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# 'Justice' in Africa

AS the year draws to its close, the passing of time reminds us of the useful convention whereby we are encouraged to enter upon some sort of a stocktaking preparatory to the closing of the annual account. In such a survey of the past year, the chain of events which has threatened, and still endangers, the peace of the world must be a salient item. Here, however, the very magnitude of the issues involved hampers critical judgment, and while the event is weighed in the scale according as it has made for or against the working of the machine which we call the League of Nations, it may not readily be discerned that 'profit and loss' are not to be assessed in terms of the number of nations declaring their formal adherence to Article xvi, but rather in any real progress towards the universal application of the fundamental principle of justice as between man and man, towards which the League was a gesture of aspiration, as well as an admittedly imperfect piece of machinery for its attainment.

However posterity may apportion blame as between Italy and Abyssinia for breach of the peace—no attempt will be made here to estimate the merits of the dispute—there can be no question that the principle of the League, as well as the letter of its Covenant, has been violated. Should the League fail to vindicate that principle, through it the prestige of white civilisation will be affected throughout Africa.

The admission of Abyssinia to the League is a matter of past history. It is profitless now to discuss whether that admission was justifiable or not. But it would be idle to pretend that she stood upon an equal footing with other members of the League. Admission was an earnest of security in the upward struggle from barbarism to which her rulers were then committed; and this attack on her by a nation of advanced civilisation with all the resources of a modern armament at its command is a breach of an implied pledge of her right to integrity, which no political, diplomatic or economic argument can justify. It is a cynical reversion to the acquisitive methods of the nineteenth century, which led to the partition of Africa among the interested Powers of Europe.

The attack of Italy on Abyssinia, however strong the argument from economic necessity or pressure of population now that other outlets are restricted, is out of harmony with the spirit of the twentieth century. Native races—using the term in a loose conventional sense—can no longer be regarded as 'inferior' and mere raw material for exploitation, whose lands may be developed, regardless of their rights and interests, solely for the benefit of a superior white race. An attitude of mind more nearly in accord with the present trend of scientific study of racial problems demands that the relations between white and black, which are a consequence of the inevitable expansion of European civilisation, should be regulated by an adjustment of the conflicting claims which arise from the clash of two cultures in some respects incompatible but, it is hoped and indeed as experience is showing, not ultimately and entirely irreconcilable. Where white civilisation successfully vindicates its claim to the superior position, it is not as an overriding, but as a tutelary force. The final ruling, for all but areas of overwhelmingly white settlement, was given in the dictum of Lord Passfield's famous White Paper, in which it was declared that "the interests of the native must be paramount". This to the native is his Magna Charta, the warrant on which the

white administration must justify its control and occasional modification of native custom and belief. This was the spirit which framed the African mandates of the League of Nations; it is not the spirit or the practice of Italian colonisation, either in Cyrenaica or in north-east Africa. Settlement here is frankly and avowedly Italy overseas, with all that that implies in regard to native interests.

The moral obligation to guard and guide the native in changing conditions is naturally not confined to mandated territory, but rests on all administrations alike. To some critics this obligation seemed in danger recently, when the development of the Kakamega gold mines was under consideration; but in fairness to the Administration of Kenya it has to be admitted that the point at issue did not really arise out of a disregard of the interests of the native, but from a difference of opinion over the question of immediate benefits, especially financial and economic, as opposed to ultimate well-being, which anthropologists and others felt would be jeopardised by the displacement of native holdings, and the cultural disintegration which is inseparable from the opening up of any area in Africa to mining enterprise.

On difficult questions such as those raised by the Kakamega gold mines—questions of frequent occurrence, though not often arousing such widespread interest—much light is thrown by two recent publications dealing with the relation of governors and governed in East Africa. Of these Dr. Thurnwald's "Black and White in East Africa"* is especially valuable for his survey of the whole course of contact between an African tribe and European civilisation from its very beginning. He also examines in great detail the various measures by which the administration deals with every aspect of its native contacts, including its organisation for the improvement of native conditions in both a material and a spiritual sense, while at the same time he gives due heed to all interests, both black and white, involved in the problem.

It is to be noted that Dr. Thurnwald, in concluding, quotes in reference to 'the outlook' the evidence of certain prominent chiefs before a commission in 1932, in which they elaborated an argument that present conditions of education and labour tend to destroy among members of the younger generation the feeling that they have a stake in the country. This is attributed to the breaking up of the old closely-knit and strongly localised family and tribal ties through these agencies. This view is of importance as a native criticism of such current tendencies as aim at 'civilising' the native. Against it, on the other hand, must be set the view, which appears to be gaining ground in West Africa—naturally among the more advanced members of the native community—that 'indirect rule' and the anthropological approach to administrative problems have been formulated as a principle with the express purpose of retarding the development of the people. Extreme as this view may be, it is unnecessary to stress the importance of its recognition as an element in the problem of which account must be taken, lest the most progressive and intelligent among the natives should be alienated. Those who hold such opinions are not necessarily all discontented or disgruntled agitators.

Even more interesting than Dr. Thurnwald's book in certain respects is an account of an experiment in anthropological and administrative research combined, which was carried out in Tanganyika*. Dr. Gordon Brown, anthropologist, and Mr. Bruce Hutt, District Officer of Iringa, joined forces, and for a year worked in close and continuous co-operation, the administrator posing questions to the anthropologist as they arose in the course of his work, and the anthropologist supplying the answer from material obtained by an investigation made *ad hoc* among the people on the special point.

The result was illuminating in more directions than one. Most important perhaps for the future of 'indirect rule'—the Hehe, the tribe under investigation, came under indirect rule in 1926—is the clear demarcation of the limits within which the application of anthropological research to administrative problems is practicable; but no less useful was the experience of the manner in which the posing of a question by the administration may open up new lines of thought and research for the anthropologist.

In so far as it is possible to summarise the result of a co-operative effort, of which every detail is worthy of careful consideration by those interested in scientific research and native administration, the work of these authors would go to show that

* Black and White in East Africa: the Fabric of a New Civilization; a Study in Social Contact and Adaptation of Life in East Africa. By Richard C. Thurnwald. With a Chapter on Women, by Hilde Thurnwald. Pp. xxii+419+16 plates. (London: George Routledge and Sons, Ltd., 1935.) 21*s*. net.

* Anthropology in Action: an Experiment in the Iringa District of the Iringa Province, Tanganyika Territory. By Dr. G. Gordon Brown and A. McD. Bruce Hutt. (Published for the International Institute of African Languages and Cultures.) Pp. xviii+272. (London: Oxford University Press, 1935.) 7*s*. 6*d*. net.

in imposing indirect rule upon the tribes of Tanganyika, the administration builded better than it knew. For investigation of the *status quo*, which was accepted by the system of indirect rule as guiding principle, as for example in continuing in office the 'headman' of the old regime, has revealed that underlying the outward form were unsuspected ramifications going deeply into social and religious belief and practice, which would have been destroyed and their benefits lost by any change that, to superficial observation, might have seemed to be little more than one in form alone.

The extension of the form, or at least the spirit, of indirect rule in the British areas of administration—the position of the Union of South Africa and the French Colonial system demand separate consideration—is in itself an adequate rejoinder to inquiry as to how stand the backward peoples of Africa there in relation to the principles of which the League of Nations is at present the nearest approach to living expression.

The aim of indirect rule clearly is by means of care for the existing order to make haste slowly. Hitherto, the efforts of those who have the interests of Africa at heart have been directed to protection of the native through the preservation of his institutions ; but this at the best is no more than a means to an end, an attempt to control the pace of development, and to avoid too rapid and disastrous breaking up of custom. But lest the native critic be justified, has the time not now come to ask ourselves : What comes next ? What is the policy of development that lies behind and gives meaning to 'indirect rule', if it is not to be regarded as entirely static ?

If any trust is to be placed in signs of the times, the day is rapidly approaching when some such question will have to be faced ; and by the practical wisdom and foresight shown in the event will the answer given by white rule in Africa be judged. We now stand at a point far removed from Kipling's concept of "the 'eathen in 'is blindness", and, to revert to the issue from which we started, the proposals for a compromise in the Abyssinian conflict cannot be allowed to evade responsibility by treating whole territories and peoples, whose future is at stake, as pawns in a game. *Fiat justitia, rual cœlum*, it may be, is no motto for statesmen, who are 'realists' ; but, unless the whole stream of history is destined to change its course, it is the acid test which will be applied by posterity. In the interests of world peace, it may be necessary to cede disputed territory, but under conditions which place the interests and well-being of the inhabitants before colonial ambition.

## A Himalayan Expedition

Nanga Parbat Adventure : a Himalayan Expedition. Translated from the German of Fritz Bechtold by H. E. G. Tyndale. Pp. xx + 93 + 80 plates. (London : John Murray, 1935.) 10*s*. 6*d*. net.

THIS is an account of the German-Austrian expedition of 1934, under the leadership of Willy Merkl, which attempted to climb the Western Himalayan mountain Nanga Parbat. This mountain culminates in a peak 26,620 ft. above sea-level—it is the tenth highest in the Himalaya. It rises directly from the Indus valley. Here it is possible to see in a single view from the river bed to the mountain top no less than 23,000 ft. of tremendous precipices. We believe this is the greatest amount of slope exposed in the world.

Nanga Parbat has unfortunately acquired an evil reputation. On its slopes in 1895, A. F. Mummery and his two Gurkha companions were lost. In 1932 a German-American expedition, also under the leadership of Willy Merkl, including two members of the expedition under review, failed to reach a greater height than 23,000 ft. owing to porter troubles and bad weather. On that occasion, porters were recruited from Nanga Parbat district "and there lay one of the main causes of its failure. Consequently it was decided at home to spare neither trouble nor expense in order to fetch Himalayan 'tigers' from Darjeeling to Kashmir", that is, men who had taken part in the Everest and Kamet expeditions. The original party comprised eight climbers, a group of three scientific workers, a doctor and a camp commandant, with a full complement of porters.

The expedition appears to have been well equipped when it reached the base camp, and both climbers and porters were experienced. Notwithstanding this, it met with the worst disaster that has befallen any Himalayan adventure. Of the advance party of sixteen, no less than nine lost their lives on the mountain—three Europeans,

including the leader, and six porters. In all, eight camps were formed above the base camp (13,012 ft.), the highest being 24,446 ft. From this point, so far as could be judged, there was no great mountaineering obstacle to be surmounted between it and the summit, which was about two miles (measured on the map) distant, while the actual nearest point reached, at a height of 25,300 ft., was only about one mile from the top, and some 1,300 ft. below it.

Here the whole advance party of five Europeans and eleven porters was caught in one of those sudden and violent storms which are a feature of the Himalayas. They had to retreat, when their goal seemed to be within easy reach, with the consequences already mentioned. Many gallant attempts were made at rescue, but all were driven back by the deep snow and blizzard.

When a disaster of this magnitude occurs, it is only natural and right to inquire so far as possible into the causes which may have led to it. It must be remembered every precaution may be nullified by the occurrence of a sudden and violent storm, accompanied by heavy snowfall. Having said this does not mean that the arrangements were free from criticism. One is forced, after reading this story, to ask the questions: Were the advance party sufficiently acclimatised? Were the high camps sufficiently equipped, before the final attempt was made, to provide for the contingency which actually occurred? Was the supporting party sufficient for the occasion?

Had camps VI and VII been provisioned and equipped with sleeping-bags, the storm might have been provided for, and the disaster at least mitigated, if not avoided. The narrative does not discuss these points. The advance party, which made the attempt on the summit, was so large as to leave very little support. It consisted of five European climbers out of the original total of eight. Drexel had died of pneumonia and Herr Bechtold, who was for a time a member of the advance party, was absent at the end, having escorted two exhausted porters to a lower camp, while another climber had returned sick to camp IV (20,300 ft.). It will be seen then how weak the supporting party was, and how very much lower down it was than the advance climbers, and with very difficult ground in between. With this distribution it would, in fact, have been difficult to keep up communication with those above even in fine weather, and in the actual circumstances quite impossible. When the danger in which the advance party found itself was recognised, every endeavour was made to help, but all failed in the face of the storm.

There were with the expedition a surveyor, a geographer and a geologist. While the rest were climbing they made a tour of the mountain. Their report, which is not included, should be interesting. The oxygen equipment which was with the expedition does not appear to have been used by the climbers. It was requisitioned from the base camp, but arrived too late for the gas to be administered to Drexel.

The book is illustrated by 110 magnificent photographs. There are three maps showing the routes taken and position of the camps. H. L. C.

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# The Molecules of Life

**Die Röntgenspektrographie als Untersuchungsmethode bei hochmolekularen Substanzen, bei Kolloiden und bei tierischen und pflanzenlichen Geweben**

Von J. R. Katz. (Handbuch der biologischen Arbeitsmethoden. Herausgegeben von Prof. Dr. Emil Abderhalden. Lief. 436. Abt. 2: Physikalische Methoden, Teil 3, Heft 6.) Pp. 3401–3716. (Berlin und Wien: Urban und Schwarzenberg, 1934.) 20 gold marks.

THIS book, which may be said to embody the long experience and considered views of one of the leading exponents of the X-ray method of structure analysis, is not concerned exclusively with the giant molecules of biological tissues, since it deals also with 'laboratory' colloids; but it is a direct and valuable contribution to a theme which must, deep down, be the theme of all scientific research. It seems to be clear now that we are living in an epoch marking, among other things, the decisive entry of physics and chemistry into biology, and the passage of time can only emphasise the great part played by X-ray analysis. The sooner, therefore, that its aims and principles become more familiar, the better.

Dr. Katz has tried here most conscientiously to minimise the difficulties and lay bare the pitfalls, and has strongly indicated what he considers the best method of approach; but as in all branches of science nowadays, there is always the trouble of limited time, and one has to live and work among crystallographers to appreciate to the full their point of view. Nevertheless, structure analysis is

essentially a habit of thought, the habit of thinking three-dimensionally: and this much at least can and should be acquired by all who are interested in the properties of molecules, especially those molecules, such as the proteins, polysaccharides and other high polymers and condensation products, in which is enshrined our very existence. It is the *shape* of molecules that counts in the end.

To one who is used to the research outlook of the English-speaking peoples, there is perhaps something lacking from this book: one misses rather the thrill and romance of advancing with the new physical weapons ever deeper and deeper into the biological unknown. Let us be cautious, by all means, but let us also be brave.

W. T. A.

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# The Cinematograph and the School

(1) The Cinema in Education:
a Handbook for Teachers. By D. Charles Ottley. Pp. xi+130+4 plates. (London: George Routledge and Sons, Ltd., 1935.) 3*s*. 6*d*. net.

(2) The Film in the School
Edited by J. A Lauwerys. Pp. 140+4 plates. (London: Christophers, 1935.) 3*s*. 6*d*.

(3) A National Encyclopaedia of Educational Films and 16mm. Apparatus
Pp. 288. (London: Central Information Bureau for Educational Films, Ltd., 1935.) 21*s*.

(1) THE reviewer is biased against this volume by the statement on the jacket that "here for the first time the film's place in education is defined, its function analysed, and its possibilities as a teacher described in words that all may understand". This claims too much; but perhaps the book is better than it might appear. There is first an apologia for films in school, then the larger part of the book is taken up with accounts of films and projectors available, and finally there is a summary of a few lessons aided by films and a series of short statements about the use of films culled from various sources.

Too much has been attempted, and while it is true that many different subjects are mentioned, it is doubtful whether in fact enough is said on any one matter except 9·5 mm. films; indeed, if the cinema in education is the subject of the book, a quite disproportionate amount of space is devoted to these films, with which the author is evidently most familiar and on which he speaks with most authority. For the teacher who has a 9·5 mm. projector the book may be useful. The author points out, for example, that one advantage of these small films is that they can be bought outright and not hired, as are the 16 mm. films, and that consequently they can be edited and cut to suit the user; he gives examples of what he has done in the way of re-editing and combining films which he has bought, and shows how much can be done with them.

(2) "The Film in the School" is a contrast to "The Cinema in Education". Its purpose is clearly stated; it is "to give advice, as practical and detailed as possible, to those who would like to use films in their work", and it is fulfilled not unsatisfactorily. The book comprises seven chapters written by authorities on their subjects. The editor in the first chapter deals with "The Place of the Film in Education", with an emphasis on "place", and makes many interesting and valuable suggestions. Chapter ii, "Choosing a Projector", gives a clear and balanced account of the advantages and disadvantages of different kinds—not makes—of projectors. It may be noted in passing that a loose leaf supplies information on the picture-size and cost of most 16 mm. projectors, sound and silent. The third chapter deals with "The Film in the Classroom", and describes a few lessons which have been given with films. "The Mass Demonstration" is mostly devoted to giving the details of organisation of, and conclusions to be drawn from, the St. Pancras experiment by Capt. Griffiths, who took a prominent part in that experiment.

In the fifth chapter, on "Film Making in School", Mr. Ronald Gow points out that "as school textbooks are, naturally, written by teachers it is not unnatural to suppose that the educational film of the future will also be written by teachers" and gives accounts of films which he produced. Miss Mary Field describes the method and difficulties of the commercial producer of educational films, and in the last chapter the technique of "Using a Projector" is clearly described by Mr. Waley. There is an appendix which states the contents of the principal film libraries and a short bibliography.

It will be seen that the volume deals with facts, not theories, a welcome development in the literature of educational films.

(3) This "Encyclopaedia", though it has a different name, is in fact a new and much improved edition of the Catalogue of Educational Films published in 1933. Additions consist of articles, a

useful list of addresses of those from whom films may be obtained, lists of 16 mm. projectors, lists of film cameras and materials, and a library list.

The chief change is in the arrangement of the catalogue of films ; these are now first listed under the headings 35 mm. and 16 mm. ; each of these is divided into sound and silent films and these again into agriculture, art, biology and the rest. This is a very great improvement. Another change, which is not altogether an improvement, consists in giving the length of all films in reels, instead of using reels, feet and minutes ; as the vast majority of films listed are of "1 reel" the information is not extremely useful.

The volume will save searching commercial catalogues, but it is not easy even yet to find what films are available on any particular topic on, say, 16 mm. silent stock—and that is the main use of a catalogue. Indeed, it still takes time to trace all the films in a particular subject such as geography ; some of the best hide themselves under agriculture, science (anthropology) or engineering and industry.

## Civilisation and its 'Crises'

### The Source of Civilization

By Gerald Heard. Pp. 431. (London and Toronto : Jonathan Cape, Ltd., 1935.) 12*s*. 6*d*. net.

MR. GERALD HEARD, in his new book, has given us plenty to think about. The substantial merits of his work are, that it is a bold attempt at a comprehensive survey of human evolution, and that it is inspired throughout by a passionate belief that only by peace with his fellows, and a sense of harmony in the universe, can his full powers be developed, or rather, as Mr. Heard would say, can he escape his imminent destruction. In the first aspect—that of comprehensiveness—it is a brilliant expression of the current spirit which refuses more and more to limit the historical vision to politics and is eager more and more to trace backward by prehistoric discoveries the origin of the fundamental directions of human thought and action. It demands an evolutionary solidarity with all life.

