points, and the curve should strictly cross the axis.

About eighty pages are devoted to the diffraction grating, and this section contains much matter, particularly that dealing with the theory of errors of ruling, and of optical ghosts, which has not hitherto been available in a textbook.

One cannot help feeling that in the sections of the book dealing with the diffraction of X-rays and of electrons by crystals the author is less at home than he is with purely optical problems. The treatment so far as it goes is adequate, but the emphasis is not always that which a worker in the subject would have given, and opportunities for bringing out the analogies with optical problems seem sometimes to have been missed. The book, however, can with confidence be recommended to students of optics.

R. W. J.

### A Treatise on Hydromechanics

Part 2 : Hydrodynamics. By A. S. Ramsey. Fourth edition. Pp. xii+415. (London : G. Bell and Sons, Ltd., 1935.) 16*s*. net.

THE influence of aeronautics on the academic hydrodynamics of a 'classical fluid' shows itself in this fourth edition of Part 2 of Ramsey's "Hydromechanics". Thus a chapter on viscosity has been added, as well as a discussion on the relation between circulation and lift of an aerofoil. There is given also some of the work due to Prandtl, Joukowski, Glauert, Jeffreys and others. Although the use of vectors or tensors has been considered and rejected, it might have been wise to follow the example of Maxwell, who in his famous treatise on "Electricity" long ago stated his results in vector form so as to give a clearer physical picture of his mathematical formulæ.

## Technology

### Principles of Phase Diagrams

By J. S. Marsh. (Alloys of Iron Research, Monograph Series.) (Published for the Engineering Foundation.) Pp. xv+193. (New York and London : McGraw-Hill Book Co., Inc., 1935.) 18*s*. net.

THE application of the phase rule to metallic systems sometimes presents difficulties, which, however, would be avoided if the principles laid down by Gibbs were strictly adhered to. A lax interpretation has become common, and it has been thought advisable to include, in a series of books devoted to the technical properties of the alloys of iron, an account of the principles on which phase diagrams are constructed and interpreted. The author has followed Gibbs throughout, and has kept to a strictly thermodynamical treatment, ignoring all questions of atomic arrangement.

The work has been done thoroughly, and the author is at pains to be logical, even at the cost of making some of the chapters rather hard reading for the metallurgist. It is only at the end of the book that any concrete examples are given, and then the ternary system selected, that of iron-carbon-silicon, is an unfortunate one, having been very inadequately studied in the laboratory. The terminology of much writing on metallic phase diagrams being rather loose, the author has suggested one on strictly logical principles. No objection can be taken to it on this ground, but the number of new terms is so large as to make it unlikely that it will be widely adopted. A simpler treatment would have been more helpful, but a careful study of this book will repay itself. In the modern study of alloys, however, changes which can only be accounted for by movements of atoms fall to be considered, such as the ordered-disordered changes in solid solutions and the precipitation of ultra-microscopic particles in age-hardening, and it would be of interest to discuss how far these can be represented in any system of phases.

### Liquid Fuels :

their Manufacture, Properties, Utilisation and Analysis ; a Practical Treatise for Engineers and Chemists. By Harold Moore. Pp. viii+264+4 plates. (London : The Technical Press, Ltd., 1935.) 21*s*. net.

THE book is put forward as a manual for chemists and engineers interested, but not specialists, in the subject of liquid fuels. Mineral oils, shale, tar oil, benzole, alcohol and vegetable oils and their manufacture are briefly described. Their behaviour, singly and admixed, in internal combustion engines is treated in considerable detail, both for engines with spark and compression ignition. Then follows the preparation and use of heavier oils for external combustion, including domestic heating and lighting. The value of the section on analysis and testing is increased by the author's comments on the significance of results of the various tests.

On the technology of coal products, the book is less precise. The author does not indicate the rapid growth of benzole production by gas works now in progress. Indeed, he seems to imply that the practice ceased after the War. On p. 49 he states that the horizontal gas retort tar is the "main source of benzene". Although the 'inhibitor' process is revolutionising the refining of benzole, it does not appear in the index. 'Gas oil' is an important fraction of petroleum, but no indication is given of the requirements of a good oil for carburetting water gas, and its use for this purpose would appear to be subsidiary to that of domestic fuel.

Leaving aside such criticisms, there must be many users and potential users of liquid fuels who need the information in this book, and to them it may be heartily commended.

H. J. H.

# Forthcoming Books of Science

## Agriculture and Horticulture

*Chatto and Windus*—A History of Gardening in Scotland, E. H. M. Cox.

*Faber and Faber, Ltd.*—The Land: Now and Tomorrow, Prof. R. G. Stapledon.

*Macmillan and Co., Ltd.*—Tropical Planting and Gardening, H. F. Macmillan.

*Putnam and Co., Ltd.*—Hardy Bulbs, Lieut.-Col. C. H. Grey.

## Anthropology and Archæology

*Jonathan Cape, Ltd.*—The Source of Civilization, Gerald Heard; We Europeans, Prof. Julian S. Huxley, Dr. A. C. Haddon and Prof. A. M. Carr-Saunders; The Wilderness of Zin, C. L. Woolley and T. E. Lawrence.

*Constable and Co., Ltd.*—Südsee, Dr. A. Bernatzik; Gari-Gari, Dr. A. Bernatzik.

*Cresset Press, Ltd.*—China: a Short Cultural History, G. P. Fitzgerald; Archaic Marble Sculpture from the Acropolis, H. Payne and G. M. Young; The Dream in Primitive Cultures, Dr. J. S. Lincoln.

*Macmillan and Co., Ltd.*—Prehistoric Man in Ireland, C. P. Martin.

*Oxford University Press.*—Human Ecology, Prof. J. W. Bews; Both Sides of Buka Passage, Beatrice Blackwood; Papuans of the Trans-Fly, F. E. Williams; The Aqueducts of Ancient Rome, T. Ashley, edited by I. A. Richmond; Bible and Spade, Dr. S. L. Caiger; Tomb Development, G. A. Reisner.

## Biology

*George Allen and Unwin, Ltd.*—How Animals Develop, C. H. Waddington.

*D. Appleton-Century Co., Inc.*—Snake-Hunter's Holiday, Dr. R. L. Ditmars and W. Bridges.

*Edward Arnold and Co.*—The Oyster and the Oyster Fishery, Prof. J. H. Orton.

*A. and C. Black, Ltd.*—Garden Ponds and Aquaria, W. Cotton; The Wonderland of Common Things, Rosa E. Jones.

*Cambridge University Press.*—The Vitamins in Theory and Practice, L. J. Harris; Order and Life, Dr. Joseph Needham.

*Cassell and Co., Ltd.*—The Living Things Around Us, T. J. S. Rowland; Sea-Gulls in London, Seton Gordon.

*Chatto and Windus.*—A Diary of Thomas Henry Huxley, edited by Prof. Julian Huxley.

*J. M. Dent and Sons, Ltd.*—Birds, Beasts and Pond Life, Eric Fitch Daglish; Plants, Flowers and Insects, Eric Fitch Daglish.

*George G. Harrap and Co., Ltd.*—Over African Jungles, Martin Johnson; Vanishing Wilderness, F. R. La Monte and M. H. Welch; The Book of Animal Life, Thora Stowell; The Book of Zoography, Dr. R. L. Ditmars.

*Hodder and Stoughton, Ltd.*—Wild Life Ways, Harper Cory; Handbook of Botanical Diagrams, Dr. Blodwen Lloyd: Studies in Plant Life, Dr. E. M. Poulton.

*Hutchinson and Co., Ltd.*—Race, Sex and Environment, J. R. de la H. Marett; Practical Zoology, H. R. Hewer.

*Longmans, Green and Co., Ltd.*—Birds and the Sea, Frances Pitt; The Variation of Animals in Nature, G. C. Robson and O. W. Richards.

*McGraw-Hill Publishing Co., Ltd.*—Pollen Grains, R. P. Wodehouse.

*Macmillan and Co., Ltd.*—Intermediate Botany, L. J. F. Brimble; Introductory Biology, E. Stenhouse; Class-Book of Biology, E. Stenhouse.

*Methuen and Co., Ltd.*—A Textbook of Practical Botany, Dr. W. Leach.

*John Murray.*—Heredity and Evolution, A. E. Watkins.

*Thomas Nelson and Sons, Ltd.*—Grey Owl and the Beaver, Harper Cory.

*Ivor Nicholson and Watson, Ltd.*—Life on Shore and Shallow Sea, D. P. Wilson.

*Oliver and Boyd, Ltd.*—A Vertebrate Fauna of Forth, Leonora J. Rintoul and Evelyn V. Baxter.

*Rich and Cowan, Ltd.*—Tropical Fishes and Home Aquaria, A. Morgan.

*George Routledge and Sons, Ltd.*—Health and Human Progress, Dr. R. Sand.

*University Tutorial Press, Ltd.*—Textbook of Biology, E. R. Spratt and A. V. Spratt.

*Ward, Lock and Co., Ltd.*—Ward, Lock's Natural History, edited by Dr. C. Tate Regan.

*Williams and Norgate, Ltd.*—Succulent Plants, H. Jacobsen.

## Chemistry

*Chapman and Hall, Ltd.*—Electrolytic Oxidation and Reduction, Dr. S. Glasstone and Dr. A. Hickling; The Chemistry of Milk, Dr. W. L. Davies; Fluorescence Analysis in Ultra Violet Light, J. A. Radley and Dr. Julius Grant.

*Eyre and Spottiswoode, Ltd.*—The Dictionary of Organic Compounds, vol. 2, edited by Prof. I. M. Heilbron.

*Charles Griffin and Co., Ltd.*—Text-Book of Inorganic Chemistry, vol. 11, part 3, and vol. 6, part 5, edited by Dr. J. Newton Friend.

*Macmillan and Co., Ltd.*—Chemistry for the Higher School Certificate Examination, Prof. T. M. Lowry and A. C. Cavell.

*Methuen and Co., Ltd.*—Flame, O. C. de C. Ellis and Dr. W. A. Kirkby; The Quantum Theory of Valency, W. G. Penney; The Chemistry of Rubber, Prof. H. Freundlich.

*George Routledge and Sons, Ltd.*—Physical Aspects of Organic Chemistry, Dr. W. A. Waters.

## Engineering

*Philip Allan and Co., Ltd.*—Gliding and Soaring, C. H. Latimer-Needham.

*Cassell and Co., Ltd.*—How, Why and When?—Railway Engines, R. B. Way.

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### Geography and Travel

*Cassell and Co., Ltd.*—Sledge, Martin Lindsay.

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### Geology

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### Mathematical and Physical Sciences

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*Cambridge University Press.*—Interpolatory Function Theory, Prof. J. M. Whittaker.

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*McGraw-Hill Publishing Co., Ltd.*—Principles of Metallography, R. S. Williams and V. O. Homerberg; The Metal Iron, H. E. Cleaves and J. G. Thompson.

### Miscellany

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*G. Bell and Sons, Ltd.*—Unsolved Problems of Science, A. W. Haslett.

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*William Heinemann, Ltd.*—The World of Science, F. Sherwood Taylor.

*Macmillan and Co., Ltd.*—Sir Donald Macalister of Tarbet, Lady Macalister, Sir Robert Rait and Sir Norman Walker.

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### Philosophy and Psychology

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*Thornton Butterworth, Ltd.*—Religion and Science, Bertrand Russell.

*Hodder and Stoughton, Ltd.*—The Sub-Normal School Child, vol. 2, Dr. Cyril Burt; Psychology and Practical Life, Prof. J. Drever and Dr. Mary Collins; A Guide to Mental Testing, Dr. R. B. Cattell; Psychology and Modern Problems, J. A. Hadfield.

*John Lane, Ltd.*—The New Road to Progress, S. D. Schmalhausen.

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*Kegan Paul and Co., Ltd.*—The Origins of Love and Hate, Dr. Ian Suttie.

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*Fountain Press, Ltd.*—Practical Infra-Red Photography, Dr. O. Helwich, translated by J. L. Baring; Enlarging and Enlargers of Today, W. Alexander.

*Hutchinson and Co., Ltd.*—Plastic Moulding, L. M. T. Bell.

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*George Routledge and Sons, Ltd.*—Tools of Tomorrow, J. N. Leonard.

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Apparatewesen E.V., held at Königsberg on July 3–5 last, indicate that the object aimed at is the use of raw materials obtained in Germany in the manufacture of German goods. When a suitable material, native to that country, is not available, steps should be taken to enable other materials, found in Germany, to be adapted for the required purpose. Where, however, suitable substitutes cannot be found, investigations should be made with the view of constructing the plant or article using the minimum quantities of imported materials. No details regarding how these objects are to be attained are given, so that unless the original papers are studied, little more than an outline of the subjects considered can be obtained, the motto of the congress being "Nur deutsche Stoffe für deutsche Waren".

### Engineers' Study Group on Economics

THE Engineers' Study Group on Economics is entering its third year of activity, and Sir Richard Gregory has been elected president for the year. The Group consists of six sections investigating the various factors that may help to solve the present paradox of poverty amidst plenty. An analysis of twenty-four existing or proposed social and economic systems, prepared by Section B of the Group, was noticed in NATURE of May 25, 1935, p. 884. Section A, which is investigating the available, the desirable and the potential production of Great Britain, hopes to present a similar report shortly. Scientific workers, not necessarily engineers, willing to help in the application of scientific principles to the urgent problems of the day are welcomed by the Group. The yearly subscription is : minimum 5*s*., maximum £1. Sections meet in the evening at 85 Gloucester Place, W.1. The next group meeting will be at the Guildhouse, Eccleston Square, S.W.1 (Berwick Street entrance), on Tuesday, October 15, at 7 p.m.; Sir Richard Paget will speak on his recent visit to the U.S.S.R. Those wishing to attend should notify the honorary secretary, A. H. Hayes, Hazlitt House, Southampton Buildings, W.C.2 (Tel. : Holborn 1068).

### Tsetse Fly Control

THE report of the East Africa Sub-Committee of the Tsetse Fly Committee, Economic Advisory Council (Cmd. 4951. London : H.M. Stationery Office. 1*s*. net), epitomises many factors bearing upon the problems of human sleeping sickness, as well as of tsetse fly diseases of animals, in Africa. Both diseases are caused by trypanosome parasites and are transmitted by tsetse flies, so that methods for eradication of the flies constitute important preventive measures. The most recent advance in this direction is by means of densification of the vegetation. It has been found that if a patch of tsetse-infested bush is protected from grass fires for several seasons, the growth becomes so dense as to be highly unfavourable to certain species of tsetse, and further investigation on these lines on a large scale is desirable.