In the second aspect, as a passionate pacifist manifesto, it is one of the most notable post-War publications. No one else has attempted—at least in English to our knowledge—so wide and detailed a denunciation of 'violence' in all its forms. When we criticise, therefore, it will be understood that it is with the deepest sympathy with the two main objects which Mr. Heard has in view. That it provokes, in that spirit, both scientific and historical criticism, is clearly a testimony to its force. Such widespread syntheses are one of the greatest needs of the time, but to be useful they must be met by friendly and searching examination.

The book, however, covers such an amazing wealth of facts and suggestions drawn from psychology, prehistory, Eastern philosophy and religious lore, that it is only possible here to make a few general remarks.

Mr. Gerald Heard's thesis, broadly speaking, is that man is naturally not a fighting but a pacific and friendly creature. He springs from a stage in the animal genealogy much further back than the brutal gorilla or any of the so-called 'primates', nearest in fact to the harmless tree-shrew. At an early stage he enjoyed a consciousness of his community with other animals, and the outside world generally, which he has since lost ; and it is by the recovery of this at a higher stage of development that his salvation, if it is at all possible, will be secured. This early stage has now retreated into the depths of the subconscious, and the main purpose of psychology is to bring it again into the light. This was once apparently secured in the civilisation of what is frequently referred to as the "Eastern arc of the proto-civilisation" (represented by the recent discoveries in the Sind region). It was continued in the early culture of India, and on this account the practice of Yoga is so important. Except in this region, the early pacific civilisation was everywhere destroyed by 'violence' and individualism. This individualistic violence is promoted by the exercise of the mind in the one-sided exploration of external Nature, which tends to make man aggressive and acquisitive and is at the root of all the imperialisms from Assyria to the Great War. We must return and strive to regain a united consciousness, if civilisation in the true sense is to be saved.

Our criticism must be that such a scheme of human evolution, in spite of its many valuable sidelights and suggestions for further inquiry, is a simplification invalidated by its obvious *parti pris* and by the elevation of small and isolated facts into decisive arguments. The human stock, with its, say, half a million of years for distinctive growth, cannot be thus confined into one type of conscious life which we select as it suits our theory. That man's greater awareness was, as Mr. Heard says, his best qualification for a later rise, is abundantly clear, and that he rose and developed his powers because he was more adaptable. The

stress on these points contain some of the most valuable thoughts in the book.

But it is impossible to maintain that the earlier man had not also combative elements in his nature. His constant normal character is sufficient evidence of this, and the weapons and remains of slaughtered foes which are a part of so many prehistoric cites and excavations. We know little enough yet about our early ancestors in those vast æons of life, but we certainly know that fighting for their lives and their food was at least one element in their age-long task. When we come down to later times, in which historical records are available, it is no less clear that sword or 'violence' cannot be dismissed as an entirely decadent and harmful thing. Alexander's empire was not the mere "Macedonian raid" which is here described, nor was the Roman Empire the last word in stupid violence.

The whole story is much more complex than that; but one or two capital facts emerge which are not allowed for in such a condemnatory survey. One, that Rome gave us, in spite of her crimes, the framework of modern civilisation in which we live, and which, it may be added, shows more hope of surviving than Mr. Heard would allow. In fact, if we survive at all, which one may postulate without over-confidence, it will be owing, among other things, to the work of Rome, including her sword. Perhaps still more important is the fact that the Greeks, to whom we owe the first definite formulations of knowledge—both objective and subjective—did this work in a constant atmosphere of war. With them at least the fighting did not inhibit keen and disinterested thought.

A last word of criticism must be that the unifying work of science is scarcely allowed for at all. This is perhaps the most serious omission. It is omitted, because to admit it would be to admit that our present scientifically organised society is actually the most stable, whereas the argument requires us to believe that civilisation is in its most acute 'crisis' and can only survive if we retrace our steps. Retrace we cannot; advance, enlarge and correct we may. The correction will include much of what Mr. Heard desires, and, above all, the further suppression of the instinct to war, which is a diminishing and not an increasing factor in our make-up. But towards that most desirable of consummations we must include, as a prime and growing factor, the disinterested pursuit of truth both as to the world around us and our own nature; and it will consist rather in developing and making more articulate the conscious than in attempting to read and make a guide of the deep-down and often misleading promptings of the subconscious. F. S. MARVIN.

Les fossiles: éléments de paléontologie

Par Prof. Marcellin Boule et Dr. Jean Piveteau. Pp. vii+899. (Paris: Masson et Cie, 1935.) 170 francs.

HERE is a textbook of palæontology prepared for France, where the subject is considered apart both from biology and from geology. The introduction dealing with these subjects is of the shortest character, and is followed by a history of the science, in which the credit for its foundation is given to Leonardo da Vinci and Bernard Palissy, artists in paint and in clay.

The main part of the work is a systematic account of the organisms of the primary, secondary and tertiary periods, followed by that of quaternary man. Groups of organisms are treated in respect to their popularity rather than their scientific interest. Thus more than 500 pages are devoted to vertebrates, while such important phyla as Protista, Porifera and Cœlenterata together are only assigned 41 pages, while insects have 9 pages in spite of the great evolutionary interest of their fossil forms. From a biological aspect the classification often does not satisfy; thus the Stromatoporids were probably Foraminifera, while the Artiodactyles and Cetacea are usually regarded as derived from the Creodonts.

The author's technique is that of a fine museum guide rather than that of the more discursive and critical teacher. At the same time the latter will appreciate "Les fossiles", since most fossil genera are mentioned, while there are 1,330 figures, of which a very large percentage are original. Unfortunately, there is no bibliography to help the reader to dip deeper into the science.

Old and New: Thoughts on the Modern Study of History

By F. S. Marvin. (University Extension Library.) Pp. 224. (London: Ivor Nicholson and Watson, Ltd., 1935.) 4*s*. 6*d*. net.

THE title of Mr. Marvin's earlier book, "The Living Past", published in 1913, and frequently and deservedly reprinted, was almost a stroke of genius. In a phrase, it seemed to reveal, or at least to suggest, the true nature of the historian's task. The question whether history is a science has often been discussed, and is one which might naturally appeal to many readers of NATURE. Mr. Marvin is too wise to spend his efforts upon the somewhat academic question whether the methods and the materials of history fairly bring it into the category of what is usually called science. He prefers to go straight to the problem what we are really doing, or ought to be doing, in that study of the past which is called history, and how the process has been changed by the general movement of thought, scientific and philosophical, in modern times. He then proceeds to deal with certain selected aspects of history, by no means repeating his earlier work, but again leaving the reader with a high sense of human achievement, notwithstanding the terrible setbacks that have to be recorded. The chapters on the scientific work of the ancient Greeks, and on the marvellous technical advance in modern times, will prove specially interesting to scientific readers.

An Introduction to Comparative Zoology:
a Text-Book for Medical and Science Students. By F. G. Sarel Whitfield and A. H. Wood. Pp. x+354. (London: J. and A. Churchill, Ltd., 1935.) 15*s*.

HERE is a textbook for the Kitchener School of Medicine at Khartoum, and presumably the animals with which it deals form the syllabus of that School, together with some consideration of embryology, heredity, evolution, ecology and metabolism. The morphology of the types is done admirably. The size, print and especially the illustrations are exceptionally good. There may be a sufficient reason in the psychology of students for making the work so morphological in Khartoum, but the tendency in Great Britain is for the teacher to lighten morphology with a consideration, most elementary of course, of function in relation to the environment in which the animal dwells. Here much emphasis is laid on parasites, blood flukes, tapeworms, *Ascaris*, ticks and 'medical' insects being included besides all the types usual in Great Britain. This may be wise, for the applied side anyhow will have to be considered later by the student in a tropical country, where he will be seeing the effects of animal parasitism. In any event, parasites are not good forms on which to teach observation, which surely is of the first importance to the commencing student. If all these additional types are to be considered, why not omit the dogfish altogether? It has little to do with the Sudan and the course would be sensibly lightened without much loss.

(1) A Manual of the Common Invertebrate Animals, exclusive of Insects
By Prof. H. S. Pratt. Thoroughly revised edition. Pp. xviii+854. 7.50 dollars.

(2) A Manual of Land and Fresh Water Vertebrate Animals of the United States (exclusive of Birds)
By Prof. H. S. Pratt. Second edition. Pp. xvii+416. 6 dollars.
(Philadelphia: P. Blakiston's Son and Co., Inc.; London: J. and A. Churchill, 1935.)

THESE two books are thoroughly revised and greatly improved second editions, and are really two volumes of the same work. They aim at giving descriptions of the common invertebrates and vertebrates of the United States, by means of which their relationships and names may be determined. The insects are excluded, their half million or so of species obviously requiring separate treatment. The classificatory keys, the analytical tables and descriptions have been tested by us in several groups, and appear to be admirable, while the numerous illustrations (184 and 974 respectively) are well selected. They enable the visitor to the coast, mountain, plain or lake to name quickly any beasts that he may be watching in the open, or perhaps at home under magnification, with reasonable certainty, and this encourages him to observe. They are clearly books valuable in every classroom and library in North America, as similar synopses of the local fauna would be in any country.

West Coast Shells:
a Description in Familiar Terms of the Principal Marine, Fresh-water and Land Mollusks of the United States, British Columbia and Alaska, found west of the Sierra. By Josiah Keep. Revised by Joshua L. Baily, Jr. Pp. xi+350. (Stanford University, Calif.: Stanford University Press; London: Oxford University Press, 1935.) 17*s*. net.

FIFTY years ago, conchology was a hobby both in Europe and America, and most large seaside towns had societies for its study. The infinite variety and the beauty of the shells were their attractions, and it was not unusual to pay several pounds for a prime specimen. Now shells are recognised as a part of the complex of every coast, often governing factors in its formation. This rewritten book of Josiah Keep, originally published in 1881, is 'tuned up' to a new conchology that may well some day be as popular as the old. Oysters, razors, limpets, borers, burrowers, clams, etc., as titles of chapters indicate its key, and the technique of their consideration is both simple and scientific. British natural historians may well read it, for on the coasts of Britain dwell each of the above groups, but such would be well advised to take old Keep's advice: "While you admire their lovely shells, think even more of the quiet and pleasant lives they spend in their ocean home".

Wild Life Studies
By Frances Pitt. (Argosy Books, No. 3.) Pp. iv+189+9 plates. (London: Thomas Nelson and Sons, Ltd., 1935.) 3*s*. 6*d*. net.

THIS is a series of studies of the private lives of certain birds and beasts, most of them common dwellers in the English fields and hedgerows—voles, weasels, hedgehogs, peewits, owls, hawks and such. There are also two chapters on puffins and seals. Miss Frances Pitt writes on all these animals with an intimacy and humour which ensure ease and enjoyment for the reader, and the perusal of the book should certainly add interest and pleasure to a Nature lover's rambles. The author directs attention to the useful work done by animals commonly known as pests in a manner refreshingly free from sentimental special pleading. The pen drawings by G. E. Collins are delightful.

The Life and Writings of Giambattista Vico
By H. P. Adams. Pp. 236. (London: George Allen and Unwin, Ltd., 1935.) 8*s*. 6*d*. net.

A BOOK on Vico in the English language has long been overdue. Mr. Adams, in giving us the benefit of detailed studies of living Italian scholars, has revealed to a wider circle of readers the greatness of mind of one recognised by Goethe as a patriarch of modern thought. Indeed, after a detailed analysis of Vico's writings, Mr. Adams shows how he has influenced the trend of modern philosophy, from the eighteenth century down to the contemporary Italian thinkers. Thus the book under review will be found of interest to the historians of philosophy as well as to those of literature and political theory. T. G.

# Charles Darwin as a Student in Edinburgh, 1825-27*

By Prof. J. H. Ashworth, F.R.S.

CHARLES DARWIN in his autobiography, written in 1876, gives in half a dozen pages ("Life and Letters", I, pp. 36–42) an account of his two academic sessions as a medical student in Edinburgh. This account includes brief references to his naturalist friends and acquaintances, a statement that he collected specimens in the tidal pools on the shore of the Firth of Forth and by going out with the "trawlers", and that he made new observations on the "so-called ova of Flustra", which "were in fact larvæ", and on the egg-cases of *Pontobdella muricata*.

It is now possible to form a more adequate conception of his early progress as a naturalist with the help of the minute book of the Plinian Society of the University of Edinburgh and of a notebook begun by Darwin in Edinburgh in March 1827, the latter of which I have been permitted to see by the kindness of Prof. C. G. Darwin and Mr. Bernard Darwin.

Charles Robert Darwin came to Edinburgh at the age of sixteen years and eight months, and with his elder brother Erasmus, who had been a medical student at the University in the previous year, signed the matriculation book, "Charles Darwin—Shropshire", on October 22, 1825. His class cards for the academic year 1825–26 were presented to the University of Edinburgh by the late Sir Francis Darwin in 1909, together with the wrapper inscribed by Darwin, in which they were found among his papers. The cards are : For the University Library, materia medica, chemistry, anatomy, clinical lectures, principles and practice of surgery and a 'perpetual ticket' for the Royal Infirmary.

In his autobiography, Darwin writes that the lectures "were intolerably dull, with the exception of those on chemistry by Hope. . . . Dr. Duncan's lectures on Materia Medica at 8 o'clock on a winter's morning are something fearful to remember. Dr. —— made his lectures on human anatomy as dull as he was himself". The "Dr." referred to was Alexander Monro *tertius*, who did not sustain the great reputation made by his grandfather and his father, who had preceded him in the chair of anatomy. Darwin attended the clinical lectures and he records that he also "attended regularly the clinical wards in the hospital". He enrolled in the class of 'Principles and Practice of Surgery', but all that is known about his attendance in this subject is his own note that on two occasions he was present at "very bad operations"—these were before the days of chloroform—and that he "rushed away before they were completed".

In his second year at the University, Darwin enrolled in the classes of midwifery, practice of physic and natural history.

Robert Jameson, then fifty-two years of age, was, and had been for twenty-two years, professor of natural history, which then included zoology and geology. He devoted himself chiefly to mineralogy, but his published work shows his interest also in marine zoology and in birds, and as editor of the *Edinburgh Philosophical Journal* and of the *New Philosophical Journal*, he maintained a wide outlook on science in general. He formed an extensive and important natural history museum in the University of Edinburgh, which was notable for the excellent state of preservation of its specimens and their scientific arrangement and for its large collection of birds. The entire museum collection, said to have been, in Great Britain, "second only to that of the British Museum", was handed over a year after Prof. Jameson's death to the new Government Museum of Science and Art, now the Royal Scottish Museum.

Darwin found Prof. Jameson's lectures "incredibly dull" ; "the sole effect they produced on me was the determination never as long as I lived to read a book on Geology, or in any way to study the science". Fortunately, he did not adhere to this decision ; within ten years he had made the observations for his three geological memoirs, one of which, on coral reefs, has become a classic.

The detailed syllabus of Prof. Jameson's lectures, as drawn up by him in 1826, shows the range of his teaching, which included not only zoology and geology but also instruction in meteorology and hydrography and some reference to botany in its relation to "the animal and mineral kingdoms". The course of zoology began with a consideration of the natural history of man, was followed by an account of the chief classes of vertebrates and invertebrates, and concluded with lectures on the philosophy of zoology in which the first subject was "Origin of the Species of Animals".

This would be the course as given in Darwin's second academic year, and the lectures, which

* From an address to the Royal Society of Edinburgh on October 28, part of which formed the subject of a paper to Section D (Zoology) of the British Association at Norwich.

began on November 8, 1826, were on five days a week and were stated to extend over five months ; hence there would be about one hundred lectures, in addition to which there were 'conversations' with the professor in the Museum, and excursions. While Prof. Jameson's teaching of some parts of geology was unacceptable owing to his adherence to extreme and discredited Wernerian views, the recorded judgments of Robert (later Sir Robert) Christison and of Edward Forbes on his teaching in general and on his enthusiasm for his subject and for the Museum under his charge show that they did not share Darwin's opinion of Prof. Jameson's course.

Although Darwin apparently did not receive from Prof. Jameson's lectures much instruction in zoology, he was able to acquire in other ways while in Edinburgh a considerable acquaintance with this subject.

Soon after coming to Edinburgh, Darwin became aware that his father would leave him "property enough to subsist on with some comfort" and this was, as he states, "sufficient to check any strenuous effort to learn medicine". Much of the time available after his attendance at classes would probably be devoted to his pursuit of natural history, especially during his second year when his brother was no longer with him in Edinburgh. His classes were in the same building as the Natural History Museum, and therefore any spare time could be immediately put to good use in the Museum, where he was likely to find at work two experienced naturalists, Dr. Robert Grant and William Macgillivray, whom he came to know well. Further, his membership of the Plinian Natural History Society brought him into association with other enthusiastic naturalists in Edinburgh at that time.

The Plinian Society was founded in 1823, and the two minute books from February 1826 to the end of the Society's existence in 1841 are preserved in the University Library. The Society, which met every Tuesday evening in the College or University of Edinburgh, had about one hundred and fifty members, but the number recorded as being present at the meetings does not usually exceed twenty-five. The secretary in February 1826 was Dr. Robert Grant, and the record includes the names of those present and of those who took part in the discussions.

Darwin was elected a member of the Society on November 28, 1826, and at the meeting a week later, at which the election of officers and council took place, he was chosen as one of the five members of the council, from which it may be concluded that he was very favourably known for his interest in natural history. There were five presidents—Messrs. Ainsworth, Coldstream, Kay, Browne and Fife—three of whom, Browne, Coldstream and Fife, had proposed Darwin for membership of the Society. He states in his autobiography that he found the meetings of the Society stimulating and that he "used regularly to attend" ; the record shows that he was present at all but one of the nineteen meetings held from the date of his election to April 3, 1827.

The minute book is of interest as showing the subjects discussed in the students' natural history society in Edinburgh one hundred years ago, and it indicates the wide range of the communications presented during the period of Darwin's membership. Darwin is noted as having participated in the discussions on four of the evenings ; it would have been particularly interesting to know what he said on the principles of natural classification and especially on specific characters when he spoke in the discussion on that subject.

On March 27, 1827, not "at the beginning of the year 1826" as stated in the autobiography, "Mr. Darwin communicated to the Society two discoveries which he had made :

(1) "That the ova of the Flustra* possesses organs of motion".

(2) "That the small black globular body hitherto mistaken for the young of Fucus lorius [loreus] is in reality the ovum [or, as he wrote in the autobiography, the egg-case] of the Pontobdella† muricata".

At the request of the Society, Darwin promised to draw up "an account of the facts and to lay it, together with specimens, before the Society next evening". The minute of the next meeting records that he presented to the Society "a specimen of the Pontobdella muricata with its ova and young ones", but does not mention any account, and if the manuscript was placed before the Society it has not been kept.

In his note-book, Darwin gives under the date April 20 a short account of the yellow embryos and ciliated larvæ of *Flustra carbasea*, records that two other species produced motile "ova" and adds a description of the egg-cases of *Pontobdella* and of the young leech when ready to escape. These observations, which occupy four and a half pages of the note-book, were not published by Darwin.