### Therapeutic Substances

THE Joint Committee constituted under the Therapeutic Substances Act, 1925, has issued additional regulations dealing with several agents, namely, staphylococcus toxoid, antipneumococcus serums (Types i and ii), staphylococcus antitoxin, gas-gangrene antitoxins and diphtheria prophylactic ("Statutory Rules and Orders 1935, No. 580"). The provisions applicable to these substances, which have now attained definite value in medical practice, include definition and proper name, labelling, quality, strength, and tests of potency, and unit of standardisation.

### Export of British Scientific Instruments to France

CERTAIN kinds of British optical and scientific instruments are subject to special quotas when imported into France. In order to ensure the full benefit of these quotas to British manufacturers, and to prevent the detention of shipments, the French Government has authorised the Scientific Instrument Manufacturers Association of Great Britain to issue certificates to shippers. The instruments to which these certificates apply are as follows :—simple surveying instruments ; dividing machines ; house barometers ; apparatus for physical and chemical demonstration for schools and colleges ; apparatus for physical and chemical researches and analyses ; surveying instruments for geodesy, topography and measurements of angle. More precise information may be obtained from the Secretary, Scientific Instrument Manufacturers Association of Great Britain, Limited, 329 High Holborn, London, W.C.1.

### International Exhibition of Nature Photography

THE Right Hon. the Earl of Onslow, president of the Society for the Preservation of the Fauna of the Empire, will open an International Exhibition of Nature Photography in the Whale Hall of the British Museum (Natural History), South Kensington, on Wednesday, October 16, at 12 noon. The object of the exhibition is to show the advance nature photography has made during recent years ; and the exhibition should be of considerable interest and educational value. It will remain open every day from 10 a.m. until 6 p.m. (Sundays 2.30 p.m. until 6 p.m.) from October 16 to November 30. Admission is free. More than 1,200 photographs of birds and mammals will be shown, including examples from all British Colonies as well as from the United States, Poland, Japan, etc.

### French Congress of Hygiene

THE twenty-second French Congress of Hygiene will be held at the Institut Pasteur, Paris, on October 21–23, when the chief subjects for discussion will be the hygiene and protection of infancy, and will be followed on October 23 by a meeting of the Société de la météorologie médicale, an offshoot of the Société de médecine publique. Further information can be obtained from the general secretary, Dr. Dujarric de la Rivière, Institut Pasteur, rue Dutot, Paris.

### German Pharmacological Society

THE German Pharmacological Society will hold its annual meeting at Munich on October 20–23, when

the following subjects will be discussed: (1) water excretion of mammals and its physiological regulation, introduced by Verney of Cambridge; (2) the problem of the relation between chemical constitution and pharmacological therapeutic action, introduced by Schuleman of Elberfeld; (3) hynotics and basal narcosis, introduced by Weese of Elberfeld, Schön of Leipzig and Frey of Düsseldorf; (4) pharmacology and clinical employment of circulatory stimulants, introduced by Hildebrandt of Giessen and Killian of Freiburg. Further information can be obtained from Prof. Janssen, Pharmacologisches Institut, Freiburg i. B., or the general secretary, Prof. B. Behrens, Dorotheenstrasse 28, Berlin.

## Announcements

THE RIGHT HON. J. RAMSAY MACDONALD will open the Coal Hydrogenation Petrol Plant of Imperial Chemical Industries, Ltd., at Billingham-on-Tees, Durham, on October 15.

AN *Exchange* telegram from Copenhagen states that Prof. Niels Bohr, on his fiftieth birthday on October 7, was handed 100,000 kroner (nearly £4,000), which has been subscribed for among scientific societies in Denmark for the purchase of radium for research.

THE following appointments have recently been made by the Secretary of State for the Colonies: Mr. A. Pickles, to be entomologist, Department of Agriculture, Trinidad; Mr. J. W. Costello, late assistant conservator of forests, to be assistant conservator of forests, Nigeria; Mr. T. A. Strong, deputy conservator of forests, to be conservator of forests, Malaya; Mr. J. G. Watson, conservator of forests, to be deputy director of forests, Malaya.

A BIOCLIMATIC investigation department is to be established at Bad Pyrmont under the direction of Reg. Rat Lossnitzer, of Berlin.

AN institute for the biology of heredity and racial hygiene has been opened at Frankfurt-on-Main under the direction of Prof. Eugen Fischer.

THE King of the Belgians has recently laid the first stone of a cancer institute bearing the name of Jules Bordet, in honour of the former director of the Pasteur Institute of Brussels. The Institute is attached to the new Hôpital St. Pierre, Brussels.

A POWER Farming Conference will be held in Oxford in January next under the auspices of the School of Rural Economy, the Institute for Research in Agricultural Engineering, and the Agricultural Economics Research Institute. The date provisionally fixed for the Conference is January 7–10.

DURING the recent International Congress of the History of Medicine at Madrid, the degree of doctor *honoris causa* was conferred at the ancient University of Alcala en Henares among others on Sir Humphry Rolleston, the British delegate, and Profs. Neuburger of Vienna, Diepgen of Berlin, Laignel-Lavastine of Paris and Sigerist of Johns Hopkins, who occupy the chair of the history of medicine in their respective universities.

BY courtesy of the Compagnie Générale Transatlantique, the Science Museum, South Kensington, has secured the loan of a fine model, more than ten feet in length, of the *Normandie*, the present holder of the Blue Riband of the Atlantic. The *Normandie* has a length of 1,029 ft., beam 119 ft., tonnage 79,280, and turbo-electric machinery developing 160,000 horse-power. Her record-breaking run, New York to Plymouth, was accomplished in 4 days 3 hr. 25 min. at an average speed of 30·31 knots.

MESSRS. A. GALLENKAMP AND CO., LTD. (Technico House, Finsbury Square, London, E.C.2), have issued a revised edition of their catalogue "Apparatus for the Examination of Soil". The list includes the latest patterns and modifications of standard apparatus used in connexion with all types of soil work. Where desirable, directions for use are included, together with the appropriate bibliographical reference, so that direct contact with the scientific origin of the apparatus is possible.

ERRATUM.—In Prof. Karl Pearson's letter on "Statistical Tests" in NATURE of October 5, p. 550, the values of the eccentricities $e$ should have been given in tenths, not hundredths; that is, $e = 0{\cdot}6$, not $0{\cdot}06$. This has no bearing on the argument.

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APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

A research assistant in insect physiology in the Imperial College of Science, South Kensington, S.W.7 (Oct. 15).

A lecturer in mechanical engineering in the Birmingham Central Technical College—The Principal (Oct. 19).

A chemist in the Admiralty Chemical Pool—The Secretary of the Admiralty (C.E. Branch), Whitehall, London, S.W.1 (Oct. 25).

A junior assistant for the Directorate of Explosives Research—The Chief Superintendent, Research Department, Royal Arsenal, Woolwich, S.E.18 (Oct. 26).

A lecturer in mathematics in Goldsmiths' College—The Warden, Goldsmiths' College, New Cross, S.E.14 (Oct. 28).

A lecturer in physics in the University of Cape Town—The Secretary to the High Commissioner for the Union of South Africa, Trafalgar Square, London, W.C.2 (Nov. 5).

A virus physiologist at Rothamsted Experimental Station, Harpenden, Herts—The Secretary (Dec. 15).

An assistant lecturer in agriculture in the Midland Agricultural College, Sutton Bonnington, Loughborough—The Principal.

# Letters to the Editor

*The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 609.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

## Robert Hooke and his Contemporaries

SOME among us, long interested in the life and times of distinguished scientific and literary personalities of the mid-seventeenth century, would fain retain the opinion that Henry Oldenburg was eminently fitted to occupy the special post that was assigned him; moreover, that his very detachment from the realms of experimental adventure and inventiveness actually facilitated and did not invalidate remarkable services, securing freedom, with a responsibility of high order.

Yet we find the reviewer of "The Diary of Robert Hooke" (NATURE, Sept. 7, p. 358) writing as follows: "I, for one, have the impression that he [Oldenburg] was an oblique, intriguing and toadying individual, jealous of Hooke's fame and earnings" (p. 360).

As a possible antidote to the implications of this conclusion, it is opportune to refer readers of NATURE to an article on Henry Oldenburg which appeared in this journal forty-two years ago (November 2, 1893), the author of which had an immediate and close intimacy with relevant documents, though not, it is true, with the lavender entries of an unpublished diary.

It may be found perhaps, on reference thereto, that the epithets "oblique" and "toadying" applied to Oldenburg cannot be sustained except at some sacrifice of historical propriety and appropriate justice.

The circumstance that no portrait of Hooke is extant is probably associated with his fickle physical condition. Certainly, he would have been a most difficult, wayward 'sitter'. We may, however, believe that Evelyn was sorry that Hooke did not occupy a place in that gallery of celebrities in which he himself was so interested. T. E. JAMES.

59, Sharp's Lane,
Ruislip.

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IN his account of the extraordinarily intriguing, human and intimate part of the "Diary of Robert Hooke", published in NATURE of September 7, Prof. Andrade has suggested that the biographer, Richard Waller, "apparently had little personal knowledge of Hooke or his intimates". This may have been the case during the earlier period before 1680, but entries in the later Diaries, which I have recently transcribed and printed, show that Waller and Hooke were fellow members of a coffee-house coterie, that met almost daily at Jonathan's. It was the habit of Hooke to abbreviate the names of his friends, and many were the talks and walks in which Hooke mentions the companionship of "Lod", "Cur", or "Wall", either into the country or to attend book-auctions held in the vicinity. That no official portrait of Hooke was painted for the Royal Society, and that no obituary notice appeared of him in the *Philosophical Transactions*, may be ascribed to the fact that his death was immediately followed by the election of Newton to the presidential chair, and Newton is known to have been unfavourably inclined towards Hooke. The neglect was in part remedied when Waller printed the "Posthumous Works" of Robert Hooke in 1705.

R. T. GUNTHER.

The Old Ashmolean,
Oxford.
Sept. 17.

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MR. JAMES'S letter is of interest as recording that he personally does not agree with my opinion of the character and temperament of Oldenburg, but it has little objective content. In my article I referred briefly to some of the facts on which I base my conclusions: the affair of the watch, where Oldenburg, who had a (secret ?) financial interest in a rival invention, went out of his way to decry Hooke's achievements, and certainly went beyond what he would have known: the undoubted political, although no doubt innocent, correspondence with foreigners, which he denied: the opinion of Sydenham. I may further point out that in his correspondence with Spinoza, extending over the years 1661–76, in which the scientific discoveries of the day are freely discussed, and the names of Boyle and Huygens occur again and again, there is only one reference to Hooke's work (to the "Micrographia", without mention of Hooke's name).

As for the question of jealousy, I am by no means alone in my opinion. To quote but one authority, Prof. More in his recent "Isaac Newton" says, *à propos* of Oldenburg's mischief-making between Newton and Hooke, "The motive for the advice [to Newton] may have been a sincere interest in his friend's welfare, but it was undoubtedly influenced by the evident jealousy which existed between himself and Hooke. As a consequence of his own antipathy, he exaggerated the Curator's [Hooke's] irascibility and gave the impression that matters were worse than they actually were. This time he succeeded." Elsewhere Prof. More has occasion to animadvert on reprehensible activities of Oldenburg.

If Mr. James would show that the points to which I have briefly referred cannot support my view of Oldenburg's character, and would state that there is nothing in the letters to Boyle which can be called toadyism, it would be more to the point than a vague and somewhat offensive insinuation that I have sacrificed historical propriety, and it would then be worth while for me to adduce other support.

The reference to the old article in NATURE (November 2, 1893) is curious. This article was unknown to

me, but on the other hand I am very familiar with the article in the "Dictionary of National Biography", which is from the same hand—that of Mr. Herbert Rix. The latter article, which cites Oldenburg's "peculiar temper", and his draft petition for a patent for Huygens' watch, has contributed to form my unfavourable opinion of Oldenburg's character. It further points out that Oldenburg first enthusiastically urged Spinoza to publish his writings, and afterwards withdrew. I have now read the NATURE article, and do not find that it runs counter to my views. Rix calls Oldenburg "an interesting man who lived in a most interesting period", and opines that without his endeavours, and those of Hooke, the Society would scarcely have held together, with all of which Mr. James and I will both agree. So far as I can see, there is nothing that shows any particular sympathy with Oldenburg's personal character, and Mr. Rix's other article, which was published two years later, and must represent his considered opinion, seems to me definitely unfavourable.

Hooke's character was manifestly imperfect, but he had the excuses of genius and chronic illness, neither of which can be advanced for Oldenburg. I was concerned not so much to estimate Oldenburg, who was, after all, a very second-rate intellect ("His scientific observations were certainly very mixed, many of them trivial, and some of them superstitious," says Mr. Rix), but rather to point out that Hooke had just cause to complain of him. I agree with Prof. More, where he refers to Hooke "showing the contrast of an essentially noble character in large matters with an irritable, suspicious and cynical temperament in the familiar affairs of life", and I am of the opinion that Oldenburg did much to embitter Hooke's character and to bring into prominence his weaker points. If all that can be done to shake my views as to Oldenburg's character is to refer to an article which stresses his undoubted industry and vast correspondence, and to sneer at Hooke's private record as "lavender entries", I shall continue in my error.

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So far as I know, the Diary which Dr. Gunther has transcribed had not been published when I wrote the article in question. This alone is sufficient to account for my not having read it. I may add that Waller himself says "the greater part of my Vouchers have been either taken out of his own Memorials or from the Journals of the Royal Society", and although it is clear from his biography of Hooke that he had spoken with his subject on more than one occasion, there is nothing in it that bespeaks intimacy.

As regards the general question of a portrait, although none has survived, it seems probable from the Diary which I reviewed that one was made, for on October 16, 1674, we read "Mr. Bonust drew picture", and on December 24 of the same year, "The workmen left work did nothing but get together my picture frame". The painter, of whom it is earlier recorded "Mr. Janeway sat for picture to Mr. Bonus", was, according to Mr. Robinson's editorial note, probably Bownest, who painted portraits, principally of dissenting ministers. Perhaps, then, there is a portrait somewhere in existence.

E. N. DA C. ANDRADE.

Physics Laboratory,
University College,
London, W.C.1.
Sept. 21.