Three days previous to Darwin's paper at the Plinian Society, that is, on March 24, 1827, Dr. Grant read to the Wernerian Natural History Society of Edinburgh, as the minute under that date records, "A Memoir regarding the Anatomy and Mode of Generation of Flustræ, illustrated by preparations and drawings", and "a notice on the Mode of Generation of the Pontobdella muricata of Lamarck".

* *Flustra*, the 'sea-mat', a genus of Polyzoa, obtained by dredging or found thrown up on the shore—the brown sea-weed now known as *Himanthalia lorea*.

† *Pontobdella*, a leech frequently found on the skate and hence often called by the fishermen the skate-leech.

Grant's paper contains a more detailed account than Darwin's of the ova of *Flustra* and of the ciliated embryos and larvæ which Grant reared in watch-glasses into young colonies.

Grant prepared a description of the cocoons of *Pontobdella*, published in the *Edinburgh Journal of Science* of July 1827, in which he stated that "the merit of having first ascertained them to belong to that animal is due to my zealous young friend Mr. Charles Darwin of Shrewsbury, who kindly presented me with specimens of the ova exhibiting the animal in different stages of maturity".

Another significant factor in Darwin's studies in natural history in Edinburgh was his friendship with some of the Newhaven fishermen, whom he sometimes accompanied when they dredged for oysters "and thus got many specimens". His note-book records *Pennatula mirabilis* (now *Virgularia mirabilis*) and *Pennatula phosphorea* from the Firth of Forth, which were no doubt obtained in that way; the cocoons of *Pontobdella* which he found on oyster and other shells were probably collected on some of these expeditions, and he procured his specimens of *Flustra carbasea* "from the dredge boats at Newhaven".

Darwin's note-book, which is inscribed on the fly-leaf "Charles Robert Darwin, March 1827", provides interesting evidence of his observations on animals collected in the Firth of Forth. He found a lumpsucker stranded on the rocks at Leith and "dissected it with Dr. Grant"; a fairly complete examination was made of its internal organs including the heart and its valves. He records and sketches the "ova" (egg-masses) of several molluscs, adds sketches of the ciliated larvæ of three of them, and gives brief descriptions of the two sea-pens, *Virgularia mirabilis* and *Pennatula phosphorea*, which he had procured no doubt with the help of the Newhaven fishermen. The last zoological entry in the note-book is that he "observed with Mr. Coldstream" a starfish, which he identified as *Asterias rubens*, but which was almost certainly a specimen of the closely similar starfish first differentiated from *rubens* as a new genus and species by Michael Sars in 1846 and now known as *Leptasterias mülleri*. Darwin saw his starfish in the act of discharging its eggs. In this species the eggs are incubated in the space enclosed by the arched disc and the inwardly bent bases of the arms.

With Darwin's Edinburgh notes were two lists of animals, one of "the Vermes found in the Frith of Forth and other parts of Scotland" abstracted from a paper by Prof. Jameson (1811), and the other of "Fishes found in the Frith of Forth" from a paper by Patrick Neill (1811). Each list was written on two double sheets, about 6 in. $\times 3\frac{1}{2}$ in., and the two sheets were fastened together by a strip of gummed paper. These lists could be carried in a pocket-book, and would be convenient for reference in his collecting expeditions.

Darwin left Edinburgh late in April 1827, when little more than eighteen years of age, and early in the following year went to Cambridge.

Reference was made to Darwin's friends in Edinburgh, of whom the most important was undoubtedly Dr. Robert Edmund Grant, then about thirty-three years old. He had graduated M.D. Edinburgh in 1814 and had studied natural history and medicine in 1815–20 in Paris and other Continental universities. He returned to Edinburgh in 1820 and explored the coasts of Scotland and Ireland and made studies, including dissections, of many animals which he collected. Grant was the author of a series of papers on sponges in 1825 and 1826, and many of the observations therein recorded were made on the shores of the Firth of Forth. In addition, he published or wrote, in the years 1825–27, more than a dozen other papers on Cœlenterata, Mollusca, Polyzoa, Crustacea, on the structure of the eye of the sword-fish, and on the anatomy of the *paca* of Brazil; he was at that time a most energetic collector and investigator, especially of marine invertebrates. Darwin states that he often accompanied Grant to collect animals in the tidal pools, and he records in his note-book that he dissected with Grant the lumpsucker he had found at Leith. It was a great advantage to Darwin to have this experienced zoologist as his friend.

In his autobiography Darwin relates that one day when he was walking with Grant the latter "burst forth in high admiration of Lamarck and his views on evolution"; Darwin adds that he listened in silent astonishment, and so far as he could judge without any effect on his mind. That exposition on Lamarck acquires fuller significance when it is remembered that Grant studied in Paris during the period 1815–20, and that he would devote much of his time to work in the Museum of Natural History, where he would very probably come into association with Lamarck only a few years after the latter had published his "Philosophie Zoologique" (1809) and while he was preparing his great work on the natural history of invertebrates (1815–22).

In the summer of 1827 Grant left Edinburgh to become the first professor of zoology in University College, London.

William Macgillivray, thirteen years Darwin's senior, was, during the time Darwin was a student in Edinburgh, assistant and secretary to Prof. Jameson and acted as assistant-keeper of the University Museum of Natural History. He was known for his papers on molluscs and on birds, and

was afterwards (1841) appointed professor of natural history in Aberdeen. With him Darwin "had much interesting natural-history talk", and while birds are not specifically mentioned, it is scarcely possible that Darwin could be in frequent association with Macgillivray—whom the late Prof. Alfred Newton regarded, after Willughby, as "the greatest and most original ornithological genius save one (who did not live long enough to make his powers widely known) that this island has produced"—without utilising such an opportunity of acquiring some of his special knowledge of the classification and structure of birds. Darwin records that in Edinburgh he had lessons on preparing birds from a Negro who had travelled with Waterton, and there is extant evidence of his interest in birds at this time in two 'keys' in manuscript found among his Edinburgh notes. One is a key to the genera of British birds and the other, to about one hundred genera of birds, was "copied from Brisson's *Ornithologie*, 4th Edit. . . . 1826", hence it was written during his second academic session.

Darwin "became well acquainted with several young men fond of natural science". He mentions Ainsworth, Coldstream and Hardie (this should be Arding, a member of the council of the Plinian Society), but he might have added the other presidents of the Plinian Society—Kay, Browne (father of Sir James Crichton-Browne) and Fife, with whom also he would be frequently associated during his last five months in Edinburgh. These men were all senior to Darwin by two to four years; Browne was already L.R.C.S. and the others qualified in medicine in 1827.

Darwin attended, with Grant, meetings of the Wernerian Natural History Society and heard, among others, Audubon, who spoke at the meetings in December 1826 and January and February 1827, and he was present at one meeting of the Royal Society of Edinburgh, where he saw Walter Scott in the chair as president.

I suggest that if, with the information now available, Darwin's experiences in Edinburgh are reviewed, there are good grounds for the conclusion that, while he gained comparatively little from the formal lectures, he had excellent opportunities, of which he appears to have availed himself fully, of developing his early taste for natural history and collecting, and that in Edinburgh he laid the foundation of his knowledge of the science of natural history.

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# Utilisation of Pine Forests

## Cellulose Pulp

A STUDY of the methods of utilising the vast areas of pine forests which occur in various parts of the world is a matter of considerable importance from the scientific and economic points of view, and both aspects have recently received considerable attention in Australia and in the United States. In each case the manufacture of cellulose pulp for the paper and allied industries has been the main objective; but the problem has been approached from somewhat different aspects in the two countries. Thus, the American workers have erected a large-scale experimental plant, and have carried out numerous pulping trials, whilst in Australia a more fundamental study of the chemistry and structure of the woods has first been made, with small-scale pulping trials to provide additional information. The two studies are therefore, in a sense, complementary; and it is interesting to consider them together.

It is well known that the objection to the use of the southern type of pine for pulping has always been the high resin content, which is a source of considerable trouble to the paper-maker. It is true that the soda and sulphate (kraft) processes of digestion remove most of this, but such methods are not always desirable for economic reasons. The mechanical and acid (sulphite) processes, which are generally preferred, provide no solution of the resin problem; it seems, in fact, that the latter induces polymerisation of the resins, which are thereby converted into an objectionable substance resembling pitch.

The key to the problem appears to be the differentiation of the sapwood and the heartwood, and it has been found from investigations on thinnings, which contain very little resinous matter, that the elimination of heartwood also eliminates the resin trouble. As an example, in the case of the longleaf pine, the average figures given for the resin in the sapwood and heartwood are 2 and 7–10 per cent, respectively. With this is also involved the question of the diameter of the tree, because in the past there probably has not been a full appreciation of the great diameter to which a tree can grow before the sapwood begins its transformation into heartwood; this is in spite

of the fact that, so long ago as 1897, F. Roth[1] stated that this transition really begins before the tree is twenty years old, and that twenty to twenty-five years is the usual age. Roth also found that the average diameter of the fibres of the spring-wood is about twice that of the summer-wood, so that, unless this difference is taken into account, measurements of the relative widths of such woods may give a false idea of the total amounts present.

The analytical data compiled by W. G. MacNaughton and F. Allen from various published sources[2] and from their own work confirm the fact that, as indicated by Roth, the difference in apparent density of the spring- and summer-woods depends on the wood structure. They also demonstrated the low resin content of southern pines free from heartwood. Laboratory pulping tests were carried out on these young pines both by the sulphite process and by mechanical methods, and average yields of 45 and 93 per cent being obtained, respectively; these are similar to the average figures obtained with other species of the wood.

The engineering and the economic aspects of the problem have been more fully discussed in several publications by C. H. Herty[3]. A small-scale plant has been erected in Savannah, Georgia, under the auspices of the Department of Forestry and Geological Development, and reels of paper 26 inches wide can be made on a small Fourdrinier machine. In order to overcome the difficulty of 'blue stain', due to sap in the summer season, experiments were made with green wood, and contrary to expectations this was found to give a pulp almost free from resin trouble. On the other hand, after seasoning for three months, the pitch trouble was more pronounced, and as this is contrary to experience with northern spruce, it suggests the desirability of an investigation into the natures of the resin from these two sources and the changes they undergo on seasoning.

Herty's account of this work is marked by an enthusiasm which, in view of the commercial possibilities involved, is probably justified. It is reassuring nevertheless to turn to a paper by L. C. Anderson[4] which is an independent account of the behaviour of the new pulps on a modern Canadian newsprint machine. Incidentally, the paper so made was used by the Georgia newspapers for a special edition to commemorate the event. A mixture of 25 per cent of sulphite and 75 per cent of ground wood (both from Loblolly pine) was used, and the complete absence of pitch trouble was confirmed. The data show quite definitely that from the point of view of the operator the utilisation of these pulps presents no unusual difficulties. On the other hand, the paper produced is considered to be poorer in quality than that made from spruce or balsam. It was limp to the hand, and the tensile and bursting strengths and smoothness and porosity values were all poorer than the corresponding average data for the northern woods. It must be remembered, however, that the pulps were prepared in a plant of experimental scale, and it is a well-known fact that the quality of pulps may usually be corrected as a result of tests on the paper made from it. There is little doubt therefore that a process operated in the normal way would give better results.

A more recent development of the work in the Georgia laboratories is the production of cellulose for viscose rayon, and Herty and Rasch[5] have described the properties of the material obtained by a short high-temperature digestion process; the yields of cellulose were 88–90 per cent.

It is now of interest to turn to the contribution of the workers in Australia, where the numerous afforestation schemes of recent years have resulted in the planting of large areas of pines, mainly *Pinus radiata* (*insignis*). The utilisation of this material is obviously of the same economic importance here as in Georgia, and the problems are very similar.

In the first of a series of chemical investigations on *Pinus radiata*, W. E. Cohen[6] deals with the nature and distribution of the non-volatile ether-extractives and the occurrence of heartwood. Eighty-five samples (6–22 years old) from South Australia, Victoria and New Zealand were extracted with ether, and the acid and ester values of the extract were determined. Experimental sulphite pulping tests were also made on a sample from a 22-year-old tree.

The results suggest that seasonal variations and changes in the nature and amount of the ether-extractive during storage are more important factors than have hitherto been realised, and that the age of the tree and the amount of heartwood present bear no definite relationship to the yield of extractives from a whole log section. The amount of ether-extractive in the inner rings was always more than in the outer rings, especially when the former contained heartwood. The ratio of the acid value to the ester value was taken as an indication of the nature of the resinous matter; the acid content is raised when heartwood is present, and high yields of resins having a high ester value are obtained in the presence of resin ducts such as occur usually in trees 16–18 years old. There is also evidence that the time of collection affects the results, because young samples (6–12 years old) collected in March had a much lower acid/ester ratio than those collected in September.

The pulping tests established definitely the difficulty of dealing with wood containing appreciable amounts of heartwood, and an increased temperature-gradient and penetration-period were required in such cases. The resin-contents actually obtained were the very low figure of 0·35 per cent for pulps from sapwood, and 3·84 per cent from heartwood pulps. No pitch trouble was experienced with the former, but the indications are that the latter would give trouble from this source.

J. G.

[1] U.S. Dept. Agric., Division of Forestry, Bull. 13; 1897.
[2] *Paper Trade J., Tech. Sec.*, **97**, 14; 1933.
[3] *ibid.*, **96**, 161; 1933. **101**, 48; 1935.
[4] *ibid.*, **98**, 109; 1934.
[5] *Rayon and Melliand Text. Monthly*, **16**, 107. *Amer. Dyestuff Rept.*, **24**, 124; 1935.
[6] *J. Coun. Sci. and Indust. Res., Australia*, **8**, 27; 1935.

## Recent Research on Cancer

THE twelfth annual report of the British Empire Cancer Campaign gives summaries of the past year's progress in most of the cancer research centres of the British Empire. During the year, more than £32,000 has been distributed by the Campaign in encouraging and supporting research along a very broad front, extending from pure physics, such as methods of inducing radioactivity in normally inactive elements, to the study of the origin and development of tumours in the human body. With the hope of improving and extending clinical research, a new clinical research committee has been formed with the co-operation of all the London teaching hospitals. Such an organisation can help considerably in comparing results and preventing overlapping and duplication of research.

The problem of the cause of cancer has been attacked mainly by means of experimental carcinogenesis, in many different institutes. Many years ago, Fibiger found that gastric cancer occurred in rats fed on cockroaches infected with *Gongylonema neoplasticum*, when the rats become hosts for the parasites. Prof. R. D. Passey has now found that infected rats do not develop cancer if they are fed on a full and healthy diet in place of the white bread diet used in Fibiger's experiments. This indicates that diet may influence the occurrence of malignant disease. In the Cancer Hospital Research Institute a new, very active carcinogenic compound, methyl cholanthrene, has been produced from deoxycholic acid (a normal constituent of bile), and has been synthesised. In structure, methyl cholanthrene is allied to sterols and sex hormones and to other carcinogenic agents, and it is conceivable that a similar active carcinogenic compound might arise adventitiously in the body by some 'error' of metabolism. This suggests a possible link between industrial cancer, such as that of gas workers and mule spinners, and natural or spontaneous cancer.

Sarcomata have been induced in fowls by synthetic carcinogenic agents and by tar in many different laboratories, and attempts have been made to obtain a filterable virus from the neoplasms so obtained. Prof. J. McIntosh has described three tar-induced sarcomata capable of propagation by cell-free filtrates. On the other hand, careful work carried out in Sheffield, Glasgow and Edinburgh, with fowl tumours induced by 1 : 2 : 5 : 6-dibenzanthracene, has not given any evidence of a filterable virus in these tumours. Prof. E. Mellanby has found that the virus of the Rous chicken sarcoma, which can be propagated by cell-free filtrates, is present, not only in the normal organs of infected birds, but also in dibenzanthracene tumours of birds bearing the filterable tumour. If a fowl bearing a tumour induced by 1 : 2 : 5 : 6-dibenzanthracene is infected with Rous chicken sarcoma, the virus of the latter passes into the dibenzanthracene induced tumour, so that an extract of the dibenzanthracene tumour injected into other fowls produces tumours resembling the Rous tumour and not the dibenzanthracene tumour.

In the study of tumour viruses, the high-speed centrifuge is being developed into a useful tool. The air-driven and air-floating centrifuge is relatively simple and inexpensive, and as it rotates at 40,000–60,000 r.p.m. it makes it possible to subject liquids to forces up to 70,000 times that of gravity. By means of this centrifuge it is possible to concentrate the active agent of fowl sarcomata. The concentrates contain elementary bodies, possibly virus particles, which can be examined under the microscope.

Work on the nature of the changes occurring in isolated cancer tissue continues to give interesting results, but the problem of the anomalous high rate of lactic acid formation in the presence of oxygen remains unsolved. Dinitro-phenols which cause increases in temperature and metabolism in man and animals also increase the respiration and lactic acid production of isolated tumour tissue—the mechanism of the biological effect of nitrophenols is still obscure. On the other hand,

naturally occurring coloured oxygen carriers such as pyocyanine and lactoflavine increase the oxygen consumption and decrease the lactic acid formation of tissues. Dr. F. Dickens has found that other dyes which are photo-sensitisers, such as phenosafranine, cause increased aerobic lactic acid production. It is remarkable that some irritants such as mustard gas (dichloro diethyl sulphide) and cantharidine prevent or delay the carcinogenic action of tar or similar agents. Dr. I. Berenblum and Dr. L. P. Kendal found that these anti-carcinogenic agents are able to inhibit glycolysis to a greater extent than respiration. It seems to the present writer that this effect may be allied to the effect of iodoacetic acid inhibiting the lactic acid production of muscle.

In the recently formed Cancer Department of St. Bartholomew's Hospital, a million volt X-ray plant is being installed. This should give a more powerful source of short-wave radiation than any radium bomb or X-ray plant at present in use. The results from this plant will be of extreme interest. The present report gives data referring to the radiological treatment of patients in many hospitals, and the pooling of results in this way must be of value in assessing the value of radiological methods in clinical work.

Radiations from radium and X-ray tubes have been used in many experiments on chick embryo and on tadpole tissues. Gamma-rays are found to have most effect on cells that are about to divide; once cell division has commenced, the process completes itself in a normal manner even in the presence of gamma-rays. The first effect of gamma-radiation is therefore apparently to reduce mitotic activity; but this is followed in turn by periods of apparent recovery, degeneration, abnormal mitosis and final recovery. Further examination of the effect of radium on tissue cultures of chick embryo tissue seems to indicate that the lethal effect depends on the actual amount of radiation rather than the time over which the radiation is spread.

Several specimens of human carcinoma removed in operation have been grown *in vitro*. An interesting phenomenon demonstrated by Dr. T. Lumsden with tissue culture methods is the action of antibodies capable of killing cancer cells *in vitro*. The effect of the anti-cancer sera has now been photographed with a cinema camera, and the death of tissue culture cells in the presence of the serum is strikingly shown in the film. It would be of interest to see the effect of the rat anti-cancer serum on tissue cultures of human carcinomata.

It was shown some time ago that snake venom had a toxic effect on malignant growths. The toxic effect of cobra venom on tumours is not prevented by anti-venom serum, and it may be possible to check the toxic effect of the venom on the host without inhibiting the effect on the cancerous growth. This is possibly a hopeful method of attacking the problem of curing cancer. With the active research that is being prosecuted along so many divergent lines in many laboratories, it is possible to say that advances are being continually made, but by which way the goal will be attained it is quite impossible to forecast.

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# Obituary

### Prof. Charles Richet

A STONE'S throw from the tip of the headland of Giens, in the south of France, there is a cluster of rocky islets. One of the most picturesque of them is pointed at with awe by the local country folk, as the home of a famous old man who carried out mysterious experiments and tried to communicate with the world beyond. It was, indeed, the country home of Prof. Charles Richet, well known in physiology and abnormal psychology, who died on December 3 in Paris.

Physiology and medicine owe to Richet the discovery of anaphylaxis, in 1902, which marked a decisive advance in modern medicine, and for which he was awarded the Nobel Prize for Medicine in 1913. This discovery was the result of a series of experiments and researches dating so far back as 1887, a year before the foundation of the Pasteur Institute, when Richet was the first to carry out an injection of serum into a human being. He was thus one of the founders of serotherapy.

In 1902, Richet was studying with Portier the action of the poison of sea-anemones, when they remarked that dogs which had withstood without any inconvenience an intravenous injection of a minimal dose of an aqueous extract of the tentacles of *Actinia*, always died after a second but weaker injection administered to them in the same way a few days later. But as this second injection was not strong enough to kill a fresh animal, they came to the conclusion that the first dose of a serum does not always immunise, but on the contrary, renders the organism more sensitive for a certain period and though the effect of the first dose seems to have disappeared. Thus were cleared up many mysterious cases of intoxication and an explanation was forth-

coming, in particular, of the occurrence of sudden death after repeated and successful administration of serum. The name of 'anaphylaxis' was given by Richet to this type of sensitiveness; and since that time a number of experiments have considerably improved the practice and effectiveness of serotherapy. Richet's "Dictionnaire de physiologie", begun in 1895, is a comprehensive study of the whole subject. He also wrote "Recherches sur la sensibilité" and "La Physiologie des muscles et des nerfs".

In later years, Richet was interested more and more in psychology and especially in the investigation of borderland phenomena. He objected to the use of the words "abnormal" or "occult" in connexion with such phenomena, as he held them to be just as natural as any others, and therefore just as much entitled to investigation by the ordinary methods of science. In 1905, the year in which he was elected president of the Society for Psychical Research, he proposed to give the name *Métapsychique* to the new science of these phenomena, which he classified under three principal types: cryptesthesy (clairvoyance), telekinesy (action at a distance without contact) and ectoplasmy (materialisation). He contended that as these phenomena occur, they must be real and subject to laws which ought to be discovered by unbiased scientific investigation. These views, which follow closely the work of Sir William Crookes (1872), are illustrated in his "Thirty years of Psychical Research", of which an English translation appeared in 1923, and which is an immense collection of cases of varying evidential value. A smaller volume, partly based on the first, appeared in English in 1929 under the title "Our Sixth Sense". Though Richet considered metapsychics to be still in its infancy, he hoped, with many other distinguished philosophers and psychologists, to see it gradually develop into a full science.

In the realm of psychology proper, Richet adopted the mechanistic theories of Descartes, which he endeavoured to extend to man himself, as had already been suggested by Lamettrie's "L'Homme Machine". Mind cannot be independent of matter, but rather subject to its fundamental laws. There is no gap between the psychical and the physiological; and the 'higher' faculties of man can be easily explained by inferior phenomena with such laws as those of reflex movements, of irritation and of association ("Traité de psychologie générale", 1912). Consequently, if introspection is useful for the study of the decisions of the conscience, it cannot help in the investigation of psychological phenomena, which must be entirely experimental. This ruthless determinism, which was well in keeping with the prevalent ideas among French men of science at the beginning of this century, caused Richet to deny the necessity of any metaphysical conceptions and to predict the death of metaphysics.

Charles Richet was born in Paris on August 25, 1850. Following the footsteps of his father and his maternal grandfather, he studied science and medicine and obtained an M.D. at the Paris Faculty of Medicine in 1876. He then worked under Marey at the Collège de France, and in 1887 he was appointed professor of physiology and medicine in the University of Paris. His first discovery was that of the presence of hydrochloric acid in the gastric juice. He investigated the relation between respiration and the area of body surface; and he carried out a good deal of research on animal heat. He also studied the problem of epilepsy and the treatment of tuberculous patients by dieting them on raw meat.

The interests of Charles Richet were not limited to physiology and psychology. He followed from the beginning the development of aeronautics and he made a name for himself as a novelist and a playwright, two of his plays ("Socrate" and "Circé") having been performed at the Odéon, in Paris. He was also a convinced pacifist and president of the Société pour l'Arbitrage entre les Nations. A member of the Academy of Medicine since 1896, Charles Richet was elected in 1914 to the Academy of Sciences. His scientific jubilee was celebrated in 1926, at the Paris Academy of Medicine, with the official participation of savants from many countries. On that occasion, Marshal Foch invested him with the insignia of Grand Cross of the Legion of Honour. T. G.

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We regret to announce the death last September in his seventieth year of the eminent Italian physiologist, Prof. Luigi Mariano Patrizi, who was born at Recanati near Ancona on September 13, 1866. He studied under J. Moleschott in Rome, where he qualified in 1890. After serving as assistant to Angelo Mosso at Turin, he occupied in succession the chair of physiology at Ferrara (1894), Sassari (1896) and Bologna (1924). During the period 1911–24 he was professor of criminal anthropology at Turin. His work was chiefly concerned with the psychometry of attention, the physiology of the intellect and criminal physiology and psychiatry. His publications include a psycho-anthropological study of Leopardi and his family (1896), the physiology of the bandit Giuseppe Musolino (1904), "The Orator" (1912), "After Lombroso" (1916) and a work on the physiological measurement of the emotions and passion (1924).

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We regret to announce the death on November 19, at the age of sixty-six years, of Dr. Dan McKenzie, who besides being a consulting surgeon in diseases of the ear, nose and throat and a former editor of the *Journal of Laryngology and Otology*, was a keen student of medical history and folk-lore. In addition to a textbook on his speciality, of which the second edition appeared in 1927, he was the author of "The City of Din" (1916), "Aromatics and the Soul: a Study of Smells" (1923), and "The Infancy of Medicine: an Enquiry into the Influence of Folk-Lore upon the Evolution of Scientific Medicine" (1927), of which a notice appeared in NATURE of January 28, 1928, p. 133.

# News and Views

### Sir Archibald Geikie (1835-1924)

THE centenary of the birth of Sir Archibald Geikie falls on December 28 this year ; it is a fitting occasion to remind older geologists of what many of them owed to him during their earlier years for his teaching and writings, and to direct the attention of younger geologists to the changes that have come over the science since Geikie began his labours. It was his good fortune to take up geology when major principles still required documentation and exposition ; he devoted much attention to the significance of denudation in the shaping of existing forms of land surface and to the results of volcanic activity, and in pursuit of field evidence travelled extensively in Europe and North America. Possessed of a logical mind, great industry and a lucid and dignified prose style—which gave him pleasure to employ—he early assumed and continued during his life to occupy a leading position as an exponent of physical geology. During his tenure of office as director-general of the Geological Survey of the United Kingdom he secured opportunities for a considerable literary output, including the compilation of his great textbook, first published in 1882, which after several revisions is still in use, but how different from its successors with their lavish employment of photographic reproductions. Sir Archibald corresponded freely with his geological contemporaries abroad, worthily maintaining the status of British geology, and he received generous recognition from many foreign societies. He took an active part in the administration of scientific institutions, and held the presidency of the Royal Society in 1904 and of the British Association in 1892 ; but it was as a writer of readable geological literature that he earned the appreciation both of the serious student and the general reader, and made thereby an indelible mark on his epoch.

### Education and Administration among Backward Peoples

IN another column of this issue of NATURE (see p. 1003) it is suggested in discussing 'indirect rule' of native peoples in Africa that the anthropological approach to problems of native administration is open to the danger of taking too conservative a view in the attempt to regulate the effects of cultural contacts. How this is to be avoided, without at the same time impairing the lessons of anthropological study, is the main thesis of an essay by Mr. F. C. Williams, Government anthropologist of the Territory of Papua, which was awarded the Wellcome Medal for Anthropological Research by the Royal Anthropological Institute in 1933 ("The Blending of Cultures: an Essay on the Aims of Native Education" : Territory of Papua, Anthropology, Report No. 16. Government Printer, Port Moresby. Pp. 46. 1*s*.). Mr. Williams, whose conclusions, necessarily, are largely coloured by his experience in Papua, points out that, rightly regarded, the problems of native education and native administration are one. Education, thus understood, he maintains is a process of three operations, or "tasks" :—maintenance, fostering necessary or desirable elements in native culture ; expurgation, eliminating undesirable elements, such as sorcery, cannibalism and head-hunting ; and expansions, which, while recognising that change is inevitable, seek to guide it by the incorporation of progressive elements which native culture is ready to assimilate, as, for example, improved methods in horticulture. It will be noted that this throws upon the administration the responsibility of formulating a 'blend' of cultures, which is both conservative and progressive, and will not prove detrimental to native character and morale. This demands an intensive study of native culture, but at the same time one which the successful administration of native affairs in Papua has shown to be not impossible.

### The Outlook for Consumers

UNDER this title, P.E.P. (Political and Economic Planning) issues a broadsheet, No. 63, which should interest everyone, because all the world is a consumer and comparatively few are producers or distributors. We all think that we suffer, at times, from the greed or petty dishonesty of those who stand on the other side of the counter, yet for the most part we grin and bear it, taking little thought of the methods that might be used to give us value for our money. Fundamentally, the problem is the one that is penetrating ever more deeply into the social conscience, namely, how the proceeds of useful human labour should be apportioned equitably among producers, distributors and consumers. Some are convinced that the principle now ruling is that of the jungle—sweets to the sweet and the hindmost to the devil—and that pending the time when men are educated morally to the same degree as some are now educated intellectually, the only solution is the total elimination of 'profit' in the Marxian sense, or drastic regulation of profits, as now practised in certain Continental countries.

OTHERS, however—and P.E.P. is apparently among them—assume that, in the main, what was, will be, and that desirable changes can or should be effected only on the basis of the existing order : evolution rather than revolution. It is from the latter point of view that the authors of the broadsheet approach the subject of consumers' interests, and after laying down that, as a rule, the buyer gets what he deserves, and that to effect any useful change he must stir himself and co-operate with his fellows, they proceed to enumerate and discuss five possible ways in which the consumer can assist himself or be assisted. One way of helping the consumer is to improve the shops. For several reasons, the old personal relationship

between shopkeepers and customers has largely disappeared, and the former are no longer the trusted purchasing agents and advisers of the latter; goods are left to sell themselves; the salesman merely wraps them up, sees that they are paid for, and passes them over the counter. The recent foundation of the Retail Trading Standards Association is a move in the right direction, but will not prove effective unless more consumers take an active interest in standards and exert a firm but constructive pressure to secure a fair deal for the consumer.

A SECOND way is for consumers to elect or appoint representatives to protect their interests. Parliament cannot be expected to concern itself with detailed questions, but special consumer councils might succeed if they could arouse public interest. Thirdly, the consumer might be protected by direct Government action. Certain State departments, for example, the Ministry of Health and the Board of Trade, already help in this respect; but they do not go far enough and can only deal with cases that come within the ambit of the law: their services are certain to increase, but no great good can be done unless public opinion is aroused and made effective through a special consumers' organisation. Another method of helping the consumer is suggested by the success of Consumers' Research, Inc., in the United States, a voluntary organisation that investigates goods offered for sale and marketing practices, and makes known the results to its members. Closely allied to the concept of a consumers' research organisation is that of a 'trade union', which would comprise consumers of certain specified products, would stand up for their rights and bring pressure to bear when occasion demanded. An example of such a body is represented by the Automobile Association, which recommends hotels and garages, elaborates route plans and provides free legal defence.

### Economics of the U.S.S.R.

IN a recent issue of the *Manchester School*, Vol. 6, No. 2, there is an interesting article on "U.S.S.R. Economics—Fundamental Data, System and Spirit" by Prof. M. Polanyi, who points out that the present moment appears to be a favourable one for taking stock of the achievements of the Russian Revolution. Socialism has been definitely instituted, and communism has been relegated to an uncertain future. Also the recent introduction of a marketing system makes it easier to review the economic situation, as we can now compute values in terms of money. Planned economy is a corollary of communism, but in fact, Prof. Polanyi states, a system of planned economy has never been attempted in the U.S.S.R. since the repeal of communism in 1921. For one thing, as Stalin bluntly admits, there has never been a proper distributive system at all. The First and Second Five Year Plans were not systems of planned economy, but merely systems of planned production, and even this is an overstatement for no great stress was laid on the systematic nature of the plan. The Soviets claim that they have carried out the First Five Year Plan, but in doing so they pass over in silence the biggest item of their plan, namely, the planned increase of agricultural production by fifty-five per cent; instead of this being achieved, a very serious fall took place during the first five year period. During the last four years, the outline of an economic system based on the principles of marketing has been developed. Prof. Polanyi concludes that while he is convinced that no return to private ownership is possible in the U.S.S.R., it seems that public and collective management is developing on lines almost identical with those in the marketing system of capitalism.

### Watt Bicentenary Exhibition at the Science Museum

A SPECIAL exhibition was opened at the Science Museum, South Kensington, on December 20 to commemorate the bicentenary of the birth at Greenock on January 19, 1736, of James Watt, the famous engineer and inventor. The exhibition will remain open until April 19. Many objects of particular interest are being shown, including three original beam engines, two of which were erected in Soho Manufactory in 1777 and 1788 respectively and the third in London in 1797, and various original experimental models, including the separate condensers of 1765 which led to his most important contribution to the development of the steam engine. The Garret Workshop, where Watt frequently worked from 1790 until his death in 1819, and which was moved with its contents from Heathfield Hall near Birmingham to the Science Museum in 1924 for permanent preservation, is on view. A large number of drawings, some by Watt himself, have been lent by the Birmingham Public Libraries Committee and form a detailed survey of the progress in steam engine design from 1775 until 1800, the period of Watt's partnership with Boulton. Numerous portraits of Watt, Boulton and their scientific friends have been generously lent for the occasion by the National Portrait Gallery, the Victoria and Albert Museum, the Royal Society, the City of Birmingham Art Gallery and others. About one hundred letters between Watt and Boulton have been selected from the voluminous correspondence preserved at the Assay Office, Birmingham, which gives an intimate picture of Watt's difficulties and achievements. Some of the memorials and books written on the life and work of Watt are exhibited also. Catalogues of the Memorial Exhibition, the Garret Workshop and the Stationary Engines Collection are on sale in the Science Museum. Special Bicentenary Lectures are being given by the guide lecturer in the lecture theatre and the gallery on various days during the period of the exhibition. Particulars can be obtained on application.

### Function of the American Chemical Society

IN his address at San Francisco on August 19 in receiving the Priestley Medal of the American Chemical Society, Prof. W. A. Noyes said that the two outstanding problems to be solved by our generation are the abolition of war, and a better

distribution of work and the products of our industries. Chemistry can no longer be thought of as an isolated branch of science, and independent of the rest of our lives. While providing for the development of personality and initiative, it is necessary to restrain those who will not contribute their share in co-operative service. Discussing the growth of the American Chemical Society, Prof. Noyes referred to the proposal to start a journal of organic chemistry as the outcome of a feeling that the Society does not sufficiently provide for the publication of non-industrial research. Emphasising the fact that chemistry is not an isolated science sharply divided from physics, biology, or even economics, sociology and political science, Prof. Noyes suggested instead the publication of the existing journal in two parts. The first part, published early each month, would contain the papers at present classified under the heading, "General, Physical and Inorganic". The second part, published late in each month, would appear under the sub-heading "Organic and Biological". Both parts would appear under the heading *Journal of the American Chemical Society*, and the pagination would be continuous. A single index would be issued, but each part would have its own editor. In concluding, Prof. Noyes discussed the question of training, the importance of giving all students a broad knowledge of our chemical heritage, and of encouraging the chemist to see his work as a unit in a co-operative democratic organisation which serves the community and gives a reasonable return to workers, directors and capital.

### "Purging" Scientific Literature in Germany

THE *Chemiker Zeitung* of November 30, p. 978, prints a notice to German chemists requiring them in future to avoid the use of "foreign" words. It is explained that this can easily be accomplished, and among the illustrations given appear the following:

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| Förderanlage | instead of | Transportanlage |
| wirtschaftlich | ,, | rationell |
| für, or je | ,, | pro |
| durchlassig | ,, | porös |
| zusammenpressen | ,, | komprimieren |
| Nachahmung | ,, | Imitation |
| Stück | ,, | Exemplar |
| Ausmasse | ,, | Dimensionen |
| umgrenzen | ,, | definieren |
| Hochstwert | ,, | Maximum |
| Tiefstwert or Niedrigstwert | ,, | Minimum. |

*Vorbild*, *Form* or *Muster* are suggested as alternatives to *Schema*, but the Editor, having perhaps seen comments on this subject in the notice of Joos' "Lehrbuch der theoretischen Physik" and in subsequent correspondence in NATURE (September 28, p. 495, and October 26, p. 675), points out that such innovations as *Kleinsehwerkzeug* for *Mikroskop* and *Scheidekunst* for *Chemie* should not be adopted, as they might be regarded as ridiculous by others.

### New Telephone Developments

IN the *Review* (No. 3, 1935), published in English by the Ericsson Telephone Factory of Stockholm, there are described two interesting developments of telephony. One of them is called the 'laryngophone' which has been specially designed for use in aircraft. Owing to the noise in airships, ordinary carbon microphones with diaphragms cannot be used. The diaphragm of the new telephone is actuated by being lightly pressed against the throat in the neighbourhood of the larynx. For aircraft, it is necessary to have both hands free, and a headphone of normal design can be conveniently fitted in the pilot's helmet, the laryngophone being worn without discomfort inside his collar, extraneous noise not being transmitted by it. This type of instrument can be usefully applied for fire control on warships, in engine rooms, on motor vehicles, tanks, etc. The other instrument is useful in connexion with the buoy-telephones which have for many years been used in the submarines of the Swedish navy. In the latest development, two buoys, with buoy telephones, are used. Each buoy contains a telephone set, and an electric lamp is fitted on the top of it. Flash signals are sent from the submarine to attract attention to the buoy. An instruction plate on the buoy tells how to open the lid of the compartment containing the telephone set, and the submarine is rung up in accordance with the directions printed on a plate on the telephone cover. Buoy telephones are fitted at each end of the submarine. The lamps are supplied from the 110 volt accumulator of the submarine and light up when a watertight telegraph key is closed.