## The Meaning of Probability

I SUGGEST that Dr. Dingle's problem in his article in NATURE of September 14, p. 423, is not quite fairly stated. If Ohm's law has been found true in 9,999 cases and found false in one case, and if $P$ who speaks truth once in 10,000 times says *he has found* it true, it is equally probable that he has struck the exceptional case and told the normal lie, or struck the normal case and told the exceptional truth. If this is not immediately clear, it becomes so on considering $10^8$ experiments by $P$, assuming, as is proper, that the exceptional case occurs once in 10,000 times throughout. In this sense, the probability that $P$ has found the law false is one half.

W. BARRETT.

Fuglestemmen,
Layters Way,
Gerrards Cross,
Bucks.
Sept. 16.

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IN his article on 'The Meaning of Probability' in NATURE of September 14, Dr. Dingle has attempted to support his case by means of a striking example. Unfortunately his illustration is by no means happily chosen, and the issue may be further confused by his treatment of it in a way no one is likely to defend. When the truth (by which we do not mean the whole truth and nothing but the truth) of Ohm's law is in question, only evidence arising from experimental investigations is pertinent; no statement, independent of experimental work, by any individual, whatever his habit regarding the truth, is of value. On the data given, the probability that the law will be found to hold in a new experiment is therefore 9,999/10,000.

For the purpose of the discussion, Ohm's law must be replaced by a question in which individual testimony constitutes relevant evidence. If we then waive the debatable point of attaching any value whatever to the statement of so notoriously untruthful an individual, we cannot reach the probability $\frac{1}{2}$ put forward by Dr. Dingle. Each statement, like each experimental inquiry, has to be regarded as a separate item of evidence. In the absence of qualifying evidence, each is to be given equal weight. Dr. Dingle, on the other hand, invites us to regard the combined results of 10,000 experiments as no more than equal in weight to a single statement made by a confirmed liar. It is obvious that we exaggerate the effect of this statement on the probability if we replace it by an additional experiment unfavourable to the law. The probability, then, so far from falling from 9,999/10,000 to $\frac{1}{2}$, certainly does not fall as far as 9,999/10,001. The ratio which would result from the given figures by simple enumeration is, in a suitable problem, 9,999·0001/10,001.

It may be observed that the fractional part of the numerator would not become zero, even if the data were strengthened to the extent that the individual concerned had never been known to tell the truth.

T. SMITH.

National Physical Laboratory,
Teddington.
Sept. 17.

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A SUFFICIENTLY general statement of the problem I was trying to exemplify is as follows:—*If we have two independent sources of information* ($\beta$ *and* $\gamma$) *bearing on the question of the truth or falsehood of a proposition*

(α), *does a combination of* β *and* γ *make a significant contribution to the question?* My answer was, No; Dr. Sterne's was, Yes, because a combination could be found which would give a unique answer. I replied that uniqueness was not enough.

In the *A* and *D* problem and the Ohm's law problem, α, β and γ have the following meanings :—

| | *A* and *D* Problem. | Ohm's Law Problem. |
|---|---|---|
| α | *D*'s remark is true | Ohm's law is true |
| β | *D*'s record | Experiment |
| γ | *A*'s weighted comment | *P*'s weighted comment |

To me these two examples both come fairly within the general case. Mr. Barrett and Mr. Smith, however, appear to challenge this with regard to the second example. I will try to state their objections in terms of the general problem, and show why I believe them to be invalid.

Mr. Barrett's objection is, ultimately, that the two sources of information are not 'independent'. But that is only because he has arbitrarily assumed that *P*'s statement is based on one of the 10,000 experiments. *P*'s statement might have been groundless; he might have 'read about it in the papers' or, in fact, spoken on any ground whatever, *except* that which Mr. Barrett has assumed, for that makes his remark dependent on part of β.

Mr. Smith's objection is that γ is not 'information bearing on the question', because 'only evidence arising from experimental investigations is pertinent'. If he feels this, let him make the harmless supposition that *P* has performed an experiment in secret (outside the National Physical Laboratory, where the 10,000 experiments were made), and that his comment arises from this investigation. Mr. Smith's objection is then met. He will possibly retort that it is not met, because by 'experiment' he meant *experiment*, and not *P*'s report on experiment. If so, I would ask him whether he has personally verified every canonical fact in physics, or whether he has accepted some of those facts on hearsay. I think he must admit the latter alternative, not merely with regard to the statement of the results, but also with regard to the belief that those results were obtained by experiments, and were not invented. He can now dispense with the useless assumption that *P*'s statement is based on experiment, for since he cannot rule out a statement merely because it is hearsay, it makes no difference to his estimate of *P*'s statement, whether or not that statement includes an assertion that *P* has experimented.

I think, however, that what is at the *very* back of Mr. Smith's mind is that we must not allow the assertion of a convicted liar like *P* to affect our evaluation of statements of workers at the N.P.L. and other reputable institutions. In that I agree with him entirely: it is, in fact, just my argument against Dr. Sterne, who wishes to *combine* information from all sources, whereas I wish independent information to be kept independent.

I would summarise the attitudes of Mr. Smith, Dr. Sterne and myself (expressed, I think, rather than really intended, in the first case) to this question, as follows. Mr. Smith maintains that the two pieces of information are independent, but one of them is irrelevant, and he therefore rejects that one entirely. Dr. Sterne, while perhaps admitting that the pieces of information are independent, thinks that since they are both relevant, they can be combined into a unique, significant result. I hold that they are independent and both relevant, and therefore can yield two independent results the relative importance of which, of course, varies with the details of the problem.

If the foregoing analysis is valid, the last two-thirds of Mr. Smith's letter calls for no comment. I am puzzled, however, by his early casual remark that by truth "we do not mean the whole truth and nothing but the truth". I, at least, meant that. Perhaps he is merely asserting that, no matter how many experiments are performed, we do not necessarily *reach* the truth. That is so, of course, or we should not be talking about probabilities, but certainties. But I was assuming (without then or now committing myself to an opinion on this point, for fear of letting loose all the philosophers) what I imagined most readers of NATURE would agree about, namely, that the statement called 'Ohm's law' was true or false independently of our knowledge on the matter.

HERBERT DINGLE.

Imperial College,
London, S.W.7.
Sept. 20.

## Negative Attenuation of Electromagnetic Waves and Sommerfeld's Theory of Ground Absorption

WE have recently measured the attenuation of wireless waves of 160 m. wave-length from a low-power Hartley transmitter installed in our laboratory. Measurements of electric field-strengths for various distances in two definite directions up to a distance of 4,800 m. have been carried out and the results are shown in Fig. 1. The attenuation factor $A$ has been taken as the ratio $E.d./E_0.d_0$, where $E_0$ is the value of the field-strength at a distance $d_0$, which is so near the transmitter that there is no perceptible ground absorption and $E$ is the value of the field-strength at any longer distance $d$. This ratio has been plotted as a function of the distance.

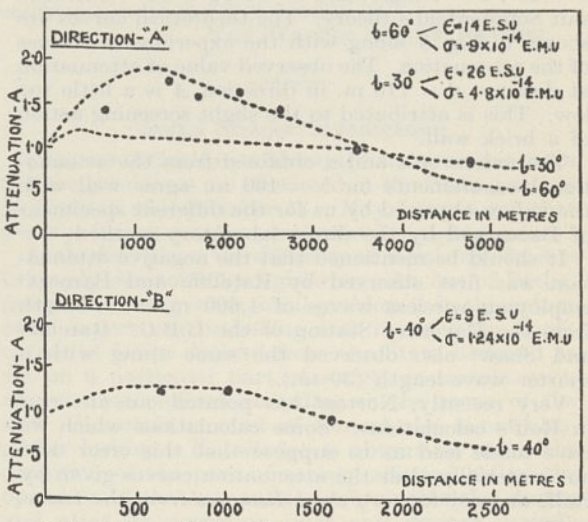


FIG. 1. Relation of attenuation factor to distance from transmitter. Observations, . . . ; theoretical curves, - - -

The results clearly indicate a negative attenuation of the wireless waves. In direction $A$, the attenuation at first rises to a value as high as 1·7 and then it gradually decreases and attains the value of unity at a distance of about 3,200 m. from the transmitter. The attenuation then falls below unity and gradually diminishes with distance in the usual way. In direction $B$, the attenuation rises at first to a value

of about 1·3, and then gradually falls and attains the value of unity at a distance of about 1,440 m. Beyond this, the value becomes less than unity and decreases gradually with the distance.

The negative attenuation, as has been pointed out by Ratcliffe and White[1], is to be expected under certain conditions from Sommerfeld's[2] theory of attenuation. According to Rolf[3], Sommerfeld's expression for attenuation can be represented in terms of only two quantities $q$ and $b$ when the field on the surface of the earth is considered. The quantities involve the electrical conductivity $\sigma$, the dielectric constant $\varepsilon$ of the earth, the wave-length $\lambda$ of the wireless wave, and the distance $d$ from the transmitter.

Rolf has shown

$$\tan b = \frac{\varepsilon + 1}{6\lambda\sigma} \cdot 10^{-15} \text{ and } q = \frac{2\pi \sin b}{(\varepsilon+1)\lambda} \cdot d$$

where distances are expressed in kilometres, $\varepsilon$ in E.S.U. and $\sigma$ in E.M.U. The attenuation curves drawn by Rolf show that for certain values of $b$ there is negative attenuation.

Making use of Rolf's graphs and Sommerfeld's formula in the form given by Rolf and comparing the theoretical values of attenuation with our observed values, we have been able to determine the values of $b$, $\varepsilon$ and $\sigma$ in the two directions for $\lambda = 160$ m. In direction $A$, we find that, up to about 3,500 m., there is agreement between theory and experiment for $b = 60°$, $\varepsilon = 14$ E.S.U. and $\sigma = 0{\cdot}9 \times 10^{-14}$ E.M.U. Beyond this, in the same direction towards the river side we require, $b = 30°$, $\varepsilon = 26$ E.S.U. and $\sigma = 4{\cdot}8 \times 10^{-14}$ E.M.U. for good agreement with Sommerfeld's theory. From the comparatively larger moisture-content of the soil, the lower value of $b$ and the higher values of $\varepsilon$ and $\sigma$ are to be expected in this region. For direction $B$ we have to put $b = 40°$, $\varepsilon = 9$ E.S.U. and $\sigma = 1{\cdot}24 \times 10^{-14}$ E.M.U. to suit Sommerfeld's theory. The theoretical curves are shown in Fig. 1 along with the experimental values of the attenuation. The observed value of attenuation at distance $d = 710$ m. in direction $A$ is a little too low. This is attributed to the slight screening action of a brick wall.

The values of $\varepsilon$ and $\sigma$ obtained from the attenuation measurements for $\lambda = 160$ m. agree well with the values obtained by us for the different specimens of Dacca soil by the direct laboratory method.

It should be mentioned that the negative attenuation was first observed by Ratcliffe and Barnett[4] employing wireless waves of 1,600 m. wave-length from the Daventry Station of the B.B.C. Ratcliffe and Shaw[5] also observed the same thing with a shorter wave-length (30 m.).

Very recently, Norton[6] has pointed out an error in Rolf's calculations. Some calculations which we have made lead us to suppose that this error does not materially alter the attenuation curves given by Rolf, at least for *very short distances* from the transmitter.

S. R. KHASTGIR.
D. N. CHANDHURI.
B. SEN GUPTA.

Physics Laboratory,
Dacca University.
Aug. 19.

[1] Ratcliffe and White, NATURE, **125**, 926; 1930.
[2] Sommerfeld, *Ann. Phys.*, **4**, 28, 665; 1909.
[3] Rolf, *Proc. I.R.E.*, **18**, No. 3, March 1930.
[4] Ratcliffe and Barnett, *Proc. Camb. Phil. Soc.*, **23**, 288.
[5] Ratcliffe and Shaw, NATURE, **124**, 617; 1929.
[6] Norton, NATURE, **135**, 955; 1935.

## Dissociation Energy of Carbon Monoxide and the Heat of Sublimation of Carbon

IN two letters, published in NATURE of June 29, P. Goldfinger, W. Lasareff and B. Rosen have calculated the heat of dissociation of carbon monoxide and afterwards the heat of sublimation of carbon. They obtain their figures from the predissociations of the term $B^1\Sigma$ and the number of observed vibrational levels of the term $A^1\Pi$ of CO. There is, however, still another possibility of determining $D_{(CO)}$ originally suggested by Kaplan[1]. Of each of the two electronic states $b^3\Sigma$ and $b'$, only one vibrational level is known, and this leads to the assumption of a repulsive curve, intersecting the potential curves of these two levels at 10·6 v.e. This value is well between the lower and upper limits (10·4 and 11·07 v.e. respectively) calculated by Goldfinger and Lasareff, but slightly below their final estimated value of $11{\cdot}0 \pm 0{\cdot}1$ v.e.

The repulsive curve which intersects at 10·6 v.e. is then the *lowest* one of all those which involve the level $C(^3P) + O(^3P)$ of the separated system, and in an earlier publication[2] we have, therefore, taken the slightly lower value of 10·45 v.e. as that of $D_{(CO)}$ which leads to a value of 155·7 kcal./mol. for the heat of sublimation of carbon (β-graphite) at 25° C.

The value of 10·45 v.e. for $D_{(CO)}$ may be confirmed in the following way. The level $B^1\Sigma$ lies at 10·72 v.e.; linear extrapolation yields a value of its energy of dissociation of 2·94 v.e., which is not necessarily correct, but is certainly an upper limit of it. This value is based on the value of the enharmonic constant of 50 cm.$^{-1}$, which is not certain; it appears that this value is the lower limit for the enharmonic constant, the other possible value being 76 cm.$^{-1}$. Since this level cannot be correlated to the level $C(^3P) + O(^3P)$, and since it certainly involves a level of the separated system with equal multiplicity of the two atoms, it has to be correlated to the level $C(^1D) + O(^1D)$. The two energies of excitation of $C$ and $O$ are together 3·21 v.e., giving an upper limit of $D_{(CO)}$ of $10{\cdot}72 + 2{\cdot}94 - 3{\cdot}21 = 10{\cdot}45$ v.e.

H. LESSHEIM.
R. SAMUEL.

Muslim University,
Aligarh.

[1] J. Kaplan, *Phys. Rev.*, **37**, 1406; 1931.
[2] H. Lessheim and R. Samuel, *Proc. Phys. Soc. Lond.*, **46**, 523; 1934.