### The British Film Institute

THE British Film Institute's second annual report, issued on October 1, records notable advances (long overdue) in its task of "furthering effective co-operation between those who make, distribute, and exhibit films on the one hand, and all who are interested in the artistic, educational, and cultural possibilities of films on the other". The scope of its activities is indicated by the chapter headings: The Cinema for the Schools, Free Trade in Educational Films, National Film Library, Vouchers of Approval, Entertainment Panel, Dominions, India and Colonies Panel, Medical Panel, Scientific Research Panel, Summer Schools, International. Its regular publications comprise *Sight and Sound*, on sale to the general public at 6*d*., quarterly; a monthly film review on sale to associate members at 2*d*.; and news letters circulated to members. In addition, there are occasional leaflets of which the best known, No. 5, on projection apparatus and films for schools, achieved a circulation of nearly 10,000; another, No. 8, gives a full account of the National Film Library established by the Institute last July. A scheme has been worked out for the award by the Institute of vouchers of approval to films voluntarily submitted to it for examination and, as a corollary of this, expert and authoritative advice is given to producers before and during production. The Entertainment Panel has undertaken a systematic inquiry

into the supply of suitable films for children's performances. The Medical Panel has compiled a catalogue of British medical films and will issue supplements from time to time. The Scientific Research Panel is collecting material for a report on the extent to which the cinematograph is, and can be, used in the advance of scientific knowledge. The first Film Summer School for teachers was held at Scarborough last August. Ten local branches, known as Film Institute Societies, have been at work during the year, at Becontree, Bristol, Brighton, Chichester, Leeds, London, Manchester, Liverpool, Belfast and Salford.

### Research and the British Academy

PROF. J. W. MACKAIL, in his presidential address to the British Academy delivered in July last (Oxford University Press, pp. 11. 1*s*. net), laid it down as a principle that "the products of the Academy as an organised body . . . are all, in their different ways, and from their different angles and lines of approach, means towards an end", which he went on to define further as including two interlinked motives: to maintain a standard of learning and to preserve the continuity of civilisation. This view of the functions of the Academy would lay a heavy burden of responsibility on any body, however august; but if the further dictum be accepted that it is by the first that the second may be most directly and most effectively attained, it adds an impressive weight to the opinion the president expressed at an earlier stage in his address, that the Academy's grant from the Treasury of £2,000, only recently restored to its full amount, is quite inadequate. In the field of pure scholarship, certain enterprises, it is true, have been able to make progress through the Academy's subsidy. Yet even here, in what might be regarded as the Academy's special province, in number they make a poor showing. In the vast and wider fields of humanistic studies the prospect is even less encouraging. In archæological research, now that the excavations at Samaria have been brought to an end, apart from the contribution to the British School of Archæology in Iraq, which stands in a special category, the only body to which the Academy contributes is the British School of Archæology in Jerusalem. Archæological research unfortunately falls between the two stools of science and letters, belonging to the one by its technique, to the other in the applications of its results. This contention apart, in comparison with Continental academies, the British Academy is second to none in the standing of its fellowship; but its material contribution, as a body, to the advancement of the subjects which have been brought within its purview is negligible.

### Mining in Tanganyika Territory

WE have received an interesting pamphlet from Tanganyika Territory entitled "Mining Publicity Pamphlet", and issued by the Department of Land and Mines. It shows at the outset a useful map of the Territory, and after a short introduction there is full information for all prospective immigrants, including such points as the customs duties and the mining and prospecting laws which have been adopted. There is an account of the geology and physiography of the Territory, and economic minerals and mineral production are fully described. We find, for example, that the value of mineral production has increased largely and in many cases has doubled since 1932 when Great Britain went off the gold standard, with a correspondingly rapid rise in the price of the precious metal; in fact, the value of all minerals has increased since 1932 with the exception of mica, which is less than half in 1934 what it was in 1932; whilst the value of the minerals produced is put down as close on £200,000 in 1932, in 1934 they had risen to close upon £364,000. Gold mining is, of course, a great attraction at present, although the pamphlet states that "it is to be anticipated that the internal prosperity it [gold production] is creating will exert its beneficial influence on other forms of mining within the territory". This is one of the few regions where the old-time prospector still finds work, and existing gold fields, containing both reef gold and alluvial gold, are fully described in the pamphlet in question. The pamphlet is of distinct use to immigrants proposing to enter Tanganyika Territory, and its perusal is strongly recommended to any who are proposing to go out, and especially perhaps to those intending to follow gold mining.

### The Spahlinger Tuberculosis Vaccine

A JOINT committee on tuberculosis of the Medical Research Council and the Agricultural Research Council has issued in the form of a green paper (London: H.M. Stationery Office, 2*d*. net) observations on the experiment with Spahlinger vaccine in Northern Ireland, the report on which was issued some weeks ago. In this experiment, 11 calves were vaccinated with the Spahlinger anti-tuberculosis vaccine, and 7 calves were kept unvaccinated as controls. Six months after the vaccination, all the calves were given the same dose of virulent tubercle bacilli intravenously. The difference in the effect on the two groups was striking. Of the 7 controls five died of acute tuberculosis within 25–73 days. On the other hand, none of the 11 vaccinated animals died from the acute disease, one died on the 607th day, and the remaining 10 lived until slaughtered on the 783rd–890th day. All, except one, of these were in good condition although found to be tuberculous to greater or less extent. The joint committee concludes that a case has been made out for further investigation, that the number of animals used in the Irish experiment were not enough to give statistically conclusive results, and that the general use of the vaccine should be deferred until a thorough investigation has been made.

### The Physique of Man in Industry

IN 1927, the Industrial Fatigue (now Health) Research Board published a report of an inquiry on "The Physique of Women". The results of this inquiry appeared to be of such value that the Board decided to institute an investigation of the same kind

amongst men. Prof. Cathcart directed the work, assisted by Messrs. Hughes and Chalmers, and in the analysis of the data by Miss Blair and Miss Werner, and their report has now been issued ("The Physique of Man in Industry". Med. Res. Council. I.H.R.B. Report No. 71. H.M. Stationery Office, 1935. 1*s.* 3*d.* net). It records the physical examination of 13,656 male volunteers aged fourteen years and upwards in fifteen areas in England and Scotland. The total includes 10,593 employed men, 1,328 unemployed men and 1,735 students. The data recorded were height, weight, grip (both hands), pull when standing, and distance of middle finger tip from the ground. The student group had the highest average height and weight, but were inferior in strength to those in manual occupations. The unemployed group was slightly inferior in weight, and definitely inferior in strength, to the employed group. No certain index of physical fitness, industrial or other, was discovered. From the average elbow height (43 in.) of the employed, it is deduced that the comfortable height of a working bench for the average man standing should be about 38 in.

### Biological Control of the Mediterranean Fruit Fly

THE Mediterranean fruit fly (*Ceratitis capitata*) has, for many years, caused ravages among many kinds of edible fruits in the Hawaiian Islands. The introduction of several species of parasites from Africa and Australia has resulted in a very appreciable reduction in the abundance of the pest in question, but a sufficiently efficient degree of control, from the commercial point of view, has not so far been achieved. We learn from Science Service, Washington, D.C., that a scheme has been put in hand which involves further application of biological control methods. In order to carry out the project, the Hawaiian Planters' Association is sending two of its entomologists, along with others from the Department of Agriculture, to Africa with the object of searching for suitable parasites. Other entomologists are proceeding to Brazil with the same aim in view. The whole project is being administered by the U.S. Bureau of Entomology in conjunction with the leading local organisations concerned in Hawaii. The Hawaiian Islands are famous as being the territory where some of the most successful examples of the biological method of pest control have been achieved. The plan of campaign against the fruit fly is expected, if successful, to lead to great benefits to the small farmers of the territory by increasing the supply of fruits that grow so luxuriously in those islands.

### New System for Nature Recording

AFTER much discussion, extending over two quarterly meetings, the council of the British Empire Naturalists' Association has agreed to form a special section to deal with field natural history records. A properly spaced system of observers is to be built up all over Great Britain, and eventually a committee of experts will be formed to decide upon the problems to be tackled, and the methods to be adopted. Plans are at present being made for a conference of branch secretaries in London next April. For some ten years, the British Empire Naturalists' Association has worked a system of publishing in its quarterly journal, *Country-Side*, bird, plant and insect records of seasonal and statistical interest, grouped in the various counties. Not only was this incomplete, in that records were more quickly forthcoming from southern areas richest in resident naturalists, and other northern areas were neglected, but also in flora especially no complete review could be made owing to the necessity of finding room for other matters in the journal. The new scheme will be welcomed by historians of field natural history, who often have to go through masses of local and national publications for scattered field records of varying value.

### A New Natural History Magazine

A NEW German periodical, edited by A. Benninghoff, K. Beurlen, K. Hildebrandt and K. L. Wolf, offering a variety and standard of contributions which ought to commend it to many readers, has recently appeared. The title, *Zeitschrift für die gesamte Naturwissenschaft*, suggests the breadth of its objective, the scope of which is extended by the inclusion of Nature philosophy and the history of Nature knowledge and medicine. The articles of the first issue (April) are not over-long—about fifteen pages—a short summary precedes each, and the matter, while avoiding too technical treatment, makes a serious contribution to the subjects discussed. K. Hildebrandt writes upon "Positivismus und Natur", and other major articles deal with "Morphologie und Erdgeschichte", "Bedeutung und Aufgabe geologischer Forschung", "Subjektbezogenen Nomenklatur in der Biologie", "Warum studieren wir Biologie ?", to which the final answer is "Wir studieren Biologie, weil wir müssen". A variety of subjects are discussed in short contributions, and there are seven signed reviews of books.

### Use of the Astrolabe

ALTHOUGH the astrolabe has found some support among surveyors, it has not been widely used by British astronomers. An extensive account in English of the practical use of the modern astrolabe has recently been published by Mme. Chandon and M. Gougenheim in the *Hydrographic Review* (**12**, No. 1). This account contains full details of the working and practical operation of various modifications of the astrolabe, and should be studied by all who are interested in the accurate determination of position. It may be hoped that this paper will stimulate astronomers to devise a means of eliminating personal equation from the astrolabe, so that the instrument may eventually compete with the transit circle in the accurate determination of longitude.

### Pathological Investigations at Edinburgh

IN the annual report for 1934 of the Laboratory of the Royal College of Physicians of Edinburgh, by the curator, Sir Robert Phillips, an account is given of the research and other activities. Much work has

been done, particularly on the pathology of the mamma, by Miss Dawson, and about 1,000 reports on tumour growths were issued; the sections made, together with the material from which they are derived, are preserved and indexed for future reference and research. The death rates of Great Britain and Sweden and the spread of infectious diseases have also been investigated statistically. More than 15,000 examinations of specimens for medical men were carried out.

### Society for the Study of Alchemy and Early Chemistry

A SOCIETY for the Study of Alchemy and Early Chemistry has been founded in London. It is intended to place the study of alchemy and early chemistry on a broad basis, and for this reason the Council of the Society is desirous of securing the co-operation of scholars in various countries who will contribute to the interests of the Society. It is proposed to hold regular meetings, beginning early in 1936, at which papers will be read and discussed, and to publish a journal in which accounts of the papers will be given as well as special articles, written contributions by members of the Society and reviews of books. The following council has been elected: Prof. J. R. Partington (*chairman*), Dr. F. Sherwood Taylor (*Editor of the Journal*), Gerard Heym (*Hon. Secretary*), K. de B. Codrington, L. F. Gilbert, Prof. S. R. K. Glanville, Sir Richard Gregory, Dr. E. J. Holmyard, Dr. D. McKie, Dr. L. W. G. Malcolm, Dr. Stephen Miall. Further information can be obtained from the Hon. Secretary, Society for the Study of Alchemy and Early Chemistry, 8 Bream's Buildings, Fetter Lane, London, E.C.4.

### International Geological Congress, 1937

THE organisation committee of the seventeenth session of the International Geological Congress, which will meet in Moscow in 1937, has issued a second circular outlining the scope of the various subjects proposed for discussion. In connexion with the problems associated with the geology of petroleum and coal, it is hoped to make an estimate of the oil reserves of the world and to review the coal resources of the U.S.S.R. and other countries. A discussion of the stratigraphy, igneous cycles, tectonics and mineral deposits of the Pre-Cambrian is proposed. The stratigraphical limits of the Permian System, at present a source of widespread controversy, again comes up for consideration. An attempt is to be made to correlate tectonics, magmatic evolution, ore deposits and geochemistry, and as a further theme a review of the data bearing on these problems with special reference to Asia is proposed. Another geochemical problem is that of the occurrences of rare elements. Geophysical subjects to be discussed include measurement of geological time; isostasy and anomalies of gravity; terrestrial magnetism; and seismology. Finally, it is hoped that reports will be presented on the history of the various branches of geology. Further particulars may be obtained from the General Secretary, Dr. A. E. Fersman, Sretenka 8, Moscow 10.

### Announcements

DR. H. S. GASSEN, professor of physiology at Cornell University, New York, has been nominated director of the Rockefeller Institute in succession to Dr. Simon Flexner.

PROF. YAS KUNO, until recently of the Japanese Medical College, Mukden, South Manchuria, and now of the Institute of Physiology, Kyoto Imperial University, Japan, has been appointed a member of the Permanent International Committee of the Physiological Congresses. This is the first time that a representative of Far Eastern physiology has been appointed to the Committee. Prof. Kuno was a pupil of the late Prof. E. H. Starling at University College, London, and is a member of the Physiological Society, Great Britain. He has done very important work on perspiration and body temperature, and has written an excellent book on the subject.

MR. M. C. LAMB, principal of the Leathersellers' Technical College, will retire from his present position at the termination of the current session, having then attained the age of sixty years. Mr. Lamb has been associated with the College from the time of its opening in 1909, and has had forty years' experience in the teaching of leather technology, having been appointed a demonstrator in the Leather Department of the University of Leeds so far back as 1895. During the period of his occupation of the principalship, the College has been progressively successful, and is now regarded as the most efficient and best equipped of its kind in the world, attracting students from every centre where leather is produced.

AMONG the awards for 1935 made by the Royal Horticultural Society are the following: *Victoria Medal of Honour*, Sir Daniel Hall, for his scientific work in connexion with horticulture; *Veitch Memorial Medals*, Dr. A. D. Cotton, for his services to horticulture, and Prof. E. J. Salisbury, for his book "The Living Garden"; *Loder Rhododendron Cup*, Mr. A. Rehder, of the Arnold Arboretum, U.S.A., for his work on the genus *Rhododendron*.

A DISCUSSION on "Probability" will be held by the London Mathematical Society on January 16, at 5 p.m., in the rooms of the Royal Astronomical Society, Burlington House, W.1. The following have promised to take part: Prof. H. Levy, Sir Arthur Eddington, Dr. P. Dienes, Prof. R. A. Fisher, Dr. Harold Jeffreys, Prof. J. B. S. Haldane.

IN reference to the article on the annual Congress and Exhibition of the British Institute of Radiology in NATURE of December 14, p. 960, Dr. J. Read informs us that the first continuously evacuated tube constructed by Lauritzen worked intermittently at 750 k.v., not 600 k.v.; also that the Soiland Clinic tube worked at 550 k.v., not 100 k.v., and that the Clinic has now installed three 200 k.v. constant potential Latour circuits in cascade in place of the cascade transformers.

# 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. 1030.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

## Mathematical Psychology of War

THIS is relevant to the Naval Conference. A letter in NATURE of May 18 was intended to show, by reference to historical facts, that a certain pair of equations did represent, at least crudely, the behaviour of nations prior and subsequent to the Great War. In order to proceed to deductions, it is convenient now to change the notation. The hypothesis aforesaid is that

$$\frac{dx}{dt} = ky - \alpha x + g \quad . \quad . \quad . \quad . \quad (1)$$

$$\frac{dy}{dt} = lx - \beta y + h \quad . \quad . \quad . \quad . \quad (2)$$

in which $x$ denotes the variable preparedness for war of one group of nations, $y$ that of the opposing group ; $t$ is the time ; $k$ and $l$ are 'defence coefficients' ; $\alpha$ and $\beta$ are 'fatigue-and-expense coefficients' and $g$ and $h$ are measures of dissatisfaction with the results of treaties. Each of $k$, $l$, $\alpha$, $\beta$, $g$, $h$ is regarded as temporarily constant. Of these, $k$, $l$, $\alpha$, $\beta$ are each positive ; but $g$ and $h$ may have either sign, and will be positive for the 'have-nots', negative for the 'haves'. The international situation is thus represented by a point $(x, y)$ in a plane. Let us think of this point as a particle moving in accordance with the equations. If the particle be tending towards plus infinity of both $x$ and $y$, then war looms ahead. But if the particle be going in an opposite direction the prospect is peaceful.

If $dx/dt$ be zero, the equation (1) represents a straight line ; similarly for $dy/dt$ and equation (2). The intersection $(x_0, y_0)$ of these two straight lines is the point of balance of power. It is given by

$$x_0 = (kh + \beta g)/(\alpha\beta - kl),\ y_0 = (lg + \alpha h)/(\alpha\beta - kl) \quad (3), (4)$$

But, unfortunately for those who live under a policy of balance of power, the point of balance has several awkward possibilities. First, by a rare chance, $\alpha\beta$ might equal $kl$ so that the lines would be parallel and no point of balance would exist. Secondly, it is quite probable that the point of balance may be situated in one of the quadrants where $x$ or $y$ or both are negative ; so that balance could be attained only by negative preparedness for war, that is, by positive preparedness for co-operation. Thirdly, although the particle is undoubtedly in equilibrium when it coincides with the point of balance of power, yet that equilibrium may be unstable.

To investigate stability the equations have been solved by a standard method via the auxiliary equation

$$m^2 + (\alpha + \beta)\, m + \alpha\beta - kl = 0\ ; \quad . \quad . \quad . \quad (5)$$

and it is found that the particle, wherever it begins, will ultimately arrive at the point of balance $(x_0, y_0)$ if

$$kl < \alpha\beta, \quad . \quad . \quad . \quad . \quad (6)$$

whereas the particle will ultimately go off towards infinity if

$$kl > \alpha\beta. \quad . \quad . \quad . \quad . \quad (7)$$

That is to say : the international régime is unstable if, and only if, the product of the two defence coefficients exceeds the product of the two fatigue-and-expense coefficients.

In the unstable régime, the particle will tend towards one or other of two opposite infinities according to where it begins. We may classify the starting points by making a transformation to polar co-ordinates $(r, \theta)$ centred at the point of balance, so that

$$x - x_0 = r\cos\theta, \quad y - y_0 = r\sin\theta \quad (8), (9)$$

For then

$$\frac{d\theta}{dt} = l\cos^2\theta + (\alpha - \beta)\cos\theta\sin\theta - k\sin^2\theta, \quad . \quad (10)$$

whence it follows that there are always two real lines given by

$$2k\tan\theta = \alpha - \beta \pm \sqrt{(\alpha - \beta)^2 + 4lk} \quad . \quad (11)$$

on which $d\theta/dt = 0$. The particle cannot cross these lines. They form barriers dividing the plane into four angular portions. In particular, if $\alpha = \beta$ and $l = k$ the barriers are at $\theta = \pm\pi/4 \pm \pi$. When the balance of power is unstable ($kl > \alpha\beta$) the barrier at $\theta = -45°, +135°$, or in general at

$$2k\tan\theta = \alpha - \beta - \sqrt{(\alpha - \beta)^2 + 4lk}$$

is of profound significance, for it divides the international plane into two portions, one of a drift towards war, the other of a drift towards co-operation.

The 'constants' are liable to secular change. The progress of engineering and chemistry has notably decreased $\alpha$ and $\beta$, so that if $l$ and $k$ were unchanged, the international régime would now be much more unstable than it was a century ago. The defence coefficients $k$ and $l$ are influenced by the suspicion or goodwill distributed by print or broadcast.

Over all, it must be remembered that the equations describe the rivalries of two groups having populations of the same order of magnitude. In the new tentative practice of 'collective security', one population is many times greater than the other, and a quite different course of events may be expected.

LEWIS F. RICHARDSON.

38 Main Road,
Castlehead, Paisley.
Dec. 4.

## Chemical Action caused by Neutrons and Gamma Rays and the Effects of these Agents on Colloids

FOR more than a year we have been engaged in investigating the action of neutrons and γ-rays : (*a*) in affecting the stability of colloids, and (*b*) in promoting chemical reactions. As sources of γ-radiation we have used platinum containers filled with radium sulphate, or radium emanation sealed into glass tubes surrounded by a few millimetres of lead. Neutrons were obtained from sources similar to these to which metallic beryllium had been added. Since all the neutron sources used emitted γ-rays, every titration was carried out in triplicate on (1) a non-irradiated control ; (2) a specimen irradiated by γ-rays alone ; (3) a specimen irradiated by neutrons and γ-rays from the same or an equal source. The strengths of the sources ranged from 30 mC to 150 mC and the periods of irradiation from a few hours to two weeks.

Irradiations were usually carried out in the following manner. The sources were enclosed in a test tube which contained either water and a metallic lead filter, or a solution of borax and a cadmium filter. This tube was surrounded by a glass vessel containing the liquid under examination. The test tube and vessel were again surrounded by a large mass of water, or placed in a cavity in a block of paraffin wax. In this way, full advantage was taken of the now well-known methods of slowing down and absorbing neutrons.

Amongst the chemical actions investigated have been the oxidations of potassium metabisulphite and sodium bisulphite, and the decomposition of hydrogen peroxide. In each case it was found that the action provoked by a pure γ-ray source was increased by using a source of equal strength which also emitted neutrons.

The following colloids have been investigated : Hydrosols of silver and gold, the sulphides of arsenic and cadmium, and vanadium pentoxide and ferric hydroxide. When prepared in the standard way it was found that a source emitting both neutrons and γ-rays increased the stability of the negatively charged colloids and decreased the stability of the positively charged colloids. A similar but definitely smaller effect was obtained with pure γ-ray sources of the same strength. Anomalous results could, however, be obtained when foreign electrolytes were intentionally added to the colloidal sol before irradiation.

In all the actions outlined above, it was found that the effect which must be attributed to the neutrons alone, was of the same order of magnitude as that due to the γ-rays alone. The greater efficiency of slow neutrons in producing these effects is strikingly exhibited, since with the sources used approximately one neutron was produced per hundred thousand γ-ray quanta emitted. So far as we are aware, no previous observations of the effect of neutrons on chemical reactions or colloidal stability have been published.

This investigation was begun in the hope of discovering a method of detecting neutrons which would be independent of the usual techniques of inducing radioactivity or the use of electrical counters. Two methods, which possess the great advantage of integrating the effects produced until they are easily measured by standard chemical methods, are indicated above.

The similarity of the effects due to neutron and γ-ray irradiation would seem to indicate that the commonly accepted views on the mode of action of the latter are in need of revision.

A fuller account of this work will be published shortly.

F. L. HOPWOOD.
Physics Department, J. T. PHILLIPS.
St. Bartholomew's Hospital,
E.C.1. Dec. 16.

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## Production of Cosmic Ray Showers at a Considerable Depth below Ground-Level

IN order to find whether showers are produced by the penetrating cosmic rays which reach considerable depths below ground-level, we have performed experiments in Holborn Underground station (by permission of the London Passenger Transport Board) at a depth corresponding to 60 m. of water. The vertical intensity of the radiation at this depth, as measured by the rate of occurrence of coincidences between three counters in a vertical plane, is about one-fifteenth that at ground-level. To count showers we used five counters, arranged in a pentagon formation, so that at least three particles are needed to discharge the five counters simultaneously. The occurrence of coincidences is therefore in itself definite proof of the presence of showers. The quintuple coincidence method is preferable to the triple coincidence method as usually used hitherto, as in the latter case a coincidence can be produced by two particles. The presence of showers can then be proved only by showing that there is an increase in the rate of occurrence of coincidences when a sheet of, say, lead is placed over the counters, the dimensions and disposition of the lead being such that coincidences due to particles originating in it must be due to at least three particles. The detection of showers then entails the establishment of a difference between rates with and without the lead, and these may be nearly equal.

Our preliminary results have shown that (*a*) showers are produced in the earth above the counting apparatus ; (*b*) the shower rate is increased several fold when the group of counters is surrounded by lead ; (*c*) the thickness of lead for maximum shower production is about 1·6 cm., that is, about the same as at ground-level ; (*d*) for this thickness the ratio of the rate of shower production to vertical intensity is not very different from that at ground-level under the same conditions.

These conclusions are not in agreement with those of Auger[1], who has reported the absence of showers under 8 m. of earth ; or those of Pickering[2], who has reported a rapid diminution in the ratio of the rate of shower production to intensity at depths down to 10 m. of water. The difference seems to be explicable in terms of the counter dispositions used in the various cases, and we shall discuss this point when our results are published in full.

Since there is good reason to believe that protons, owing to their large mass, should produce very few showers, we can conclude from our results that a considerable part of the radiation which penetrates 60 m. of water must consist of positive or negative electrons.

D. H. FOLLETT.
Birkbeck College, J. D. CRAWSHAW.
London, E.C.4.
Dec. 5.

[1] Auger et Bertein, *J. Phys.*, **6**, 253 ; 1935.
[2] Pickering, *Phys. Rev.*, **47**, 423 ; 1935.

## Influence of the Velocity of Slow Neutrons on their Capture by Certain Nuclei

WE have tried to measure the dependence of the cross-section of protons for absorption of neutrons on the relative velocities of these particles. A method which allows of the determination of the absorption of slow neutrons by paraffin wax was used[1]. A source of neutrons (radon + beryllium) was placed in the middle and a silver plate at one end of a cylinder of paraffin wax (4·5 cm. diameter, 18 cm. long). This end could be dipped 5 cm. deep in liquid oxygen. A screen of cadmium could be interposed at different distances between the source and the silver.

The intensity of activation of the silver obtained at room temperature was plotted against the distance between the silver and the absorbing cadmium screen. A curve was obtained, which showed that the diminution of the activity of the silver, due to interposing the cadmium screen, decreased to a half when the distance between the silver and the absorber was increased by 1·6 cm. This shows that, in the given geometrical circumstances, 50 per cent of the slow neutrons, which are absorbable in cadmium, are absorbed or scattered out of the wax cylinder after diffusion through 1·6 cm. of paraffin. Cooling the end of the cylinder to 90° K. increased the activity of the silver, but had no effect on the thickness of the layer of paraffin wax required to reduce the slow neutrons to 50 per cent. This shows that the cross-sections of protons for elastic scattering and for absorption of neutrons are not much increased when the neutrons are slowed down below the velocity they obtain in paraffin wax at room temperature. This seems contradictory to the theory of capture of neutrons by protons[2]. Mr. Francis Perrin and Mr. Walter M. Elsasser, who kindly discussed this result with us, think it compatible with theory for the following reason. The protons in paraffin wax have, in consequence of the total degeneration of the C–H vibration, always a minimum velocity which is large compared with the thermal velocity at room temperature. The relative velocity between a neutron and a proton is therefore changed by a smaller factor than $\sqrt{T_1/T_2}$ when the temperature of the wax is changed from $T_2$ to $T_1$. ($\sqrt{T_1/T_2}$ is 1·78 for our case; a change of cross-section of less than 15 per cent would not have been observable.)

Moon and Tillman[3] have shown that neutrons slowed down by paraffin wax are more capable of activating silver and rhodium, when the wax is cooled down to 90° K., but less efficient for iodine. When repeating these experiments, we found the same increase for the activation of silver (28 ± 5 per cent) but an increase of about 10 per cent instead of a decrease for iodine. It might be expected that the cross-section of most nuclei for the capture of slow neutrons would be inversely proportional to the relative velocity between the capturing nucleus and the neutron. In this case, the increase of activation should be 78 per cent for cooling down to 90° K. Moon and Tillman have suggested that not all the neutrons capable of activating silver are already in thermal equilibrium with the protons of the paraffin wax. If the probability for the capture of neutrons by silver be proportional to $1/v$ ($v$ being the velocity of the neutrons relative to the silver atoms), neutrons of energy higher than $kT$ might still give an appreciable contribution to the activation of silver. But cooling the diffusing paraffin would have no big influence on the velocity of these neutrons, and the total activity would therefore be increased by a smaller factor than $\sqrt{T_1/T_2}$.

We observed that the activation of silver by neutrons which had diffused through paraffin was independent of the temperature of the latter when 2 mm. of cadmium was placed directly in front of the silver. It thus seems possible to distinguish at least roughly the neutrons which are still capable of activating silver—although with a small probability—but have a higher energy than $kT$, from those the energy of which is on the average $kT$. If the activations above this background, which is independent of the temperature and of the thickness of the cadmium screen in front of the silver, are compared, the activity obtained at 90° K. was 70 per cent higher than that obtained at room temperature. This result indicates that the cross-section for the capture of neutrons by silver nuclei is actually proportional to $1/v$.

For thin cadmium screens a dependence of the absorption coefficient on the velocity of the neutrons was found. These results will be published later.

PETER PREISWERK.
HANS VON HALBAN, JUN.

Institut du Radium,
Laboratoire Curie,
Paris.
Nov. 22.

[1] Hans von Halban, Jun., and Peter Preiswerk, [NATURE, **136**, 951; 1935.]
[2] E. Fermi, *Phys. Rev.*, **48**, 570; 1935.
[3] M. B. Moon and J. R. Tillman, NATURE, **135**, 904; 1935.

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## Redetermination of the Soludility of Chloropentammine Cobaltic Chloride

RECENTLY, I had occasion to describe an improved method for the purification of chloropentammine cobaltic chloride, and to note that the product behaved differently from that obtained by the older method, in that it passed into solution much more rapidly[1]. For this reason, and as previous measurements[2] are not very concordant and may in some cases have been carried out with impure materials, a redetermination of the solubility seemed of interest.

Experiments were carried out at 25·00° and at 0·20°; the salt was violently stirred with water and samples were taken every half-hour or so by means of a pipette fitted with a small sintered-glass filter, until a constant composition was reached. Analyses were carried out by volumetric determination of chloride after decomposition with alkali.

In the experiments at 25°, the influence of the conditions of precipitation was studied by measuring the solubilities of specimens which had: (*a*) been precipitated quickly in the cold from water solution by HCl; (*b*) been heated for some hours under HCl after precipitation in the cold; (*c*) been slowly precipitated on the water-bath from a solution of pure roseo-chloride in presence of excess HCl. No appreciable difference in the final solubilities could be detected.

The solubilities found were, in mols/litre, at 25·00°, 0·0211; and at 0·20°, 0·00925. When plotted (log $s$ against $1/T$) these results are found to agree well with those of Brönsted and Peterson, but not with the other determinations.

Mention should be made of the possible effect of aquotisation in the course of the experiment. This takes place at 25° to the extent of about 0·6 per cent per hour, and means that the saturated solution

contains a little excess chloride ion and a little less purpureo-ion. It is easy to show, however, that if the mass-law may be assumed for the small range concerned, the two corrections mutually cancel, and the *total* (including non-ionisable) chlorine concentration in the solution is constant. In practice, once equilibrium had been attained, no variation with time of the solubility as measured could be detected.

F. J. GARRICK.

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Leeds.

[1] Garrick, *Z. anorg. Chem.*, **224**, 27; 1935.
[2] Lamb and Simmons, *J. Amer. Chem. Soc.*, **43**, 2196; 1921. Brönsted and Peterson, *J. Amer. Chem. Soc.*, **43**, 2269; 1921. Ephraim, *Ber.*, **56**, 1531; 1923.

## Flame Speeds during the Inflammation of Moist Carbonic Oxide–Oxygen Mixtures

IN 1932[1] we found that the mixture of carbonic oxide and oxygen which gave the maximum speed of flame during the 'uniform movement' was approximately that for combining proportions ($2CO + O_2$), in accordance with the theory advanced earlier[2]. This conclusion is supported by recent experiments carried out at the U.S. Bureau of Standards by Fiock and Roeder[3], using two different methods for measuring the speed of flame, with central ignition (*a*) in a closed sphere and (*b*) in a soap bubble. The concentration of moisture was carefully measured and kept constant in each series (a necessary precaution which we emphasised in our paper), but differed in the two series, being 2·7 and 3·3 per cent.

Fiock and Roeder's results are of further interest in that they show a slight but distinct displacement of the maximum speed towards a mixture containing an excess of carbonic oxide. This effect can be explained as being due to the moisture present in the mixtures taking part in the combustion, so that there are simultaneous reactions:

$$2CO + O_2 \rightarrow 2CO_2$$
$$CO + H_2O \rightarrow CO_2 + H_2,$$

and the displacement should be greater the higher the concentration of water vapour. Fiock and Roeder's experiments indicate that this is so; our own experiments, which gave no evidence of a displacement, were made with mixtures containing only 1·6 per cent of water vapour.

W. PAYMAN.
R. V. WHEELER.

Safety in Mines Research Board,
Research Laboratories,
Sheffield, 1.
Nov. 30.

[1] *J. Chem. Soc.*, 1835; 1932.
[2] *J. Chem. Soc.*, 48; 1920.
[3] Nat. Advis. Com. Aeronautics, Report No. 532, 1935.

## Effect of Adsorbed Water on the Catalytic Decomposition of Hydrocarbons (by a Molecular Beam Method)

BY using true molecular beams of various hydrocarbons projected on to a platinum filament (4 mm.$^2$ heated area) of known and controllable temperature, we have studied the primary decompositions instantaneously by pressure variations in the filament chamber, which is large compared with the filament. Similar decompositions at a carbon surface have also been studied, the carbon surface consisting of a thin layer of carbon deposited on platinum by heating a strip of the latter in a hydrocarbon atmosphere. Some preliminary results were briefly reported at the meeting of the American Physical Society in June, 1934[1]. The inhibiting effects then ascribed to hydrogen are actually due to water.

It has been conclusively shown that in both cases —the bright platinum filament and the carbon filament—no dehydrogenation of paraffins, olefines or alcohols takes place unless traces of water are present in the vapours concerned. We postulate that this water is necessary to maintain a monomolecular layer of water molecules on the catalytic surface, and that this layer is the true seat of dehydrogenation. The dehydrogenation is inhibited by an excess of water on the foil in the lower temperature region. Thus the temperature at which the reaction falls off is dependent on the water content of the gas investigated. This phenomenon makes it impossible to follow the uninhibited course of the reaction into lower temperature regions. Traces of air in the presence of traces of water do not affect any of these reactions.

Under favourable conditions, the dehydrogenation is within the limits of experimental error complete over temperature ranges of several hundred degrees centigrade. This must mean that the promoting water layer is adsorbed on the surface in a different manner from the inhibiting layers. Therefore, we can draw interesting conclusions regarding the adsorption of water at high temperatures and the heat of activation of the dehydrogenation process itself. If the filament is heated to about 1550° C., at which temperature all adsorbed vapours are driven off (slight carbon formation on the surface cannot under these conditions be prevented), the pressure in the reaction vessel drops to zero in all cases tested except that of methane. This complete disappearance of all incoming molecules leads to the conclusion that free radicals are formed by rupture of C–C bonds and that the reaction products are readily adsorbed on the walls of the reaction vessel.

The investigation of the decomposition of methane is not yet concluded, but the fact that at temperatures above 1550° C. the pressure in the reaction chamber is only slightly diminished, favours the assumption of a decomposition of methane into the methylene radical and a hydrogen molecule. The assumed decomposition of all other hydrocarbons into free radicals upon collision with a completely degassed surface at high temperatures can likewise be shown to take place at temperatures several hundred degrees lower when the measurement is performed immediately after degassing the foil at temperatures above 1550° C. In these cases the slow covering of the foil first with a dehydrogenation promoting layer followed by further adsorption layers inhibiting all reaction may be easily followed.

The experimental evidence that the dehydrogenation takes place only in the presence of a promoting mono-molecular water layer on the catalyst alters this catalytic problem fundamentally, since from the theoretical point of view both the mode of adsorption of water and the dehydrogenation reaction proper in presence of the adsorbed water layer have to be considered. The latter may very likely be interpreted as an interaction between the carbon-hydrogen bonds of

the hydrocarbon and the activated hydrogen-oxygen bonds in the adsorbed state.

We have experimental evidence that the water may be substituted by certain other molecules having hydrogen bonds with electronegative elements, for example, hydrogen sulphide.

Since then, we have started experiments by a different method to study the effect of water on the reverse process, the hydrogenation of unsaturated hydrocarbons. The outcome of these preliminary experiments apparently shows that the presence of water is equally important for the hydrogenation process. A hypothesis that adsorbed water plays a vital part in the hydrogenation process was advanced by Boswell[2] in 1922, based on the study of the reduction of nickel oxide by hydrogen as well as the catalysis of the hydrogenation by partially reduced nickel oxide. The great difficulties of proving this hypothesis quite conclusively in the case of the hydrogenation seem to have led to it receiving little attention.

The first part of a detailed account of this work containing the experimental method and the results with paraffins will be submitted for publication in the *Proceedings of the Royal Society* at an early date.

Grateful acknowledgement is made to the directors of the Shell Development Company and especially to Dr. E. C. Williams, for their continuous interest in this work and their permission to publish it.

OTTO BEECK.

Shell Development Company,
53rd and Horton Streets,
Emeryville, California.
Nov. 13.

[1] *Phys. Rev.*, **46**, 331; 1934.
[2] M. C. Boswell, "The Mechanism of the Catalysis of Hydrogenation by Nickel", *Trans. Roy. Soc. of Canada*, Sect. 3, **16**, 1, later extended to platinum, *ibid.*, **17**, 1.

## Endocrine Organs of the Blue Whale

As nothing seems to have been published in the literature on the hormone-producing organs in the whale, I submit a short communication of the preliminary results[1] of my investigations on the subject. The endocrine organs were collected by me during a whaling expedition to the Antarctic. They were preserved in a frozen or dried condition or by means of alcohol for four to ten months before examination.

The *anterior lobe of the pituitary gland* in the blue whale weighs about 30 gm. I have been able to demonstrate the presence of the follicle-stimulating, luteinising, thyreotropic and lactogenic hormones.

The *thyroid gland* in the blue whale weighs about 6–8 kgm. In a dry powder prepared from it was found an average iodine content of 2·03 per mille. The powder produces an increase of metabolism.

The *pancreas* of the blue whale weighs about 50–80 kgm. After being preserved in the frozen state for about five months, it will yield by extraction 500 international units of insulin a kilogram.

The *ovary* in the blue whale weighs 4–5 kgm. The quantity of follicular fluid that can be drained from one ovary is about 500 c.c. It contains about 2,000 mouse units of œstrogenous substances a litre.