## Oxygen in the Sun's Chromosphere

PHOTOGRAPHS which I have taken at the Kodaikanal Observatory show that oxygen is a normal constituent of the sun's chromosphere, and is probably in great abundance.

Placing the slit of a spectrograph tangentially to the image of the sun's limb, I have found that the infra-red triplet of oxygen, λλ 7771, 7774 and 7775, shows as emission lines in the sun's chromosphere. This is not a unique appearance in one photograph only, for the reversal of the oxygen triplet into bright lines has been photographed every day since it was first observed.

Fig. 1 is a microphotometric record of one of my photographs taken on August 23, and clearly shows the oxygen lines as emission lines brighter than the continuous spectrum from the sky, compared with the neighbouring Fe and Ni absorption lines in the sky spectrum. When the chromosphere is not on

the slit, the sky spectrum, of course, shows the oxygen lines as absorption lines.

From the length of the emission lines as seen in my photographs with a straight slit tangential to the sun's limb, the greatest height reached by oxygen in the chromosphere is deduced to be 3·5″; but since the limb of the sun is probably a little distance from the slit at its nearest point (in order to avoid the risk of photospheric light entering the spectrograph) this is very likely an underestimate. In eclipse photographs, it is to be expected that the oxygen lines will extend to greater heights than this.

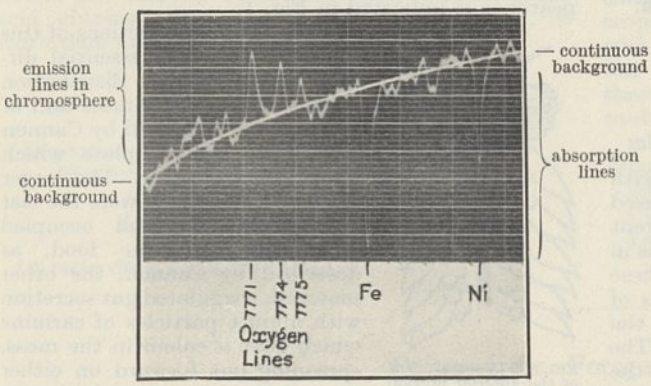


FIG. 1.

The presence of oxygen in the chromosphere, in addition to the previously known presence of H, He and Ca+, is of importance for the theory of support of the chromosphere. This question is more fully discussed, together with details of the observations, in *Kodaikanal Observatory Bulletin* No. 107 which will appear shortly.

T. ROYDS.

Kodaikanal Observatory,
South India.
Aug. 29.

## Records of Fatalities from Falling Meteorites

WITH reference to the remark in NATURE of July 27, p. 128, in a notice of Prof. Heide's "Kleine Meteoritenkunde" that "it is reassuring to find that there is no certain evidence of any person having been killed by a falling meteorite", may I direct attention to the following:

(1) Humboldt in his "Cosmos", vol. 1 (English translation by E. C. Otté. London, Bohn, 1849, p. 124), writes: "Several persons had been struck dead by stones falling from heaven, as for instance, a monk at Crema on September 4, 1511; another monk at Milan in 1650 and two Swedish sailors on board-ship in 1674".

(2) T. L. Phipson, in his "Meteors, Aerolites and Falling Stars" (p. 85) (London: Lovell Reeve, 1867), also mentions these incidents and describes particularly the Crema incident at great length, as the result of a meteoric shower, citing "The Commentary" of Surius, a Carthusian monk of Cologne, "De Rerum Varietate" of Jerome Cardan, and "Opus Epistolarum" of Petrus Martyr; and adds that "birds, sheep and even some fish were killed by the shower".

Prof. H. H. Nininger, secretary of the Society for Research on Meteorites, in his book "Our Stone-pelted Planet" (The Riverside Press, Cambridge, U.S.A., 1933), chapter xvii, "Danger from Falling Meteorites", refers to a man being wounded by the fall of a meteorite at Mhow, U.P., India, on February 16, 1827, and to another being stunned by the concussion from a meteorite which fell at Nedagolla, Madras, on January 23, 1870. The cases cited by Humboldt are not mentioned in this book, possibly because no specimens from these falls are preserved or are identifiable at present.

*Ward's Bulletin* (vol. 3, Nos. 1 and 2, October and December 1934, Rochester, U.S.A.) invited correspondence on the subject of 'homicidal' and 'man-killing' meteorites, but the accounts of alleged recent incidents received from correspondents either did not stand the test of accurate inquiry or were much too vague to call for an investigation.

There are several accounts of narrow escapes, some of which are mentioned in Nininger's book above referred to. I may mention one from the shower of September 29, 1928, near Naoki, Hyderabad, Deccan, described in the *Journal of the Osmania University College, Hyderabad*, vol. 1, No. 2; 1934, in which an aerolite is reported to have fallen "only twelve paces" from a shepherd at Kawagam.

MOHD. A. R. KHAN.

Begumpet, Deccan,
N.S.R., India.
Aug. 29.

MOST of the cases referred to in the above letter are mentioned in Prof. Heide's book along with several others; unless the two Indian cases quoted by Mr. Khan are better substantiated than the others I must prefer to accept Prof. Heide's statement that "noch kein einziger, sicher beglaubigter Fall ist vorgekommen, dass ein Mensch von einem Meteoriten erschlagen oder verletzt worden ist".

THE WRITER OF THE REVIEW.

## Social Science Investigation

CERTAIN difficulties with regard to investigation in the social sciences are discussed in the leading article in NATURE of September 14. May I point out that perhaps these are not so great as at first sight appears?

In the first place, the difficulty of social experiments is largely overcome by legislation. An Act of Parliament concerning some social problem is in the nature of an experiment in dealing with it: it is the application of forces derived from the State designed to act on a particular part of society in certain ways more or less defined according to the terms of the Act. A certain amount of control also is not altogether lacking. Knowledge is obtainable as to the condition of the part of society affected before the operation of the Act, and it is obtainable also during and after its operation over any desired period; while the changes which are thus disclosed may frequently be connected with the Act in the relationship of cause and effect. Further information, too, is to be had in many cases where legislation on similar lines has taken place in our own past history, or in the history of other countries, and something may be learned regarding the effects produced in such cases.

We may take it as tolerably certain, however, that the changes effected in society by an Act of

Parliament are seldom confined to that part which it was designed to affect: it is bound to have its repercussions for good or for harm in all parts of society. It would be in tracing these ulterior effects where the skill of the investigator would perhaps be most taxed, since they call for knowledge of, and insight into, social structures and functions which few seem to possess.

I may add that Herbert Spencer's "Descriptive Sociology" (recently completed, I believe) is a work designed to supply the sociologist with facts concerning societies at large which should be useful in formulating the first principles of the science.

ALAN BLAIR.

Meir, Stoke-on-Trent.
Sept. 23.

## Function of the Labral Glands in *Chirocephalus*

THE possible connexion of the labral glands with the feeding process in *Chirocephalus* has aroused considerable controversy (see Cannon[1]). Current work on the function of the numerous body glands in this animal leads us to the conclusion that these have the same function as the tegumental glands of the Decapoda (Yonge[2]), that is, the formation of the outer, cuticular portion, of the integument. The labral glands have essentially the same structure as the body glands and we have increasing evidence that they have the same function. We are therefore interested in the claim recently made by Cannon[1] that he has identified the secretion of the labral glands. He has directed attention to the presence in sections of an amorphous mass on either side of the labrum, over the ventral food groove and also throughout the gut, which stains with anilin blue. A very detailed study of the arrangement of this has led him to the conclusion that this must all be formed by the labral glands.

We find a number of *a priori* reasons for opposing this.

(1) The very great amount of this staining mass compared with the very small size of the glands, added to the fact that it must be poured out continuously because it is passed into the gut which, apart from the food, it fills.

(2) The difficulty of reconciling the presence of the mass outside, which Cannon claims is semi-coagulated, with the rapid movement of the appendages.

(3) The fact that multicellular glands present in the labral region in all 'Malacostraca' are certainly tegumental glands producing cuticle the presence of which is equally vital to all Crustacea.

(4) Where there is definite evidence as to the nature of the secretion of the unicellular dermal glands of the 'Entomostraca', for example, cement glands of Cirripedes, uterine glands of *Chirocephalus* (Yonge[3]), this is of the same nature as the secretion of the multicellular glands of the 'Malacostraca', for example, tegumental glands of *Homarus* (Yonge[2]), cement glands of *Homarus* (Yonge[3]), glands in statocyst of *Homarus* (Lang and Yonge[4]), nest-forming glands of *Amphithoe* (unpublished work), namely a substance of low surface tension which sets as a *hard cement* on contact with water. All the unicellular glands of the 'Entomostraca', including the labral glands, have essentially the same structure.

We have an alternative explanation as to the origin of the mass described by Cannon. This was suggested by the fact that antiperistalsis is of normal occurrence in the Crustacea. A *Chirocephalus* was kept overnight in a suspension of carmine. The gut was then red throughout and the animal was transferred to several changes of fresh water until no trace of carmine remained outside the body. It was then fixed in Bouin and observed at the same time under the binocular microscope. A series of antiperistaltic waves of contraction passed along the gut and about half the contents of the gut were regurgitated passing out of the mouth as a semi-coagulated mass which flowed forward on either side of the labrum and backward down the ventral food groove. The final appearance is indicated in Fig. 1.

FIG. 1. Ventral view of the anterior portion of *Chirocephalus* after feeding with carmine and fixation. Regurgitated mass stippled.

Examination of sections of this animal revealed no essential difference between the distribution of this regurgitated mass and of the material described by Cannon and shown in the plate which illustrates his paper. The larger particles of carmine were the last to be extruded and occupied the position of the food, as described by Cannon, the other material, coagulated gut secretion with minute particles of carmine which gave it colour in the mass, spreading out forward on either side of the labrum and also in and below the food groove posteriorly.

We feel justified in claiming that the association of the labral glands with feeding has not been conclusively demonstrated. Prof. Cannon, with whom one of us (C.M.Y.) has had a very pleasant correspondence on this matter, is not entirely convinced by our arguments or experiments. One reason for publishing this letter is the hope that it may induce some third party, not previously committed to a belief in the secretion of the labral glands as either concerned with feeding or with the formation of the cuticle, to undertake a further study of the origin of this amorphous mass.

K. W. NICHOLSON.
C. M. YONGE.

Department of Zoology,
University,
Bristol.

[1] Cannon, *Proc. Roy. Soc.*, B, **117**, 455; 1935.
[2] Yonge, *Proc. Roy. Soc.*, B, **111**, 298; 1932.
[3] Yonge, NATURE, **136**, 67; 1935.
[4] Lang and Yonge, *J. Mar. Biol. Assoc.*, **20**, 333; 1935.

## Multiplanar Cyclohexane Rings

WITH reference to the letter of Dr. Qudrat-i-Khuda in NATURE of August 24, we wish to state that in this laboratory, the synthesis of the 1-carboxy-4-methyl-*cyclo*hexane-1-acetic acids from the dicyano ester prepared from 4-methyl*cyclo*hexanone by Higson and Thorpe's method, led only to a pair of isomerides melting at 137° and 173° respectively. These acids proved identical with the acids previously obtained by oxidation of the isomeric α-keto-4-methyl*cyclo*hexane-1:1-diacetic acids with hydrogen peroxide.

Since the remaining two isomerides described by Dr. Qudrat-i-Khuda were at no time encountered in

this synthesis, it was decided to repeat this work. The acids described as (*A*), (*B*) and (*C*) were isolated in accordance with this author's directions[1], but no trace of the fourth isomer could be obtained. The acids (*A*) and (*C*) proved identical with the two acids obtained by Higson and Thorpe's method, but the third isomer (*B*) was actually a mixture of (*A*) and (*C*). We thus arrived independently at the conclusion of Goldschmidt and Grafinger, that there are only two stereoisomeric forms of 1-carboxy-4-methyl*cyclo*hexane-1-acetic acid.

It may be added that we have been unable to isolate the carboxy-3:3-dimethyl*cyclo*hexane-1-acetic acid obtained from 3:3-dimethyl*cyclo*hexanone, in more than one form.

R. D. DESAI.
R. F. HUNTER.

Department of Chemistry,
Muslim University,
Aligarh.
Sept. 20.

[1] *J. Indian Chem. Soc.*, **8**, 277; 1931.

## Spectrum Analysis

THE term 'spectrum analysis' was originally used to denote the analysis of substances by means of their spectra, and it would probably still be interpreted in this sense by most experimental spectroscopists. To those not accustomed to this usage, however, it seems to connote the analysis of the structure of a spectrum, for example, its resolution into series or multiplets.

Might it not be well to abandon the term 'spectrum analysis' and substitute one free from this ambiguity?

Prof. E. N. da C. Andrade suggests 'spectrochemical analysis' and Prof. W. E. Curtis 'spectroscopic analysis'. For the time being, those associated with me here will endeavour to use the former phrase, but I should be glad, as doubtless would others, if through the medium of your pages other opinions could be brought to light for our guidance.

F. TWYMAN.

Adam Hilger, Ltd.,
98 Kings Road,
Camden Road,
London, N.W.1.
Sept. 19.

## Points from Foregoing Letters

THE reviewer of "The Diary of Robert Hooke" is criticised by Mr. T. E. James for his description of Henry Oldenburg as an "oblique, intriguing and toadying individual". Mr. James ascribes the absence of Hooke's portrait in the Royal Society to Hooke's "fickle physical condition" probably making him a difficult 'sitter'. Dr. R. T. Gunther complains of the statement that the biographer, Richard Waller, "apparently had little personal knowledge of Hooke", and points to the recently published later diaries, which indicate that Waller was frequently in the company of Hooke. The reviewer, Prof. E. N. da C. Andrade, gives some of the historical evidence upon which he has based his unfavourable opinion of Oldenburg and asks for counter-evidence. He directs attention to diary entries which suggest that a painting of Hooke by "Bonust" may perhaps be in existence.

Dr. Dingle has distinguished three aspects of probability: (i) the ordinary everyday aspect or 'likelihood' (such as the odds in betting on a horse race), usually the result of instinctive evaluation rather than of calculation; (ii) the physicist's probability, measured from past events (the favourite wins once in ten times); (iii) the mathematically derived 'chance' of future occurrences derived by combining data from independent sources such as (i) and (ii). Dr. Dingle has called the probability calculated in this way a symbolical function, meaningless from the operational point of view. W. Barrett and T. Smith take exception to the reasoning in one example adduced by Dr. Dingle to illustrate his view. Dr. Dingle restates his case in general terms and points out that the objections raised are due to misunderstandings.