The *corpus luteum graviditatis* may, in the blue whale, weigh up to 4 kgm. After having been preserved in a frozen state for a year, it still contains considerable quantities of progestin, namely, at least 60 rabbit units a kilogram.

Quantitative investigations have hitherto been carried out only with the pancreas and the ovary.

A complete and detailed description of the experiments and their results will be published later.

ALF P. JACOBSEN.

Physiological Institute,
Royal University,
Oslo. Nov. 27.

[1] Alf P. Jacobsen, *Tidsskrift for den norske Lægeforening*, Nr. 5; 1935.

## Swarming of *Odontosyllis phosphorea*, Moore, and of other Polychæta near Nanaimo, B.C.

IN his very interesting article on the "Possible Bearing of a Luminous Syllid on the question of the Landfall of Columbus" in NATURE of October 5 (p. 559) L. R. Crawshay mentions the swarming of *Odontosyllis phosphorea*, Moore, in this neighbourhood. He refers to the observations made by Potts[1] in 1911, from which it was inferred that there was a periodicity in the appearance of the swarming forms of the species in Departure Bay, and that this could be correlated with the phases of the moon.

As a result of much more extended observations of the actual state of affairs in 1914, it was shown by Fraser[2] that there is no such periodicity, and that swarming forms of both sexes may be taken on any day over a period of between three and four months provided the water is still at sundown, at which time, exclusively, swarming occurs. In more recent years, I have had many opportunities of confirming Fraser's observations, and swarming forms have been taken at dates both earlier and later in the year than recorded by him. It is interesting to find this difference in the behaviour of *O. phosphorea* from that of both *O. enopla*, Verrill, as recorded by Galloway and Welch[3] and of the Bahamian species, as now described by Crawshay.

The swarming form of *O. phosphorea* has not yet been taken at any point in this neighbourhood far distant from that at which it was observed by Potts and Fraser, but there is little doubt that this is due to the lack of sufficiently intensive search, since the area of distribution of the atokous form has now been so extended as to indicate that it is quite general in the Strait of Georgia. The conditions in Departure Bay are, due to its sheltered situation and to the set of the currents into it from around the adjacent islands, particularly favourable to finding epitokous polychætes and, as Fraser points out, these factors are, no doubt, partly responsible for the concentrations of swarming *O. phosphorea* which occur at the entrance to the bay.

It would, perhaps, be of interest in this connexion to record other species the epitokous forms of which have been taken in Departure Bay in recent years. These include *Autolytus prismaticus*, Fabricius, *Syllis elongata*, Johnson, *Syllis armillaris*, Müller, *Syllis borealis*, Malmgren, *Autolytus magnus*, Berkeley, *Nereis virens*, Sars, *Platynereis Dumerilii* (Aud. M-Edwards) var. *Agassizi*, Ehlers, *Nereis pelagica*, L., *Nereis vexillosa*, Grube, *Glycera nana*, Johnson, *Armandia brevis*, Moore. All these have been taken at or near the Station float at various seasons and at various times of day and night.

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[1] *Proc. Camb. Phil. Soc.*, **17**, Pt. 2; 1913.
[2] *Trans. Roy. Soc. Canada*, **19**; 1935.
[3] *Trans. Amer. Micr. Soc.*, **30**; 1911.

### Records of Fatalities from Falling Meteorites

WITH reference to Mr. M. A. R. Khan's letter in NATURE of October 12, p. 607, on the above subject, I would point out that Col. G. H. Saxton's letter[1] regarding the Nedagolla meteorite of January 23, 1870, states that of the people in the village, who were greatly alarmed, "some received violent shocks and a man near to whom it fell, was stunned". Apparently the man was not hit, but was stunned by the air pressure.

In the original account[2] of the Mhow meteorite, also referred to by Mr. Khan, it is stated that the largest fragment weighed three pounds, and fragments were picked up four or five miles apart; "one broke a tree, and another wounded a man severely in the arm". However, the authority for the statement is not given and in default of substantiation, it is best, like "The Writer of the Review", to accept Prof. Heide's statement.

Mr. Khan should refer to my account[3] of the Naoki meteoric shower of September 29, 1928, to which his[4] is supplementary.

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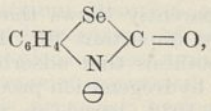
Calcutta.
Nov. 4.

[1] *Proc. Asiat. Soc. Beng.*, pp. 64–65; 1869.
[2] *Edin. J. Sci.*, **9**, 172; 1828.
[3] *Rec. Geol. Surv. Ind.*, **62**, 444–451; 1930.
[4] *J. Osmania Univ. Coll.*, **2**, 22–23; 1934.

### Absorption Spectra of Tautomeric Selenazoles

THE ultra-violet absorption curve of 1-hydroxyl benzselenazole in methyl alcohol is almost identical with that of 1-keto-2-methyl-1 : 2-dihydrobenzselenazole, and quite distinct from that of the *o*-methyl ether. In aqueous sodium hydroxide solution, the curve of the hydroxyselenazole is shifted to the left (deformation), and there is a decrease in maximum due to the production of the ion



on which tautomeric change depends.

1-Thiolbenzselenazole also shows a striking similarity to thiazole analogues in the ultra-violet region, the curve in methyl alcohol being closely similar to that of 1-thio-2-methyl-1 : 2-dihydrobenzselenazole. The absorption curve for the thiolselenazole in aqueous sodium hydroxide belongs to the same family, but shows a slight shift towards the region of shorter wave-length, and an appreciable drop at the first maximum on account of the removal of mobile hydrogen.

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## Points from Foregoing Letters

TAKING as variables the "preparedness for war", "defence coefficients", "fatigue and expense coefficients", and "dissatisfaction with treaties", Dr. L. F. Richardson expresses by means of differential equations the tendency towards war or peace. He deduces that the international system is unstable if the product of the two defence coefficients exceeds the product of the two fatigue coefficients and may drift either towards war or co-operation, according to the value of the different constants in the equations.

The effect of gamma-rays and of neutrons upon colloidal dispersions (gold and silver, arsenic and cadmium sulphides, vanadium pentoxide, ferric hydroxide) and upon chemical reactions (oxidation of potassium metabisulphite and decomposition of hydrogen peroxide) has been investigated by Prof. F. L. Hopwood and J. T. Phillips, with the view of obtaining a method for the detection of neutrons, not dependent on the formation of radioactive substances, which are variable with time. They have detected an effect upon the chemical reactions and also changes in the stability of the colloidal dispersions.

Experiments carried out below ground at a depth equivalent to 60 m. of water, by D. H. Follett and J. D. Crawshaw, show that cosmic rays which penetrate to this depth have, proportionately, the same ability to produce electron showers as those at the earth's surface, thus indicating that they consist of positive or negative electrons. These findings are not in agreement with those of previous investigators, who have reported rapid diminution of the ratio of the rate of shower production, or even complete absence of showers, at lesser depths.

The radioactivation of silver by neutrons at different temperatures and after traversing different thicknesses of paraffin (with a cadmium shield interposed at various distances) has been investigated by Drs. P. Preiswerk and H. von Halban, Jun. They find, in accordance with Fermi's theory, that for silver nuclei the chance of capture varies inversely as the relative velocity of nucleus and neutron, when account is taken of the velocity of thermal neutrons; this result does not hold for collisions of neutrons with the hydrogens of paraffin wax. The authors further find, unlike Moon and Tillman, that cooling the paraffin wax to 90° K. increases by 10 per cent the radioactivity induced in iodine.

The catalytic dehydrogenation of alcohols, paraffins and olefines at a hot platinum or hot carbon surface has been studied by O. Beeck by means of a molecular beam technique. He finds that a monomolecular layer of water is necessary in order to render the surface catalytically active, and that for all cases except methane the primary reaction is a splitting into free radicles (methane splits to free methylene and molecular hydrogen). At lower temperatures an excess of water inhibits the reaction. Water is, apparently, also necessary for the reverse (hydrogenation) reaction.

The presence of various hormones in the thyroid and pituitary glands, pancreas, ovary and corpus luteum of the blue whale has been ascertained by Dr. A. P. Jacobsen.

In connexion with Crawshay's recent suggestion that a phosphorescent syllid may have been responsible for the light "like the flame of a small candle" observed by Columbus after sunset on approaching the American shores, E. Berkeley gives further particulars of the swarming habits of *Odontosyllis phosphorea* at Departure Bay, B.C.

# Research Items

## Gallo-Roman Official in Early Britain

A RECENT accession to the British Museum (Bloomsbury) collections has enriched the Museum with a closely dated inscription of an interesting historical figure, and made possible a restoration of one of the most important sepulchral monuments surviving from the Roman Province of Britain. For more than eighty years, the Museum has possessed two stones from what must have been one of the most imposing sepulchral monuments of London, which had been dated tentatively as late first century or early second century of our era. One is a 'bolster' with imbricated leaves and central binding; the other bears the beginning of an inscription and is 2 ft. 6 in. in height and more than five feet long as found. Owing to the rarity of the name 'Classicianus' appearing in the mutilated inscription, some reserve was shown in attempting any solution of the problems of meaning and purpose. These stones had been found in 1852 built into one of the semi-circular bastions added in later Roman times to the walls of the city of London. They were found in Trinity Square, Minories. A small portion of the bastion survived until June 1935, when it was brought to light by the enlargement of the Minories Sub-station. An inscribed stone was then discovered upside down in the lowest course of masonry. This has now been presented to the Museum and identified as part of the Classicianus monument. In a description by Mr. C. F. C. Hawkes (*Brit. Mus. Quarterly*, 10, 2) it is pointed out that the stone had already been re-used before it was built into the bastion. It is suggested that the mortuary inscription, so far as now restored, points to this Classicianus being identical with the official of that name mentioned by Tacitus as taking over the procuratorship of Britain on the death of Catus Decianus in A.D. 61, the year of Boudicca's rebellion, and that his names indicate that he was probably a native of Gallia Comata—an interesting example of the tendency noted by Tacitus for natives of Gaul to occupy office even at this early date.

## African Bark Canoes

MR. JAMES HORNELL describes and figures in *Man* of December a bark canoe which he saw on the shore in the native quarter of Mozambique in 1926, comparing it with a similar canoe recently described from the Pungwe River in Northern Rhodesia. The Mozambique example represents a great advance upon the Pungwe design. Instead of being made from a continuous length of bark stripped from one tree and sewn into shape without any internal framework, its construction was rather on the model of a sea-going Irish curragh, except that it was sharp at both ends, whale-boat fashion. The bottom was rounded and the sides had a distinct tumble-home form. The framework consisted of a large number of closely set transverse frames made of bamboo poles, bent into a wide U-shape. They were held in position and stiffened by two pairs of stout bamboo poles running longitudinally on the floor, each pair lashed about nine inches on either side of the median line; while another pair on each side formed a rude, but efficient, gunwale. A single lighter bamboo was made fast to the ribs on each side, four or five inches below the gunwale. Five stout plank thwarts strengthened the framework transversely. Their ends were inserted beneath and hidden by the gunwale bamboos, to which they were fastened by stout cord passed through two holes made in each thwart end. A median hole in the midships thwart, and a hole in a short wooden bar on the floor below, showed that the canoe could be used for sail. The bark skin was sewn together in long thick sheets by palm-fibre cord. Where the bark sheets met at each end, they were sewn together at a considerable distance from the edges, the free ends acting as a fender and protecting the sewing. The sides were made of several lengths of bark, with an overlap. The bark skin was sewn to the gunwale by double stitches at short intervals with a single connecting cord running along the outside. The canoe was about fourteen feet in length with an extreme beam of four feet.

## An Interesting Habitat for Copepods

IN a paper entitled "A New and Important Copepod Habitat" (*Smithsonian Misc. Coll.*, 94, No. 7, 1935), C. B. Wilson discusses the occurrence of copepods in the spaces between the sand grains of beaches, which he terms "terraqueous", and compares them with free-swimming, commensal and parasitic copepods. Such copepods, he states, are widely distributed in quartz sand, but are seldom found in coral sand and never in 'sand' composed of shell fragments, in which the interstices may be greatly reduced or absent. They occur, however, in mud, where the surface layers are more or less flocculent. They show a wide distribution within any given area of sand, occurring from high to low water and even below low water. Individual species usually show a restricted distribution within a given area, and species change not only from one bay or sand-bank to the next, but also with change in level from high-water downwards. Owing to the nature of the habitat, copepods inhabiting such a region are of minute size, seldom attaining a length greater than 0·5 mm. (in sand), and are usually many times longer than broad, the elongate shape being a necessary modification due to the habitat. This elongation is accompanied by increased flexibility, essential for movement in such surroundings. There is a large development of sensory setæ on the antennules. At the same time, as Remane has pointed out (*Wiss. Meeresuntersuch.*, Kiel, 21, Pt. 2, 1933), there may be a reduction in the development of the eyes, analogous to that of the fauna of caves. These features may both be correlated with the habitat. It is interesting to note that members of the three chief groups of copepods are represented in this fauna, even Calanoids, though the majority appear to belong to the Harpacticoida, and all show the same type of modification in body structure. Owing to its inaccessibility by ordinary dredging methods, this fauna has remained undiscovered until the last few years, during which a large number of new genera and species of copepods and other animals has been described by W. Klie (*Zool. Jahrb. Syst.*, 57, 1929), C. B. Wilson (*U.S. Nat. Mus. Bull.*, 158, 1932) and others.

### Structure of *Ctenoplana*

DR. TAKU KOMAI (*Mem. Coll. Sci., Kyoto Imp. Univ.*, B, **9**, No. 4, Art. 6 ; 1934) describes a specimen of *Ctenoplana* found with a second individual attached to drift seaweed near the Misaki Marine Biological Station. This peculiar creeping ctenophore is very rare and extremely interesting. It is closely related to *Cœloplana*, sharing with it the creeping sole, pigment, branching canals, compact testes, spermiducts, processes of polar plates and the absence of pharyngeal canals. It differs, however, in being much smaller, the ribs persisting, the musculature far less developed and the finger-like processes of the polar plates better differentiated than in *Cœloplana*. These differences are apparently correlated with the swimming and creeping habit, whilst *Cœloplana* is limited to creeping life in the adult stage. There is a close resemblance between *Ctenoplana* and the larvæ of *Cœloplana* which has been already pointed out by Dawydoff. There are, however, differences in the gastro-vascular system, which is far better differentiated in *Ctenoplana*, and in the disposition of the tentacular apparatus—vertical in *Cœloplana* larvæ and horizontal in *Ctenoplana*.

### Cultivation of the Walnut

DR. JOYCE B. HAMOND, of the East Malling Research Station, contributes a paper on "Recent Developments in Walnut Growing in England" to the *Journal of the Royal Horticultural Society* for November. This account brings together the results of many original investigations. It may be claimed that the present satisfactory state of walnut culture in Great Britain is largely due to the efforts of research workers whose interest was primarily academic. Ten years ago, the walnuts of this country were poor in taste, unpleasing in colour, often covered by a gaping shell, and altogether unattractive. Then Mr. Howard Spence determined to improve the nut. His own work and wider stimulation laid the foundations for the investigation of methods of propagation by Mr. A. W. Witt, the study of graft diseases and methods of storage of nuts by Miss Hamond, and the control of bacterial blight by Dr. H. Wormald. These aspects are described with detail in the paper under review. Four nursery firms have now taken over the stock of improved trees raised by the East Malling Research Station. These are grafted upon standardised rootstocks, produce well-flavoured fruit of good taste, and are phenologically adapted to the English climate. Grafting of walnut trees is discussed, and bush specimens of this crop may be obtained by merely removing the tips of any shoots which tend to increase in length too vigorously. Miss Hamond shows how the nuts may be bleached and stored in coco-nut fibre mixed with salt. The would-be grower is provided with full information for production of nuts of the highest quality, and the account should go far to popularise the improved walnut as a crop, and extend its cultivation.

### Stripe Disease of Daffodils

A DISEASE of daffodils where the leaves become mottled with yellow patches has attained rather serious proportions of late years. Various causes, ranging from 'inherent weakness' to the effects of soil and climate, have been propounded in the past, but it is now realised that a virus is responsible for the malady. Mr. N. K. Gould (*J. Roy. Hort. Soc.*, Nov.) describes a number of experiments upon the incidence, transmission and control of the disease. The Poetaz and Tazetta sections of the Narcissæ are completely free from stripe or mottling, but the other groups can be kept free from the trouble only by the strict removal of infected plants. Treatment with hot water for three hours—the normal precaution against eelworm—has no effect, either in transmitting or inactivating the causal agent. The virus is quite unaffected by treatment with fourteen disinfectants mentioned in the paper, and has not been transmitted from diseased to healthy plants by grafting or by needle inoculations.

### Sooty Mould Fungi

MISS LILIAN FRASER, Linnean Macleay fellow of the Linnean Society of New South Wales, is making a detailed study of the peculiar aggregations of fungi known as sooty moulds. These usually consist of a member of the Capnodiaceæ, a species of *Atichia*, and a third organism belonging to Fungi Imperfecti. Three new papers have been contributed to the *Proceedings of the Linnean Society of New South Wales* (60) during the present year, and represent the third, fourth and fifth of the whole series. Part 3 (pp. 97–118, May 1935) describes "The Life Histories and Systematic Positions of *Aithaloderma* and *Capnodium*, together with Descriptions of New Species". Life-histories of four fungi are considered in detail, and three which are described for the first time are *Capnodium salicinum*, Mont., var. *uniseptatum*, *Aithaloderma ferruginea* and *A. viridis*. Much technical discussion of the systematic position of these fungi is included, and it is held that the Capnodiaceæ, as represented by *Capnodium* and *Aithaloderma*, should be included in the Dothideales. "Species of the Eucapnodieæ" is the title of the fourth part (pp. 159–178, Sept. 1935), which adds six new species and varieties. Amended descriptions of the incompletely known species *Capnodium Walteri*, *C. fuliginodes*, *C. anonæ* and *C. mucronatum* are given, and *Scorias philippinensis* is now recorded from Australia for the first time. Part 5 (pp. 280–290, Sept. 1935) is entitled "Species of the Chætothyriaceæ", and therein eight new species of this subsection of the Capnodiaceæ are described in detail. The taxonomic conclusions of all three papers are based upon adequate culture experiments, and the series should go far towards an elucidation of the complexities of the commonly occurring sooty moulds.

### New Current-Measuring Apparatus

FOR the last ten years or more, there have been in existence various types of continuous current meters for the direct measurement and automatic recording of the speed and direction of water flow past lightships and other moored vessels. Such meters are mainly fine-precision instruments, and therefore quite unsuitable for use in exposed positions during periods of severe storm. This has been a very serious drawback, for data relating to bad weather conditions are highly important from the biological point of view. In order that such data may in future become available for fishery research workers and others, Dr. J. N. Carruthers, of the Fisheries Laboratory, Lowestoft, has recently devised a simple, cheap and very sturdy current-measuring apparatus to which he has given the name 'Vertical Log' (*J. Con. Internat. Explor. Mer*, **10**, No. 2, 151–168 (1935) ). The instrument, it is claimed, will

work continuously in very exacting conditions indeed. It is, however, not automatic in point of direction recording, but requires fleeting attention—often not more than a glance—every now and again. As experience in its use is acquired, it often becomes possible to leave the apparatus unread for several hours on end; at other times it will call for brief inspection every quarter-hour or so. It can be worked equally well from both wooden and steel ships and at all depths. The makers, Messrs. Elliott and Garrood, of Beccles, Suffolk, estimate that, after the first few instruments have been supplied, they will be able to make further 'logs' of this type at a cost of about £12 each. We hope that this new current meter will fully justify the high hopes of its inventor.