Graphs indicating first a rise and then a decrease in the attenuation of radio waves in two definite directions up to a distance of 4,800 m. are submitted by Dr. S. R. Khastgir, D. N. Chandhuri and B. Sen Gupta. The authors point out that the experimental results can be accurately accommodated by Sommerfeld's formula, making use of Rolf's graphs, by giving to the two main constants values agreeing with laboratory determinations of the dielectric constants and electrical conductivities of soils of varying moisture content.

From spectroscopic and quantum-mechanical considerations, H. Lessheim and Prof. R. Samuel calculate the heat of dissociation of carbon monoxide (by Kaplan's method) and find a somewhat lower value, 10·45 v.e., than that recently calculated by Goldfinger, Lasareff and Rosen in a different manner. The corresponding heat of sublimation of carbon comes to 155·7 k.cal./mol. at 25° C.

The presence of oxygen in the sun's chromosphere up to a height of 3·5″ or more has been observed by T. Royds by means of a spectrograph. The infra-red oxygen spectrum lines, 7771, 7774, 7775, are clearly recorded.

Referring to a recent leading article in NATURE, in which the various factors needed for the development of a social science were discussed, Alan Blair points out that Acts of Parliament are equivalent to social experiments; although perfect 'controls' to such experiments are lacking, one may compare the effects produced with conditions before the passage of such Acts and with the effect of similar laws elsewhere.

Prof. Cannon, by staining with anilin blue a specimen of the fairy-shrimp, *Chirocephalus*, has observed an amorphous mass on either side of the upper border covering the mouth (labrum) over the ventral food groove, and has concluded that it was secreted by the labral glands. Miss K. W. Nicholson and Prof. C. M. Yonge, who believe that the labral glands have nothing to do with feeding but are effective in the formation of the cuticle, report an experiment in which a *Chirocephalus* was fed a suspension of carmine. After fixation, an amorphous mass similar to that observed by Cannon but due merely to the regurgitated contents of the gut was noted.

# Research Items

## Early Man in Palestine

EARLY man in Palestine was the subject of a report and of communications from Miss D. A. E. Garrod, Sir Arthur Keith and Mr. T. D. McCown in Section H (Anthropology) at the Norwich meeting of the British Association. Miss Garrod's excavations in caves on Mt. Carmel on behalf of the Association's committee in 1934 carried further the excavation of Tabun ("The Oven") with the object of exposing bed-rock over as large an area as possible. Further finds of animal bones now give a very good idea of the fauna of the Acheuleo-Mousterian period. Both rhinoceros and hippopotamus confirm previous indications of a warm, damp period. A new and important find was a large portion of the tusk of an elephant, the first Pleistocene elephant to be discovered in the Near East. In the artefacts the typological divisions noted in the previous year were much less marked. A steep slope of the rock and its overlying deposits complicated excavation. It became clear that this slope ended in a swallow-hole, into which the deposits had subsided. As complete excavation of the swallow-hole would be costly and lengthy, further examination was abandoned, and the excavation of the Tabun may now be regarded as complete. In the report on the remains of Mousterian man in Palestine, Miss Garrod, dealing with the culture of the people of the caves of Wady Mughara, concluded that the association of skeletal remains with implements of Levallois type and the fauna of a warm, moist climate, as contrasted with the temperate woodland fauna of later Mousterian levels, indicated that they belonged to the end of the Riss-Würm interglacial, approximately contemporary with the Ehringsdorf and Tauback remains. Sir Arthur Keith and Mr. McCown dealing with the skeletal material, both complete and fragmentary, concluded that their anatomy pointed to a variant form of Neanderthal man, which exhibits features comparable with those of the more primitive races of modern man.

## Psychology of Attention

THE *Human Factor* (**9**, Nos. 7 and 8) has an article by Mr. Ivor Benson on attention problems in the judging of newspaper literary competitions. The author describes the work of the adjudicators, and points to it as an open field of research for industrial psychologists. It offers what is perhaps a unique opportunity for studying the problem of attention among intelligent, imaginative workers. The circumstances of adjudicating necessitate the close control of material and output which is essential to psychological investigation, but can seldom be imposed upon workers of this kind. In performing a given task, the greatest possible sensitiveness, speed and accuracy must be maintained by the adjudicator at a constant level for as long as 7½ hours. The degree of efficiency varies from day to day, both collectively and among the individual workers. In the office tested, it was found that the root cause of inefficiency was emotional disturbance. Sensory distractions were unnoticed so long as the adjudicators were in a cheerful mood, but when they were gloomy they exaggerated sounds and movements and were disturbed by them. Fear and the sense of insecurity that followed a reprimand had also an inhibiting effect, and caused them to slacken their speed in over-anxious concentration.

## Sperms of Freshwater Ostracods

THE remarkable spermatozoa of certain small freshwater ostracods are known to attain a length of 6 mm., that is, ten times the length of the adult ostracod. A. G. Lowndes (*Proc. Zool. Soc.*, London, Part 1, 1935) records the results of his observations on the spermatozoa of certain British ostracods with particular reference to their motility. He points out that motile sperms can be obtained only from the spermatheca of a female specimen, and that comparatively few females ever contain sperms, because parthenogenetic reproduction is prevalent. All attempts to obtain motile sperms from males were unsuccessful. Each sperm consists of a long thin pointed part which the author has observed to be anterior in movement, and a thicker cylindrical portion—the flagellum ; Retzius and other previous observers regarded the thicker portion as anterior. Mr. Lowndes states that ripe eggs placed in a drop of fluid containing sperms are not attractive to the sperms ; the entry of the sperm into the egg has never been described in ostracods. The thin anterior part of the sperm appears as a long central rod with a thin hyaline band twisted round it, and at its tip a small rounded knob, suggesting an acrosome. The flagellum has the appearance of a twisted cable, as there are two spiral bands. Throughout the entire length of the sperm is a central spiral thread, which in the flagellum is twisted round an axial strand. The sperm is enveloped in a thin hyaline membrane. Definite information as to the nature of the nucleus is lacking. Three kinds of movement of the sperm are described—rotation, undulation and ripple movement. The author points out that in many species of ostracods males are unknown, but the spermathecal ducts are present in the females, and there is no evidence that they are undergoing reduction. He regards the highly complicated copulatory apparatus and the abnormal sperms as having ceased to have any real function.

## Watermark Disease of the Cricket-Bat Willow

DR. W. J. DOWSON described a serious disease of *Salix cærulea*, the cricket-bat willow, to the members of Section K (Botany) at the Norwich meeting of the British Association. The malady causes death of the tops, induces a greyish stain or watermark in the wood, and in all is responsible for a loss of something like £150,000 to the growers in Essex. Mr. Day, of Oxford, originally named the causal organism *Bacterium salicis*, but Miss Lindeijer, working in Holland, obtained a slightly different pathogen, which she named *Pseudomonas saliciperda*. Dr. Dowson now confirms Day's naming, so far as the disease in Essex is concerned, though a harmless organism with all the characters of *P. saliciperda* has also been found. Control measures suggested were mainly concerned with the extension of legislation to prevent spread of the disease.

### Dating of Scottish Varved Clays

MEASUREMENTS made by Dr. J. B. Simpson of fifty-nine varves in a deposit near Dunning in the Earn valley south-west of Perth form the basis of an attempt by Baron De Geer to fix their absolute age (*Proc. Roy. Soc. Edin.*, **55**, 23; 1935). After a systematic comparison, De Geer has succeeded in matching the thickness-variation diagram of the varves with that of a series from the neighbourhood of Copenhagen. This indicates that the Dunning varves represent the years 4313–4371 before the zero year of the Ice Age, which itself occurred about 8,700 years before our century. Thus the measured varves were deposited during the earlier part of the Goti-glacial sub-epoch when the Scandinavian land-ice still filled the whole of the Baltic depression. That the varved clays near Perth are often moraine-covered may be explained by oscillations of the ice-border during its recession. Further measurements are necessary to determine whether varve-deposition was going on during the extension or the recession of the ice-border.

### Natural Gas Conservation

THE trend of chemical research to-day indicates that, quite apart from its particular and well-known function in the production of oil, there is a wide field of usefulness for natural gas as a basic raw material in the manufacture of dyestuffs, solvents, anæsthetics, etc. Its conservation, therefore, is of paramount importance. Gas found in intimate association with commercial accumulations of oil has for some time past been conserved, so far as economically practicable, and a wealth of literature has emanated on this aspect of the subject. Mr. C. T. Barber, in his work on "The Natural Gas Resources of Burma" (*Mem. Geol. Surv. India*, **66**, part 1, 1935), takes a less familiar point of view, and stresses the importance of conservation of gas not found in association with oil. Of the vast natural gas resources of Burma, he points out, a considerable proportion is not in intimate association with commercial accumulations of oil. Some of this actually occurs in structures not containing, or not known to contain, oil, while some is found either as free gas in the crestal portions of oil-bearing sands or in non-oil-bearing beds in structures yielding oil from other horizons. In addition to problems of gas conservation, Mr. Barber's work includes a brief outline of the Tertiary geology of Burma, and detailed accounts of the principal natural gas fields, their geographical situation, stratigraphy, and approximate production. Useful maps and an up-to-date bibliography complete this latest work on natural gas in Burma.

### Magnetic Testing of 'Work-Hardening' Steel Wires

THE testing of the steel wires used in colliery 'winding' and 'haulage' is of great importance. It is well known that the so-called 'work-hardening' of a wire rope is as great a menace to its safety as the actual mechanical fracture of a group of the component wires of a rope. In a paper which appeared in the *Engineer* of September 13, Dr. T. F. Wall, of the University of Sheffield, points out that only to measure the elasticity of the wires is not a sufficient criterion of their condition. Another characteristic quantity of the greatest importance is the viscosity of the metal forming the wires. There appears to be two kinds of viscosity, one associated with simple longitudinal stresses and the other type associated with a travelling surge of stress in the wire. Dr. Wall describes two electromagnetic methods. The first uses the magneto-striction effect for measuring Young's modulus for a wire by means of longitudinal vibrations. The other is to measure directly the speed at which a surge of stress travels along the wire. Experiments show that the former method provides a very sensitive means for detecting small effects of magnetic loading which cannot be detected in any other way. Work-hardening results in a relatively greater magnetic response to small stresses and a relatively smaller magnetic response to large stresses. The second method measures the velocity of a surge stress by passing the wire through several solenoids connected in series and at the centre of each of which is a search coil connected with an oscillograph. Oscillograms are taken with different magnetising forces and the one which shows that the magnitude of the induced E.M.F. in the search coils varies logarithmically gives the rate of decay of the surge itself. Knowing the velocity of the surge, Young's modulus can be found.

### Activity Coefficients from Electromotive Forces

THE electromotive force of a cell containing two solutions of a uni-univalent salt at different concentrations is given by the equation $E = -(2tRT/F)\log(a_1/a_2)$, where $t$ is the transport number and $a$ activity. When, as is usually the case, $t$ is a function of concentration, this must be replaced by $E = -(2RT/F)\int t.d\log a$, the integration being over the range of concentrations used. This equation has been used to find transport numbers, but now that accurate values of the latter are known, it can, as A. S. Brown and D. A. MacInnes (*J. Amer. Chem. Soc.*, **57**, 1356; 1935) show, be used in the determination of activities. The potential is known to be very reproducible and independent of the method of formation of the liquid junction, and this has been further confirmed by measurements with sodium chloride solutions. The electrodes were of silver and silver chloride. If the activity is expressed as the product of concentration ($c$) and activity coefficient ($f$), the values of the latter can be very well represented by Hückel's equation: $\log f = -\alpha\sqrt{c}/(1+\beta\sqrt{c}) + Dc$, where $\alpha$, $\beta$ and $D$ are constants. It was, however, necessary to change the theoretical value of $\beta$ from 1·463, as obtained by extrapolation at high dilutions, to 1·315. The value 1·463 corresponds with a 'distance of closest approach' of the ions of 4·45 A., which is sufficiently large to make the higher terms in the extended theory of Gronwall, La Mer and Sandved negligible. The equation proposed by Hitchcock, $-\log f = \alpha\sqrt{c} - Bc$, did not give satisfactory results. Harned and Nims have published results for activity coefficients of sodium chloride obtained with amalgam cells not involving liquid junctions, and these fall on the same curve as the present ones if they are adjusted so as to coincide at 0·1 $N$ concentration. The values of the Hückel constants found by Harned and Nims for the more concentrated solutions used do not, however, agree with those found with dilute solutions by Brown and MacInnes, whose results extend to 0·05 $N$.

ERRATUM. In the paragraph entitled "Structure of Keratin" (NATURE, Oct. 5, p. 557, lines 21 and 22), for "were respectively normal and parallel to the flat surface" read "were respectively parallel and normal to the flat surface".

# Sixth International Botanical Congress

## AMSTERDAM MEETING

ABOUT nine hundred members, including delegates from more than fifty countries, attended the sixth International Botanical Congress at Amsterdam in the first week in September. The much-regretted death of Prof. F. A. F. C. Went had, a few weeks previously, deprived the Congress of its president. His place was taken by Prof. J. C. Schoute, who, in welcoming the members at the opening meeting, referred to the great loss to botany and to their regret that the directing hand had been unable to carry the work to completion.

The papers in the various sections were given by invitation of the executive committee, and were grouped under headings. A great variety of subjects were included, of special and general interest, the latter often affording combined meetings with other sections. Thus the evolution of angiosperms interested palæobotany and taxonomy, flower morphology attracted taxonomists as well as morphologists, and "Taxonomy and Genetics" had an obvious dual interest. Joint discussions were indicated between cytology and genetics, between each of these and mycology, between agronomy and phytopathology or physiology and so on. The programme, a marvel of condensation in three languages, informed members as to subject, date and place of meeting, and a volume of abstracts of the papers provided a useful handbook. Members interested in special studies found opportunity for informal meeting and discussion.

The Nomenclature Section of Taxonomy, under the presidency of Dr. Merrill, worked through a series of proposals, the main purpose of which was to clarify points, where desirable, in the recent edition of the "Rules of Nomenclature". Certain additions suggested by the palæobotanists to meet difficulties, arising especially from the fragmentary character of the material, were accepted.

An admirable "History of Botany in the Netherlands" had been prepared by the senior secretary, Dr. M. J. Sirks, and a pamphlet by Prof. Leeuw described in detail the Netherlands as an environment for plant life.

Linnæus was a student at Leyden, and his early botanical work was done in Holland. The bicentenary of the publication of his "Systema Naturæ" (Leyden, 1735) was commemorated by an appropriate exhibit of Linneana at Amsterdam during the Congress.

Days reserved for excursions gave opportunity for visiting botanical laboratories and gardens, as at Utrecht, Leyden, Baarn. Special care was taken by those in charge to make the visits instructive and interesting. The botanical garden at Leyden is one of the oldest in Europe. Founded in 1587, it was laid out under the supervision of Clusius in 1594, and members were shown a replica of his garden recently prepared from an original plan and inventory. More than 1,000 species and varieties were represented, and it showed a character, novel for the time, of a botanical, not merely a medical, garden. At Baarn, the extensive collections of pure cultures of fungi, amounting to 5,000 units, under the care of Dr. Joh. Westerdyk, were visited and at Lisse the admirably equipped bulb research laboratories.

A drive along the old Zuyder Zee and on the dam which now holds back the North Sea was an object lesson in the essentially Dutch art of converting sea-flooded areas into cultivable polderland. Various stages in conversion were seen, culminating in a polder bearing crops and two new villages which five years ago was open sea.

Pleasant social functions were evening receptions by the Netherlands Botanical Society, and, at the Rijksmuseum, by the Netherlands Government; the latter gave opportunity of inspecting the famous picture galleries.

At the final plenary meeting, an invitation from Sweden to hold the meeting in 1940 at Stockholm was accepted. An invitation to meet in South Africa had been withdrawn.

The executive committee is to be congratulated on its successful organisation; special mention is due to the senior secretary, Dr. M. J. Sirks.

A. B. RENDLE.

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# Twelfth International Congress of Zoology

## LISBON MEETING

IN view of the restrictions on foreign travel imposed in several European countries it was expected that the number of members attending the Congress of Zoology which was held at Lisbon on September 15–21 might fall short of that reached at some previous meetings of the Congress. In the event, however, the number proved to be little, if at all, less than that of the last meeting at Padua in 1930. Under the presidency of Prof. Arthur Ricardo Jorge, some five hundred members took part, and the programme showed about two hundred separate communications to be read either before the full Congress or at the sessions of the twelve sections into which it divided.

At the opening meeting, presided over by the President of the Portuguese Republic, the Minister of Public Instruction welcomed the Congress and delivered an address on the place of biology in education, in which he advocated instruction in the principles of biology as a necessary preparation for the teaching of ethics, civics and even politics.

It is not possible here to enumerate even the more important of the communications made to the Congress, but one or two may be mentioned which, for different reasons, happened to interest members of the British delegation. Prof. R. Anthony (Paris) gave an address on the evolution of the molar teeth in mammals, in the course of which he criticised

once again the much criticised 'tritubercular theory'. In this, he was supported by Mr. Hinton, of the Zoological Department of the British Museum. Prof. R. Goldschmidt (Berlin) gave an account of the progress of his long-continued researches on the genetics of local races of the gipsy moth, and came to the conclusion that local races do not represent a stage in the evolution of species. Prof. Przibram (Vienna) demonstrated living specimens of a stick insect in which transplanted legs were voluntarily movable, although sections of similar specimens failed to reveal any connexion with the central nervous system.

Dr. Calman directed attention to the centenary of Darwin's visit to the Galapagos Islands and to the action of the Government of Ecuador in declaring certain of the islands a Nature reserve. The Congress adopted a resolution expressing its appreciation of the step taken by the Ecuadorian Government and offering its co-operation in any further action that might be necessary to preserve from extinction the very interesting fauna of the islands.

Probably no section of the Congress worked harder than the members of the International Commission on Zoological Nomenclature who sat (mostly in their shirt-sleeves !) for several hours each day under the chairmanship of Dr. Jordan of Tring, striving to disentangle the complexities of the problems submitted to them. For the first time in many Congresses, they met without their indefatigable secretary, Dr. C. W. Stiles, of Washington, who was prevented by illness from travelling to Lisbon. The result of their labours was the addition to the official list of *nomina conservanda* of a considerable number of generic names, mostly of insects, that were threatened with displacement or transference by a strict application of the rule of priority.

Unfortunately, some of the rooms where the meetings were held proved defective in their acoustic qualities. In particular, the lofty hall used for the plenary sessions, being lined with polished marble, provided an excellent demonstration of the reflection of sound. Since each speaker used a language which was foreign to some eighty per cent of his audience, effective discussion was impossible except where an abstract of the paper had been supplied beforehand. It is to be hoped that at future Congresses an attempt will be made to print abstracts of all papers and to distribute them well in advance of the opening day, and perhaps even to supply the full text of the more important addresses.

Finally, mention should be made of the lavish hospitality shown to the Congress by the Portuguese Government, the Municipality and the University of Lisbon, and the Municipality of Sintra, as well as by the Portuguese zoologists themselves. Many northern zoologists, making acquaintance for the first time with the brilliant sunshine, the blue sea, and the subtropical vegetation of Portugal, will not soon forget the friendliness of their Portuguese colleagues.

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# International Meteorological Conference

## WARSAW MEETING

THE International Meteorological Conference is an assembly, which meets every six years, of the directors of meteorological services in all parts of the world. A meeting was due in 1935, and by invitation of Dr. J. Lugeon, director of the National Meteorological Service of Poland, it was held in the Palais Stasjic, Warsaw, on September 6–13 under the presidency of Prof. E. van Everdingen. The conference was formally opened by the President of the Republic of Poland on September 6, and an address of welcome was delivered by the Minister of Communications. Only directors can be members of the full conference, but much of the detailed work of organisation is carried out by commissions nominated for special subjects, and each commission is composed of those meteorologists who are most expert in the work of the commission. Meetings of nearly all the commissions were held either in Warsaw before and during the main conference, or in Danzig during the preceding week.

The work of the conference and commissions covers a very wide field—synoptic meteorology, investigation of the upper air, climatology, agricultural meteorology, maritime meteorology, terrestrial magnetism, bibliography, etc., with many ramifications of detail. Synoptic meteorology, including the taking of observations at agreed hours, their broadcasting in code, reception and plotting on charts, has required the building up of an international organisation of great complexity, which is of vital importance not only for daily weather forecasting, but also for aviation. The extension of regular long-distance flying, in particular, has had the result that pilots pass from one country to another, and need to consult a variety of different weather charts, not only for the general isobars and winds, but also for details such as the form and height of clouds, or the presence of fog, thunderstorms, etc. To avoid confusion, the observations must be made and coded in a uniform manner —for which purpose detailed instructions in the use of the codes have been drawn up for international use. It is equally important, however, that the weather reports should be entered on the weather charts of different countries, according to a general plan, so that the pilot knows at once exactly where to look for the particular information which he requires. This 'station model', as it is termed, has been the subject of very careful consideration at Warsaw by the Commission for Synoptic Weather Information, and a great measure of agreement has been arrived at as to the form which it should take.

Another subject studied by this commission also concerns the international language of meteorology, namely the symbols used to represent various meteorological phenomena. At Warsaw, several new symbols, especially one for drizzle, were added to this international language. Finally, among a number of minor improvements in the codes for weather reports must be signalised the beginning of the arrangements for the inter-continental exchange of weather information by wireless, with the view of preparing within a few hours daily weather

charts for a hemisphere, if not for the whole world.

The great importance of weather in aviation necessitates close relations between meteorological services and the authorities in charge of air lines. To meet this need, the conference at Warsaw formed a new commission, the purpose of which is to keep in close touch with the requirements of aviation, and to maintain and develop as required the meteorological organisation necessary for this purpose.

Another aspect of synoptic meteorology to which reference must be made is the construction of detailed daily charts of the northern hemisphere, now being prepared by the Deutsche Seewarte with international co-operation for the whole period of the Polar Year 1932–33. As reported by the Polar Year Commission, the preparation of these charts is progressing, though difficulty is being experienced in obtaining data for some of the more remote parts of the northern hemisphere. When completed, these charts will be of the greatest value for studies in dynamical meteorology.

The tendency towards internationalisation has appeared also in the domain of climatology, in the form of an international 'alphabet' for the headings of columns. Thus the column, for example, for 'pressure' in a climatological table should bear the letter *P*, no matter what country issues the table. The Climatological Commission has also devised a standard form of table for the guidance of meteorological institutes. Months are designated I–XII, but both in climatology and in agricultural meteorology the need has been felt for the use of a unit of time shorter than a month and there has been great discussion of the relative advantages of the 5-day period, or pentad, and the week, with the result that both units have received international approval.

The Commission for Terrestrial Magnetism and Atmospheric Electricity was occupied mainly with questions of detail. Among the resolutions were also appreciations of the action of the British Admiralty in deciding on the construction of a non-magnetic ship specially designed to carry on the researches formerly made on the ill-fated *Carnegie*, and of the Canadian authorities in transforming the temporary geophysical station erected at Chesterfield Inlet for the Polar Year into a permanent station.

The report of the Commission for Bibliography, which was unanimously adopted by the conference, presented a new plan of classification for meteorological literature, affiliated to the decimal classification of the International Institute of Bibliography, but thoroughly revised. This classification has been studied and discussed for several years, and its completion will greatly facilitate bibliographical work in meteorology.

The work of an international conference does not end with the formal debates and resolutions; there remain many problems which can only be resolved by private discussion among the members. The value of the Warsaw conference was greatly increased by the presence of delegates from all parts of the world. Africa was especially well represented, and the practical problems of organisation in that difficult continent were fully explored.

On Sunday, September 8, an all-day excursion was made to the new aerological and radiometeorological observatory at Jablonna, which owes its inception to Dr. Lugeon, and which promises to be of as great importance in studies of the ionosphere in Poland as is the station at Slough, in England. On the evening before the final meeting, H.E. the Minister of Communications entertained members and their wives to a State banquet, where all speakers reflected the spirit of optimism prevailing in meteorology to-day, which was the keynote of the whole conference. After the meeting, many of the delegates proceeded to Cracow and the Tatra Mountains on an excursion which was admirably organised and provided an experience not readily to be forgotten.

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# Biochemistry in Relation to Therapeutics

SIR FREDERICK GOWLAND HOPKINS delivered the inaugural sessional address at the opening of the ninety-fourth Session of the College of the Pharmaceutical Society on Wednesday, October 2. His address included a wide survey of the needs of pharmacy to-day and of the educational means for satisfying them, and led him to examine a problem as old as education itself, the problem of how far vocational training is compatible with true education in which a subject is studied for its own sake as an intellectual exercise. It has often been said that science can only be taught properly when it is taught as pure science without reference to its applications. This claim is justified to the extent that vocational needs must not make the teaching of science so one-sided that the student risks missing the intellectual stimulus which the great generalisations of science provide.

Teachers of applied scientific subjects will be grateful to the president of the Royal Society for his declaration that the skilful teacher of students whose ultimate aim is to apply science in practice, can illustrate general principles adequately while selecting facts and aspects which have a permanent vocational value. Indeed, for the encouragement of the average student, it is important that the reality of this permanent value should be part of his faith. Without it he can never be an enthusiast for his calling. The preference for vocational training may well be based on the Anglo-Saxon preference for action rather than thought and for practice rather than theory, but it is an attitude of mind having in it the seeds of certain dangers. Indeed, a distrust of theory has sometimes kept Great Britain from being in the van of intellectual and not less of commercial progress: "It was because it had become really scientific that the medical knowledge of another country received for a long period and up to the time of the War the greatest respect in the world and it was because its chemists were so fully trained in theory that the same country obtained among other similar advantages a long lead in the production of synthetic drugs which rightly or wrongly brought it enormous profits".

On the same occasion Sir Frederick Gowland Hopkins took occasion to review the present state of biochemistry; in particular, in its relation to

therapeutics. As he pointed out, while the structure of a drug administered as a medicine may be known, very little has been known about the nature of the events in the tissues of the body which are affected by the drug. The pharmacologist relies upon the obvious and visible reaction of the body as a whole to the drug when administered, or at least, of the reaction of a specific organ as a whole. His observations throw little light upon the precise and intimate mechanism of the drug's action. This is the province of biochemistry, and modern biochemistry is fast acquiring methods which enable it to follow the progress of the invisible molecular events which occur in the tissues while they are living.

Biochemistry should in the future be able to describe in detail the numerous chemical reactions which proceed in ordered sequence in every living tissue cell. The great majority of drugs act by intruding among these chemical reactions and by modifying their course or by entering relations with the enzymes which catalyse these reactions. When we know into what kind of reaction and at what stage in its progress a given kind of molecule intrudes, or when we know exactly the chemical nature of the enzyme with which, owing to mutual structural affinities, it makes sufficient contact, then we shall be in a better position for understanding just why the details of its molecular structure confer upon each drug a particular physiological activity. Biochemical investigation of the relationships of the vitamins and hormones has led to the view that it is nearly, if not quite, justifiable to look upon a vitamin as a hormone which the body cannot make for itself, or on a hormone as a vitamin which it does make for itself.

## Educational Topics and Events

ST. ANDREWS.—Mrs. Low of Blebo has given £1,000 to the University for the purpose of founding in memory of her son, the late Capt. W. A. Low, a Gold Medal and prize to be awarded annually to the student adjudged to have had the most distinguished course among those graduating in the year as M.B.,Ch.B. The foundation will be named "The Captain W. A. Low Memorial Prize".

The Court has appointed Dr. James A. Macdonald to be a lecturer in botany in the United College.

Dr. James F. Murray, lecturer in bacteriology in the Medical School, Dundee, having resigned that post, the Court has appointed Dr. Alexander B. Stewart, presently assistant in the Department, to the vacant lectureship.

In the old Parliament Hall, St. Andrews, on Friday, October 4, Dr. E. T. Copson was inducted to the chair of mathematics and Dr. R. C. Garry to the chair of physiology, both in University College, Dundee.

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AMONG the university extension and tutorial classes arranged by the University Extension Committee of the University of London is a series of lectures on the human mind to be delivered by Prof. Cyril Burt in the City L.C.C. Literary Institute beginning on January 15, and a series on recent discoveries in psychology by Dr. C. E. Allen being given in the lecture hall of the public library, Croydon, which began on October 9. Other lectures on psychology are being delivered by Mr. E. Miller, Mrs. G. R. Blanco-White and Mr. C. E. M. Joad, at Morley College, and the Rev. F. E. England in Whitefield's Central Mission. Apart from these courses in psychology, the only other series of lectures of scientific interest is that by Prof. W. B. Brierley on the biological sciences and modern problems at Gresham College, which began on October 2. A complete list of the lectures can be obtained from the University Extension Registrar, University of London, South Kensington, S.W.7.

THE appeal for new buildings for Birkbeck College (University of London) was launched at a meeting arranged by Lord and Lady Luke at 29 Portman Square on October 2. Lord Luke, chairman of the Appeal Committee, announced that His Royal Highness the Duke of York has consented to accept the presidency of the College and will be present with the Duchess at a meeting at the Mansion House on November 7 when the Lord Mayor and Mr. Ramsay Macdonald, both old students of the College, will speak on the needs of Birkbeck. Mr. Hichens, chairman of the Governors, referred to the grant by the University of London of space for the new buildings on the University site in Bloomsbury, and Dame Helen Gwynne-Vaughan spoke of the good work of Birkbeck students. As is well known, Birkbeck College is a school of the University of London for evening and part-time students who are prevented by their employment from attendance at a college during the day. In the Science Departments, an increasing number of students come from large research laboratories under the auspices of the Department for Scientific and Industrial Research or of private firms. A special feature of the College is the strength of the postgraduate work; each year sees the publication of numerous contributions to knowledge resulting from the work of staff and students. Opportunity for investigation is given to a large number of capable men and women.

IN university circles in the United States there is widespread anxiety as to the curtailment of academic freedom. Leaders in the learned world denounce the 'brutal tyrannies' under which in more than one foreign country the expression of opinions and even the dissemination and discussion of information in universities have been stifled. Of three graduation addresses by the presidents of Harvard, Yale and Princeton, respectively, published in *School and Society* of July 13, two contain such denunciations, and one disparages the extravagant faith, so common in this age, in the efficacy of idealised social systems such as Communism and Fascism as devices for lifting humanity by its own bootstraps. A week earlier, the well-known chancellor (S. P. Capen) of another university held forth on a similar occasion on "The Obligation of the University to American Democracy". He contrasted the functions of universities in countries such as Italy, Germany and Russia, where there are dictatorships, and in democratic countries. In the former these functions have been simplified and the universities have become, in so far as they concern themselves with the social sciences, organs of propaganda. In the latter, in so far as they are true to democratic principles, the method of the propagandist is abhorrent to them. Nevertheless, in the United States alone among democratic countries, the procedure of universities in this respect is, we are told, challenged and they are constantly being attacked for "teaching socialism or pacifism or atheism or communism, or all of them together".

## Science News a Century Ago

### Captain Back's Arctic Expedition

*The Times* of October 13, 1835, contained a statement by William Bowles, the chairman of the Arctic Land Expedition, to the subscribers who financed the expedition. In the course of the statement, he reviewed the circumstances which led to the project of sending out a party to find Captain Ross, referred to the eminent services of Captain Back, his companion Mr. King the surgeon and to the assistance given in the United States and Canada and to the eight men who had made the boat journey to the coast with Captain Back. The subscriptions, Mr. Bowles said, included £2,000 from the Government, £500 from the Hudson's Bay Company, £105 from the Lord Mayor and Corporation of London, £105 from the Committee of Lloyds and £100 from the Corporation of Trinity House. "The Committee," he said, "has the highest possible gratification in announcing that, on the recommendation of the Lords Commissioners of the Admiralty, His Majesty in Council has been pleased to grant an order, dispensing in Captain Back's case, with the actual service afloat, which according to the rules of the Navy, would have been otherwise requisite to qualify him for a step in his profession. He has thus been promoted in the most gracious manner, without delay; and a munificent individual (Robert Holford, Esq., of Westcliff, Isle of Wight) has remitted 100£ to be divided in equal shares among his boat's crew, the partakers of his greatest difficulties and dangers".

### Lyell and Mantell

SHORTLY after his return home from his tour in France, Switzerland and Germany, Lyell on October 14, 1835, wrote from London to Dr. Gideon Mantell at Brighton giving him an account of some of his geological excursions. In the course of his letter, he said: "I entered Switzerland by Porrentrui, and there I had Thurmann for my guide, who gave me in a short time a beautiful insight into the structure of the Jura . . . and I was glad to verify his observations in the field, and to see his beautiful collection of Jurassic shells, and his attempt to assimilate the oolitic series and their fossils of the Swiss Jura with our English oolitic groups. I afterwards had a work in another part of the Jura with some geologists at Neuchâtel, where the chalk, as it appears to me by its fossils, fills the bottom of the valleys of the Jura limestone. I next had a work with Studer at Berne, and then had a work of about six weeks in that part of the Swiss Alps which is called the Bernese Oberland. . . . People seem to be in high spirits here on the success of the Dublin meeting. Agassiz looks in good health, and is satisfied with the great progress he has made, and looks forward with great pleasure to a first visit to Brighton. . . . I have been writing this by candle-light after the labours of the day, and as you know my eyes of old, you will excuse its not being in my own handwriting. . . ."

### Prof. Tiedemann in Edinburgh

ON October 17, 1835, quoting from the *Scotsman*, *The Times* said: "The celebrated Professor Tiedemann of Heidelberg has been in Edinburgh for some days. He is collecting materials for a work on the comparative anatomy of the brain and has visited London, Glasgow and Dublin. In Edinburgh he has pursued his researches in the Museum of the Royal College of Surgeons, the College Museum and the Museum of the Phrenological Society, which last he has visited on three successive days for the purpose of weighing and measuring the skulls of different nations". Tiedemann, who was born at Cassel in 1781 and died in 1861 at the age of seventy-nine years, was made professor of zoology, anatomy and physiology at Heidelberg in 1816.

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## Societies and Academies

### PARIS

Academy of Sciences, August 26 (*C.R.*, 201, 461–476). MARCEL DELÉPINE: The work of the late Antoine Nicolas Guntz. PIERRE DE VANSSAY: Drawing the azimuth line on a Mercator projection. S. CARRUS: The successive evolutes of a skew curve. ARNAUD DENJOY: Groups of homographic substitutions. RAPHAËL SALEM: The generalisation of certain lemmas of Van der Corput and applications to trigonometrical series. MARCUS FRANCIS: The electrolytic method of preparing thin deposits of $U_3O_8$. Starting with a salt of uranium not carefully purified, other radioactive substances deposit first during electrolysis and a satisfactory deposit of uranium oxide cannot be obtained. LUBOMIR DONTCHEFF and CHARLES KAYSER: The signification of respiratory coefficients below 0·7 in certain pœcilotherms.

September 2 (*C.R.*, 201, 477–492). HENRY GAULT and MATUS COGAN: Formyltropic ester. This is produced by the condensation of formylphenylacetic ester with formaldehyde. FRANÇOIS DUPRÉ LA TOUR: Polymorphism in the series of the normal fatty diacids. JACQUES DE LAPPARENT: An essential constituent of fullers earth. HENRI LONGCHAMBON: The essential mineralogical constituents of clays, and especially of fullers earth. ANDRÉ CAILLEUX: Traces of important interglacial aerial action in Poland. GEORGES BOURGUIGNON: Chronaxy in voluntary movement and in pain in normal man. Static chronaxy and dynamic chronaxy. MME. ISABELA POTOP: Researches on the acid-soluble phosphorus, the mineral phosphorus and the ultrafiltrable phosphorus of the blood.

September 9 (*C.R.*, 201, 493–508). The president announced the death of LÉON FREDERICQ, *Correspondant* for the Section of Medicine and Surgery. PAUL LÉVY: The law of large numbers for connected variables. G. PFEIFFER: A special method of integration of complete systems of linear partial differential equations of the first order of an unknown function. ARNAUD DENJOY: The geometry of homographic groups. ANDRÉ BRIOT and BORIS VODAR: The absorption spectra in the ultra-violet of gaseous, dissolved or liquid ammonia. PIERRE DONZELOT and MAURICE CHAIX: The Raman spectra of substances with two benzene nuclei. The substances examined included diphenyl and compounds of the type $C_6H_5.X.C_6H_5$, where X was $CH_2$, O, S, Se, CH(OH) or Hg. MLLE. BERTHE BIECHELER: The existence of a chromatic cyclosis in the peridineans. JOSEPH KAHN and MME. LUBOV CHEKOUN: The disengagement of ammonia by the brain, following a state of natural stimulation.

### AMSTERDAM

Royal Academy of Sciences (*Proc.*, **38**, No. 7, September 1935). C. U. ARIËNS KAPPERS: Stability and variability of Central and Palæo-Asiatic index maxima and some remarks on the Greenland Eskimo. G. VAN ITERSON, JR. and J. COUMOU: A few remarks on the iodine-amylum reaction. Discussion of the nature of the blue complex and observations of the temperature of gelatinisation of starch in the presence of iodine and potassium iodide, separately and together. A relatively large rise of the gelatinisation temperature was observed in the last case. J. A. SCHOUTEN and J. HAANTJES: On general conformal geometry in projective treatment. A. A. NIJLAND: Mean light curves of long period variables. (24) *R. Lacertae*. The light of this star varies with a period of 299 days and an amplitude of 5·07 magnitudes. H. R. KRUYT and H. G. BUNGENBERG DE JONG: Extension of the theory of complex coacervation to ionic disperse systems. Experiments showing that coacervation (unmixing) occurs not only in colloidal solutions but also in supersaturated solutions of electrolytes. MISS A. M. HARTSEMA and A. H. BLAAUW: Shifting of periodicity by means of high temperatures. Adaptation and export to the southern hemisphere (2). By keeping daffodil bulbs at 28° until the next spring they can then be exported to the southern hemisphere to flower in late August. J. H. GISOLF: A demonstration experiment concerning the use of a Lummer plate. Shows the resolving power is markedly dependent on the direction of polarisation of the incident light, being greatest when the electric vector is parallel to the plane of the plate. A. ELLIOTT: A note on the β bands of boron monoxide. Data on the magnitude of the spin doubling in these bands, the existence of which had been questioned by Funke and Simons. V. HLAVATY: On conformal geometry (2). Applications particularly to the problem of the affine normals. C. S. MEYER: Integral expressions for Lommel and Struve functions (2). J. W. A. VAN KOL: Correction of some numbers of biquadratic space-curves of the first kind. There are 540 curves $k^4$ which meet four given straight lines. F. W. WENT: Coleoptile growth as affected by auxin, aging and food. Experiments on the function of auxin in which the auxin content is artificially increased. E. FREY: Experimental researches on the nucleus basalis opticus in the porpoise. E. FREY: The nucleus basalis opticus of the porpoise. T. KUROTSU: On the nucleus magnocellaris periventricularis in reptiles and birds. H. G. BUNGENBERG DE JONG and J. BONNER: Phosphatide autocomplex coacervates as ionic systems and their relation to the protoplasmic membrane. Suggests that the special properties of the protoplasmic membrane depend upon one or more double layers of oriented phosphatide ions similar to the double films of the phosphatide auto-complex coacervate.

### CAPE TOWN

Royal Society of South Africa, July 17. A. J. H. GOODWIN: Recent changes in terminology in European prehistory. The term Clacton has been introduced in Europe to cover a flake culture which divides the Chellean and Acheulean. When Gabriel de Mortillet first organised the prehistoric period of France into a single chronological scheme, the site at Le Moustier shelter was made the type site of a major period. Later work by Commont on the gravels of the Somme River necessitated the introduction of the term Levallois to cover part of the complex present at Le Moustier. Recent work by Dr. Ami at Combe Capelle, and by Henri Martin at La Quina have rendered a further analysis necessary. As a result, the Le Moustier site is now regarded as presenting three cultural themes, which here mingle: the Levallois, the true Moustierian, and the Acheulean tradition. Afterwards Péyrony, Breuil and others have shown these themes in their earlier forms, and terms have been applied to cover these developments.

## Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

### Sunday, October 13

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—Dr. Susan Finnegan: "Spiders".*

### Monday, October 14

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—Capt. Guy Dollman: "Egg-Laying Mammals".*

UNIVERSITY OF LEEDS, at 5.15.—E. O. G. Turville-Petre: "Iceland".*

### Tuesday, October 15

UNIVERSITY COLLEGE, LONDON, at 3.—Prof. B. Ashmole: "Greek Sculpture".*

KING'S COLLEGE, LONDON, at 5.30.—A. Ramsay Moon: "Electric Welding as Applied to Structural Work" (succeeding lectures on October 22 and 29).*

GRESHAM COLLEGE, at 6.—A. R. Hinks: "Our Sun's Neighbours" (Gresham Lectures on Astronomy. Succeeding lectures on October 16, 17 and 18).*

BRITISH INSTITUTE OF PHILOSOPHY, at 8.15.—(in University College, Gower Street, W.C.1).—The Right Hon. Sir Herbert Samuel: "New Science and Old Philosophy". (Presidential Address.)

### Wednesday, October 16

SOCIETY OF GLASS TECHNOLOGY, at 2.—(at the University of Sheffield). B. P. Dudding: Presidential Address.

### Thursday, October 17

BRITISH INSTITUTE OF RADIOLOGY, at 8.—(in the Reid-Knox Hall).—L. A. Rowden: "Looking Backward and Looking Forward" (Presidential Address).

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE, at 8.15.—Sir Arthur Bagshawe: Presidential Address.

### Friday, October 18

ROYAL ASIATIC SOCIETY, at 4.15.—Prof. John Garstang: "Further Discoveries at Jericho".

NORTH EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS, at 6.—Dr. John T. Batey: Presidential Address.

## Official Publications Received

### Great Britain and Ireland

Brighton Technical College. Calendar, Session 1935–36. Pp. 119. (Brighton: Technical College.)

British Medical Association. Family Meals and Catering. Pp. 27+3 plates. (London: British Medical Association.) 6*d*.

Spanish Influence on the Progress of Medical Science: with an Account of the Wellcome Research Institution and the Affiliated Research Laboratories and Museums founded by Sir Henry Wellcome. Commemorating the Tenth International Congress of the History of Medicine, held at Madrid, 1935. Pp. 121. (London: Wellcome Research Institution.)

Transactions of the Royal Society of Edinburgh. Vol. 58, Part 2, No. 19: The Female Reproductive System in the Guinea-Pig; Intra-vitam Staining, Fat Production, Influence of Hormones. By Dr. Thomas Nicol. Pp. 449–486+6 plates. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.). 8*s*. 6*d*.

Rothamsted Conferences. 20 : The Cause and Control of Swarming in Bees. Contributions by Brother Adam, Miss A. D. Betts, C. F. Clay, W. Hamilton, D. Morland, W. H. J. Prior, L. E. Snelgrove. Pp. 31. (Harpenden : Rothamsted Experimental Station.) 1*s.* 6*d.*

Annals of the Cape Observatory. Vol. 14, Part 1 : Stellar Parallaxes (1st Series) determined in the Years 1926–1930 with the Victoria Telescope of the Royal Observatory, Cape of Good Hope, under the direction of Dr. H. Spencer Jones ; completed for publication under the direction of Dr. J. Jackson. Pp. xvii+119. (London : H.M. Stationery Office.) 12*s.* net.

Memoirs of the Cotton Research Station, Trinidad. Series A : Genetics. No. 11 : Chromosome Numbers in the Malvaceæ, 1. By A. Skovsted. Pp. 263–296. (London : Empire Cotton Growing Corporation.) 2*s.* 6*d.*

Annual Report of the Director of the Meteorological Office, presented by the Meteorological Committee to the Air Council, for the Year ended March 31, 1935. (M.O. 388.) Pp. 47. (London : H.M. Stationery Office.) 9*d.* net.

Department of Scientific and Industrial Research. Forest Products Research Records, No. 1 : The Testing of Timbers at the Forest Products Research Laboratory. Pp. ii+8. 6*d.* net. Forest Products Research Records, No. 2 (Timber Mechanics Series, No. 1) : Strength Tests of Structural Timbers. Part 1 : General Principles with Data on Redwood from Gefle and Archangel. By C. J. Chaplin and J. Latham. Pp. ii+10. 6*d.* net. (London : H.M. Stationery Office.)

Potato Marketing Board. Miscellaneous Publications, No. 1 : The Potato as an Article of Diet. Bibliography and Notes thereon by Dr. W. H. Archbold. Pp. 20. (London : Potato Marketing Board.) 6*d.*

Economic Advisory Council : Committee on Locust Control. The Locust Outbreak in Africa and Western Asia in 1934. Survey prepared by B. P. Uvarov. Pp. 65+11 maps. (London : H.M. Stationery Office.) 3*s.* net.

Joint Committee on Water Resources and Supplies (Session 1934–35.) Vol. 1 : Proceedings of the Committee, 3rd to 25th July 1935 (inclusive). Pp. viii. 2*d.* net. Vol. 2 : Minutes of Evidence (11th to 25th July 1935, inclusive), together with an Appendix. Pp. ii+99. 3*s.* net. (London : H.M. Stationery Office.)

Air Raid Precautions. Memorandum No. 1 : Treatment of Casualties and Decontamination of Personnel. (Issued by the Home Office, Air Raid Precautions Department.) Pp. 15. (London : H.M. Stationery Office.) 4*d.* net.

## Other Countries

Department of Agriculture, Mauritius : Sugarcane Research Station, Bulletin No. 8 : The Maintenance of First Year Characters in New Sugarcane Clones. By A. Glendon Hill. Pp. 7+3 plates. (Port Louis : Government Printer.)

Southern Rhodesia : Geological Survey. Bulletin No. 28 : The Geology of the Makaha Gold Belt, Mtoko District. By A. M. Macgregor. Pp. 47+1 plate. (Salisbury : Government Stationery Office.) 1*s.* 9*d.*

Transactions of the San Diego Society of Natural History. Vol. 8, No. 10 : The Mangrove Warbler of North-Western Mexico. By A. J. van Rossem. Pp. 67–68. Vol. 8, No. 11 : A New Race of Brown Towhee from the Inyo Region of California. By A. J. van Rossem. Pp. 69–72. Vol. 8, No. 12 : A New Silky Pocket Mouse from Sonora, Mexico. By Laurence M. Huey. Pp. 73–74. Vol. 8, No. 13 : A New Sub-species of *Crotalus confluentus*, the Prairie Rattlesnake. By Laurence M. Klauber. Pp. 75–90+plate 8. Vol. 8, No. 14 : New or Little-known Crabs from the Pacific Coast of Northern Mexico. By Steve A. Glassell. Pp. 91–106+plates 9–16. Vol. 8, No. 15 : A New Genus and Species of Pigmy Goose from the McKittrick Pleistocene. By Roland Case Ross. Pp. 107–114. (San Diego, Calif. : San Diego Society of Natural History.)

Indian Central Cotton Committee : Technological Laboratory. Technological Bulletin, Series B, No. 20 : Fibre-Maturity in relation to Fibre and Yarn Characteristics of Indian Cottons. By Amar Nath Gulati and Dr. Nazir Ahmad. Pp 31. (Bombay : Indian Central Cotton Committee.) 8 annas.

Thirty-second Annual Report of the Bureau of Science, Philippine Islands, for the Year ending December 31, 1933. By Arthur F. Fischer. Pp. 95. (Manila : Bureau of Printing.)

Brooklyn Botanic Garden Record. Vol. 24, No. 4 : Prospectus of Courses, Lectures and other Educational Advantages offered to Members and to the General Public, 1935–36. Pp. xii+195–228. (Brooklyn, N.Y. : Brooklyn Institute of Arts and Sciences.)

U.S. Department of Agriculture : Bureau of Biological Survey. North American Fauna, No. 54 : Alaska—Yukon Caribou. By Olaus J. Murie. Pp. 93+10 plates. (Washington, D.C. : Government Printing Office.) 20 cents.

Report of the First Scientific Expedition to Manchoukuo under the Leadership of Shigeyasu Tokunaga, June-October 1933. Section 4, Part 2 : Contributio ad cognitionem floræ Manshuricæ. By Takenoshin Nakai, Masaji Honda and Masao Kitagawa. Pp. iv+187+19 plates. Section 5, Division 1, Part 2 : Crustacea of Jehol. By Masuzô Uéno, Tune Sakai and Hajime Uchida. Pp. iv+16+16+8+6+4+19 plates. Section 6, Part 1 : Contribution to the Prehistoric Archæology of Southern Jehol, by Ichiro Yawata ; On the Chemical Investigation of a Bronze Vessel unearthed in the vicinity of Pei-Piao in Chao-Yang Prefecture, by Tsurumatsu Dôno. Pp. ii+106+29 plates. (Tokyo : Waseda University.)

Daily Meteorological Observations taken at St. George's, Bermuda, during the Polar Year, August 1932–August 1933. Pp. 32. (Bermuda : Meteorological Office.)

Meteorological Observations in Nigeria during the Polar Year 1932–33. Compiled under the direction of the Surveyor-General. Pp. viii+95. (Lagos : Survey Department.)

Annual Report of the Imperial Council of Agricultural Research for the Year 1933–34. Pp. iv+141. (Delhi : Manager of Publications.)

The Imperial Council of Agricultural Research. Scientific Monograph No. 5 : The Bombay Grasses. By Dr. E. Blatter and C. McCann. Pp. xxi+324+189 plates. 20.12 rupees ; 32*s.* 6*d.* Scientific Monograph No. 6 : Helminth Parasites of the Domesticated Animals in India. By G. D. Bhaleras. Pp. iii+365. 7.12 rupees ; 13*s.* 3*d.* (Delhi : Manager of Publications.)

Ministry of Agriculture, Egypt : Technical and Scientific Service. Bulletin No. 155 : Evaporation and Deterioration of Cut Cane in Egypt. By Arthur H. Rosenfeld. Pp. 26. 3 P.T. Bulletin No. 159 : A Mealy Bug new to Egypt (*Pseudococcus brevipes*, Ckll.) on Roots of Phœnix sp. and its Control by the Application of Chemicals to the Soil. By M. Hosni and Dr. M. Shafik. Pp. 8+3 plates. 2 P.T. Bulletin No. 160 : Efficiency of Commercial Sodium Cyanide and Sulphuric Acid in liberating Hydrocyanic Acid Gas for Fumigation. By Dr. M. Shafik and A. A. Amer. Pp. 6. 2 P.T. (Cairo : Government Press.)

Union Géodésique et Géophysique Internationale. Travaux de l'Association Internationale de Géodésie. Tome 11 : Rapports nationaux sur les travaux exécutés dans les différents pays établis à l'occasion de la cinquième Assemblée générale, Lisbonne, 14–25 Septembre 1933. Fasc. 3. Pp. iii+10 papers. (Paris : Association Internationale de Géodésie.) 140 francs.

U.S. Department of the Interior : Geological Survey. Water-Supply Paper 742 : Surface Water Supply of the United States, 1933. Part 2 : South Atlantic Slope and Eastern Gulf of Mexico Basins. Pp. vii+206. 30 cents. Water-Supply Paper 743 : Surface Water Supply of the United States, 1933. Part 3 : Ohio River Basin. Pp. ix+357. 25 cents. Water-Supply Paper 746 : Surface Water Supply of the United States, 1933. Part 6 : Missouri River Basin. Pp. viii+276. 20 cents. Water-Supply Paper 750 : Surface Water Supply of the United States, 1933. Part 10 : The Great Basin. Pp. v+107. 10 cents. (Washington, D.C. : Government Printing Office.)

U.S. Department of Agriculture : Bureau of Entomology and Plant Quarantine. Miscellaneous Publication No. 220 : Directory of the Bureau of Entomology and Plant Quarantine. Pp. 88. (Washington, D.C. : Government Printing Office.) 10 cents.

Cornell University : Agricultural Experiment Station. Bulletin 622 : Dry Concentrates as a Partial Substitute for Whole Milk in Calf Rations. By E. S. Savage and C. H. Crawford. Pp. 29. Bulletin 623 : Mobility of Rural Families, 2 : Changes in Residence and in Occupation of Sons and Daughters in Rural Families in Genesee County, New York. By W. A. Anderson. Pp. 37. Bulletin 624 : Investigations in Pruning Mature Apple Trees. By Joseph Oskamp. Pp. 42. Bulletin 625 : A Critical Study of the Methods for Measuring Oxidation-Reduction Potentials of Soils, with special reference to Orchard Soils. By Michael Peech and L. P. Batjer. Pp. 23. Bulletin 626 : Soils in relation to Fruit Growing in New York. Part 6 : Tree Behavior on Important Soil Profiles in the Williamson-Marion Area, Wayne County. By Joseph Oskamp. Pp. 29. Bulletin 627 : Soils in relation to Fruit Growing in New York. Part 7 : Tree Behavior on Important Soil Profiles in the Kinderhook, Germantown and Red Hook Areas in Columbia and Dutchess Counties. By L. P. Batjer and Joseph Oskamp. Pp. 30. Bulletin 631 : Interests, Activities and Problems of Rural Young Folk, 2 : Men 15 to 29 Years of Age. By W. A. Anderson and Willis Kerns. Pp. 43. Bulletin 632 : Greensprouting Seed Potatoes. By E. V. Hardenburg. Pp. 29. Memoir 173 : Biology of the Midge *Chironomus tentans* Fabricus, and Methods for its Propagation. By William O. Sadler. Pp. 25. Memoir 175 : Effect of Temperature on Pollen Germination and Tube Growth in the Tomato. By Ora Smith and H. L. Cochran. Pp. 11. Memoir 178 : Synthetic Diets for Herbivora, with special reference to the Toxicity of Cod-Liver Oil. By L. L. Madsen, C. M. McCay and L. A. Maynard ; with the cooperation of George K. Davis and J. C. Woodward. Pp. 53. (Ithaca, N.Y. : Cornell University.)

Bulletin of the National Research Council. No. 97 : A Table of Eisenstein-Reduced Positive Ternary Quadratic Forms of Determinant $\leqq 200$. By Burton W. Jones. Pp. 51. 1 dollar. No. 98 : Report of the Committee on Sedimentation 1932–1934. Pp. 246. 1 dollar. (Washington, D.C. : National Academy of Sciences.)

U.S. Department of Agriculture. Technical Bulletin No. 482 : Selenium Occurrence in Certain Soils in the United States, with a Discussion of Related Topics. By Horace G. Byers. Pp. 48. (Washington, D.C. : Government Printing Office.) 5 cents.

Elihu Root Lectures of Carnegie Institution of Washington on The Influence of Science and Research on Current Thought. Popular and Unpopular Science, by James R. Angell ; The Nature of Progress in Science, by H. A. Spoehr. Pp. v+54. (Washington, D.C. : Carnegie Institution.)

Government of India : Department of Industries and Labour (Public Works Branch.) Irrigation in India : Review for 1933–34. Pp. 53. (Delhi : Manager of Publications.) 1.12 rupees ; 3*s.*

Carte Générale Bathymétrique des Océans. Troisième édition. Sheet A1 : North Atlantic Ocean. 1.1 metres × 0·75 metre. (Monte-Carlo : International Hydrographic Bureau.) 35 francs.

Canada : Department of Mines : National Museum of Canada. Bulletin No. 76 : Annual Report for 1934. Pp. 25. (Ottawa : King's Printer.) 10 cents.

Canada : Department of Mines : Bureau of Economic Geology : Geological Survey. Memoir 175 : Portland Canal Area, British Columbia. By George Hanson. (No. 2371.) Pp. ii+179. 50 cents. Memoir 177 : Lake Ainslie Map-area, N. S. By G. W. H. Norman. (No. 2374.) Pp. iv+103+4 plates. 25 cents. Memoir 178 : The Mining Industry of Yukon, 1934. By H. S. Bostock. (No. 2387.) Pp. v+10. 10 cents. Memoir 180 : Mudjatik-Haultain Area, Saskatchewan. By F. J. Alcock. (No. 2393.) Pp. ii+16+2 plates. 10 cents. (Ottawa : King's Printer.)

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## Catalogues, etc.

Sankey's New Improved Down-Draught Preventing Pot. Pp. 12. (Ilford : J. H. Sankey and Son, Ltd.)

Catalogue of Microscopes. Part 6 : Polarizing Microscopes. Pp. 601–632. (London : W. Watson and Sons, Ltd.)

Price List of B.D.H. Laboratory Chemicals. Pp. 195. (London : The British Drug Houses, Ltd.)

Cambridge Electrocardiographs. Pp. 6. (London : Cambridge Instrument Co., Ltd.)

Practical Hints on Patents. By M. E. J. Gheury de Bray. Fifth edition, entirely revised and considerably enlarged. Pp. 48. (London : Imperial Patent Service.) 6*d.*