### Noise Limitation in Valve Amplifiers

IT is now well recognised that the chief factor which limits the amplification obtainable by means of thermionic valves is the electrical noise generated within the amplifier itself. It is not practicable to amplify any electrical signal unless the input voltage of this signal is greater than the electrical noise voltage developed in the early stages of the amplifier. The fundamental limiting sources of this noise are two, namely, thermal agitation of electricity in the input circuits and the voltage fluctuations within the valves themselves. The first of these, thermal agitation, is now fairly well understood and is actually used as a source of calibrating voltage in certain types of receiving and field measuring equipment. The second noise arises from the fact that the space current in a valve is not smooth, but is subject to rapid and irregular fluctuations in magnitude. This matter is discussed in an article by G. L. Pearson entitled "Quiet Amplifier Tubes" published in the October issue of the *Bell Laboratories Record*. The output noise of a valve amplifier due to the intermittent nature of the electron current has been measured for a variety of valves and over a wide range of frequencies. In order to reduce the noise to a minimum under conditions of high signal amplification, it was found that, in general, the valve cathode must be operated at as high a temperature as possible, without impairing the life of the valve. Also the negative bias of the control grid must be reduced to as near zero as possible without causing excessive grid current, while the anode and screen voltages must be reduced below the values normally recommended. Expressing this electrical noise as an equivalent input voltage, the value was found to vary between limits of about 0·7 and 1·5 microvolts for a selection of fifteen American valves. In general, the triodes gave a lower value than the multi-grid valves. At low audio frequencies, this noise is inversely proportional to the frequency, but it remains approximately constant for frequencies above one or two thousand cycles per second.

### Toxicity of Cod Liver Oil

THE use of synthetic diets composed of the individual nutrient constituents in purified form has contributed largely to our modern knowledge of nutrition. Purified diets for Herbivora present special problems in that these animals normally consume rations containing large amounts of cellulose, and studies have been conducted on this subject by L. L. Madsen, C. M. McCay, and L. A. Maynard (Cornell University Agricultural Experiment Station, Memoir 178, 1935). After trials, a regenerated cellulose known as washed 'Sylphrap' was adopted as the cellulose constituent, and the diet devised which proved successful in maintaining an adult goat over an extended period consisted, in percentages, of cellulose 30, corn starch 30, casein 15, sucrose 10, yeast 7, salt mixture 5 and lard 3, with the addition of about 1·6 per cent of cod liver oil. Sheep thus reared from weaning were successfully maintained for 480 days, similarly goats though not quite so satisfactorily, and less success was achieved with guinea pigs and rabbits. In the last-named, and to some extent with goats, eventual failure was due to the development of paralysis dependent upon muscular degeneration. It was demonstrated that the cod liver oil was the essential agent causing this lesion, which ensued unless the cod liver oil ration was kept below 0·1 gm. per kilo of live weight. As the authors are careful to state, the results, while furnishing no evidence applicable to the human species, should serve to direct further attention to the reports of Agduhr and others describing similar lesions in infants as being caused by cod liver oil.

### New British Standard Glue Tests

THE British Standards Institution has just issued a series of British standard methods for the testing of bone, skin and fish glues. The tests laid down include methods for the determination of moisture content, jelly strength, viscosity, melting point, foam, water absorption, keeping quality, joint strength in shear, reaction, grease, ash, sulphur dioxide and chlorides. The relative importance of the tests described must necessarily depend largely on the purposes for which the glue is intended. The joinery trade is particularly interested in strength and spread, the gummed paper manufacturer in tackiness and foam, etc. It will be seen therefore that it is not necessary for any one particular trade to utilise all the tests laid down. Apart from the industry itself, these methods of test should prove particularly interesting to all those concerned with the examination of glues, both in the laboratory and in the workshop. Copies of this British standard (B.S. No. 647–1935) may be obtained from the Publications Department, British Standards Institution, 28 Victoria Street, London, S.W.1, price 3*s*. 8*d*., including postage.

### Maximum Error of Observations

THE statistical properties of the mean of a set of $N$ observations are well known. E. J. Gumbel (*Ann. l'Institut Henri Poincaré*, 5, 115; 1935) discusses the properties of the greatest and least observations of a set, a problem of importance when it is desired to estimate the maximum error of observations. If the distribution of the original observations is normal, or, more generally, what is called of exponential type, the distribution of the extreme values is doubly exponential. Similar conclusions hold for the second greatest and second least, and so on. The work is related to that of Prof. R. A. Fisher, but treated from a different point of view. M. Gumbel remarks that the theory has been applied to the determination of the greatest deviation of artillery fire, the intervals between radioactive emissions, the extreme duration of human life and the intelligence of a racial minority in a certain country of central Europe.

# Mechanism of Salt Absorption by Plant Cells

By Dr. W. J. V. Osterhout, Rockefeller Institute for Medical Research, New York

TO solve the problem of the mechanism of the absorption of electrolytes by the plant cell, we need accurate knowledge of what goes on inside the cell. This cannot be obtained with cells of ordinary size. We have therefore studied very large multinucleate plant cells, especially those of *Valonia*[1]. Since this work has called forth comments[2], due to misunderstanding, a brief statement of facts is submitted, although this statement is naturally far from being complete.

(1) *Injury.* A great advantage of *Valonia* is the ease with which injury can be detected. In our laboratory especial care has always been used to avoid working on injured cells. Dr. Steward concludes that our experiments with ammonium chloride were made with injured cells. Working at the high temperatures of Tortugas in the summer, he found that *Valonia* was easily injured by ammonium chloride.

This may happen also in Bermuda in summer, but in winter cells are obtainable which benefit by concentrations of ammonium chloride up to 0·005 *M*. They behave as plants usually do when given an optimum amount of nitrogen. In such experiments certain precautions are necessary, as we have gradually learned during several years of work. The proper handling of these cells requires considerable experience. When the internal concentration of $NH_4^+$ approaches 0·3 *M* injury may result. This was not the case here.

The following evidences of injury are cited by Dr. Steward :

(*a*) Sodium entered more rapidly than in the controls. This is not significant in view of the fact that in other experiments the rate of entrance in the controls was very variable and was sometimes greater than in this case.

(*b*) Potassium went out 'with the gradient'. It may be misleading to speak of the passage of a cation 'with' or 'against' a gradient without considering the accompanying anion and the product of the ions, which is proportional to the chemical potential. To call this injury is to misunderstand the situation. For injury always causes an escape of potassium chloride which, though much more concentrated inside the cell than outside, is normally retained because the protoplasm is only slightly permeable to it. Injury quickly increases the permeability, and in consequence potassium chloride comes out and growth ceases.

Our experiments present a picture in no way resembling this. No chloride escaped. On the contrary, it continued to enter as usual 'against a gradient', a conclusive proof that the cell was not injured. (During this period the gain in moles of chloride was 14·1 per cent ; the loss of potassium was about 15·8 per cent. Presumably potassium went out as potassium hydroxide, to which the protoplasm is normally very permeable.) At the same time ammonium entered ('against a gradient') and became more than a hundred times as concentrated inside as outside. This could not happen if the cell were injured.

Moreover, the cells were better than the controls in growth, in photosynthesis (unpublished work) and in general appearance. They lived indefinitely. In experiments lasting a month a few cells died, but the death rate was no higher than in the controls. The expression "corrected volume" applied to these cells has nothing to do with the death of cells. (All volumes were multiplied by the same factor.)

(*c*) A misunderstanding must be responsible for the following statement. "Considerable prominence has been given to the fact that an external *p*H of 5·5 which causes irreversible injury and death also produces loss of potassium ions." In our work the lowest external *p*H was 6·8, at which there was no sign of injury. According to Steward, 7 is optimal for absorption.

(2) *Metabolism.* Dr. Steward concludes that the study of *Valonia* must be misleading because its metabolism is less than that of storage tissues (for example, potato) the chemical activity of which has been abnormally raised by being cut into thin slices and placed in well-aerated solutions. (Cutting increases abnormally the output of carbon dioxide.)

This involves the relation of metabolism to the absorption of electrolytes. In *Valonia*, the production of carbon dioxide (and of other organic acids) keeps the chemical potential of potassium hydroxide less inside than outside : hence potassium hydroxide continues to enter. The metabolism of *Valonia* is ample for this purpose. The *p*H of the sap is about 5·8 as compared with 8·0 to 8·2 of the sea-water. In a cell 1 cm. in diameter the volume of the protoplasm is less than one per cent of the total. Hence a correct estimate of metabolism, based on the amount of protoplasm, will be more than a hundred times as great as one based on the volume of the cell. In the laboratory the growth in volume under favourable conditions is 0·5–2 per cent per day.

Other aspects of metabolism may be important : if so, it should eventually be possible to demonstrate their roles as clearly as that of carbon dioxide in *Valonia* (and in models).

(3) *Theoretical.* (*a*) When we increase the external *p*H, potassium goes in more rapidly. Its entrance decreases the activity of water inside and raises the osmotic pressure, so that water enters more rapidly : in consequence, the internal concentration of potassium remains approximately constant. Hence the only way to find out how fast potassium enters is to measure the increase of moles of potassium in the cell.

(*b*) If potassium enters chiefly as potassium hydroxide, its rate of entrance will increase with increasing *p*H until secondary changes begin to interfere. Such secondary changes become striking at high *p*H values and undoubtedly begin much lower. It is therefore impossible on theoretical grounds to predict the optimum *p*H. If it should turn out to be 7 in any given case, it would not invalidate the hypothesis.

(*c*) Since *Valonia* is able to accumulate electrolytes without the complications of storage tissues —for example, the presence of intercellular spaces and of injured or altered cells in the sliced tissues, the fact that the cells are placed under abnormal

conditions, and the impossibility of obtaining the cell sap without contamination and chemical change—we must perforce congratulate ourselves on finding such a satisfactory organism for study.

Certain principles which appear to govern accumulation in *Valonia* are so simple that they have been embodied in models in which potassium chloride enters until its chemical potential inside becomes several times as great as outside. (This depends on the bubbling of carbon dioxide through the artificial sap to imitate its production by the living cell.) Such increase in chemical potential involves an expenditure of energy, which comes from chemical reactions (as it does in the cell).

Some of these principles play an important role in other organisms. Future research must reveal the extent of their application.

[1] Osterhout, W. J. V., *Ergebnisse der Physiol.*, **35**, 967; 1935.
[2] Steward, F. C., NATURE, **135**, 553; 1935.

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### By Dr. F. C. Steward, Birkbeck College, University of London

ONLY minor comments are necessary to the reply of Dr. Osterhout, which is devoted mainly to the question of injury to *V. macrophysa* by ammonium chloride.

Even if the ammonia experiments are free from the suspicion of injury, the fact still remains that the subsequent movements of *potassium* and *sodium* neither necessitate a distinction between ions and molecules nor are they in the direction usually associated with accumulation.

In order to evade the unfortunate implications of the results with respect to sodium, Dr. Osterhout implies that a difference between the 'control' and 'ammonia' groups which, on the data given, is clearly significant, is after all not real. This difference, whether due to injury or not, is certainly in a direction not in accord with the theory and cannot be dismissed, because of the behaviour of cells (unpublished) which were not strict controls for this experiment[1].

Since injury "in the summer time", even at Bermuda, to *V. macrophysa* by ammonium chloride is now acknowledged, readers will scrutinise even more carefully any crucial experiments which involve this salt, and, no doubt, demand more precise designation than the vague terms 'summer' and 'winter', of the seasonal variations which can be tolerated and the limits of internal concentration which differentiate an 'injurious' from a 'beneficial' effect (it is stated[2] that injury occurs in the Bermuda material at a concentration "less than 0·3M".)

However, the major problem is not the applicability of the theory to the absorption of ammonia, or even its ability to explain the secondary effects which this substance produces on the distribution of potassium and sodium, but rather its generalisation to embrace the initial accumulation of all electrolytes, even the alkali halides.

To the discussion of the effects of external reaction, in so far as they test the theory, Dr. Osterhout contributes two observations although he does not answer the more searching criticisms. One denies that the theory derived any of its support from its undoubted ability to explain qualitatively the behaviour of cells in a medium equally acid as the sap, and the second insists that vague, unspecified "secondary" effects obscure the direct effects of external hydroxyl ion concentration which the theory demands. A theory which, already heavily weighted with hypothesis, fails to satisfy a direct test and can only be retained by resort to such vague assumptions would be better abandoned.

Clearly, one cannot conclude from the work on *Valonia* that the simple mechanism suggested will explain adequately the general facts of salt accumulation by cells[3]. Dr. Osterhout may dismiss the metabolic processes which accompany rapid salt accumulation in storage tissue by regarding them as abnormal chemical activity; but if so, he must also be prepared to eliminate as "abnormal" some of the most fundamental attributes of actively growing cells which, in roots and developing leaves (aquatic and otherwise), are now known to be as intimately concerned with salt accumulation as in the cut storage tissues. The theory of "thermodynamic potentials of free base" and its subsidiary hypotheses is completely inadequate as an explanation of the behaviour of any or all of these systems.

If this discussion emphasises that the problem is still an open one, it may not have been in vain.

[1] A. G. Jacques and W. J. V. Osterhout, *J. Gen. Phys.*, **14**, 309; 1930.
[2] W. C. Cooper and W. J. V. Osterhout, *J. Gen. Phys.*, **14**, 124; 1930.
[3] F. C. Steward, *Ann. Rev. Biochem.*, **4**, 527; 1935.

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# Progress of Building Research*

THE work of the Building Research Board embraces the products of such a wide range of industries and touches so closely upon the lives of the people that any description of its work is not only of scientific value but is also of importance to the industries directly and indirectly concerned, while at the same time the record is a serious contribution to the material side of social improvement. In this last connexion, it is interesting to note in the annual report for 1934, recently issued, that the Board's resources for research and inquiry have been placed at the disposal of a departmental committee appointed by the Ministry of Health to report on materials and methods of construction suitable for working-class flats.

In the search for fire-proof materials, officers of the Building Research Station have worked in close co-operation with the Fire Offices Committee in the design of the laboratory for fire resistance tests at Elstree (NATURE, Dec. 21, p. 996). The need for data on the transmission of sound through the fabric of a building has led to the provision at the Research Station, in conjunction with the National Physical Laboratory, of facilities for full-scale tests on floors and to the setting up of a special Sub-Committee on Sound Transmission. The problem of impact noises

*Department of Scientific and Industrial Research. Report of the Building Research Board, with the Report of the Director of Building Research, for the Year 1934. Pp. x+174+14 plates. (London: H.M. Stationery Office, 1935.) 3*s.* 6*d.* net.

—the cause of considerable anxiety in certain types of construction—is also under examination.

On the subject of damage to buildings by vibration from traffic, machinery, pile-driving and other sources, the investigations, started some years ago and discontinued, are now being resumed, and a preliminary programme of research has been outlined. While it would appear from the report that vibration stresses are, in general, below the estimated fatigue strength of brickwork and concrete even after allowing for considerable stress amplification due to resonance, they are, however, above the compressive fatigue strength of lime mortar, which is therefore liable to gradual disintegration. For the more thorough investigation of this most complex question, special vibrators are being designed for use both on the structures and on the ground, and dynamic extensometers are to be used in the measurement of strains.

The determination of Young's modulus for various building materials, including stone, brick, concrete tiles and asbestos sheeting, has been effected by measuring the frequency of vibration of a specimen in a special apparatus which is described. The error in the observed value of the frequency can be limited to $\pm 0{\cdot}5$ per cent, and the modulus is derived from the formula $E = 4l^2n^2\rho$.

Wind-pressure measurements made on the Severn Bridge during a gale in January are discussed, and further tests on the shielding effect of one building on another have yielded certain general conclusions. To carry this investigation further, a model of a portion of London is being made for tests in a wind tunnel.

The general research work of the Station has included the important problem of the weathering qualities of natural building stones, and the report claims that by applying simple tests the value of Portland stone samples can now be determined with confidence. Certain common terms in specifications are held to be needlessly restrictive of choice and tend to exclude material of the best weathering quality. The information available points to the prime importance of careful selection of the stone, and suggests considerable doubt as to the value of preservatives. The effects of atmospheric pollution and of various physical factors influencing weathering are also discussed, and a lengthy investigation on the relation of micro-organisms to the decay of stone is stated to have shown that these are not directly responsible in any considerable degree for the processes of decay—nor, as yet, have they been found to exert any indirect influence. Many other building materials have been under review, and the notes on these give valuable information as to their properties.

It is, however, with structures and the strength of materials that the major part of the report deals, and in this section the results of the investigations are set out in detail. Concrete beams, piles and road slabs have been the subjects of large-scale experiments, and in the case of beams comparative tests were made for the Ministry of Transport to ascertain the behaviour under load of ordinary reinforced concrete, of Ritchie type and of modified Ritchie type continuous girders. Photographs, diagrams and tables give a clear picture of the results obtained, and these show that the ultimate loads carried by the Ritchie and modified Ritchie beams are about 15 per cent higher than those carried by the ordinary type. If, however, the point of failure be taken as that at which the rate of increase of deflection with load begins to become excessive, the conclusion is that there is little to choose between the three types, which each carry, at this point, about three times the working load.

From these brief notes of the subject matter of the report, it will be gathered that this is a volume which should receive close attention from those who are engaged in research in this or cognate fields, or associated professionally or industrially with modern problems of building. J. A. C.

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# Increasing Aridity in West Africa

BEFORE Section E (Geography) of the British Association meeting at Norwich, Prof. E. P. Stebbing returned to the subject of "The Encroaching Sahara", on which he read a very important paper to the Royal Geographical Society in March of this year (see *Geog. J.*, **85**, 506, June 1935). Leaving on one side the difficult and still disputed question of secular desiccation, it is clear that the activities of man have resulted in assisting the spread of desert and semi-desert conditions—"the eastern Sahara Desert is advancing south and threatening the future prosperity of considerable stretches of West Africa".

As a forester, Prof. Stebbing naturally attributes this to the removal of forest, but it would be nearer the truth to say that the removal of any natural vegetation cover, whether by man-made fire and the plough or through grazing by man's domestic animals, conduces to soil erosion and so to deterioration and apparent desiccation. This has happened in the middle western States of America through the ploughing of prairie grassland, and is now being actively combatted; it is happening in West Africa through the shifting cultivation and increasing herds of a semi-civilised population, and is not yet being arrested.

Prof. Stebbing's suggestion for West Africa is to preserve against human occupation and grazing two continuous east to west belts of forest—one, with a minimum width of $7\frac{1}{2}$ miles, of dry forest in the latitude of Lake Chad; the other a belt 30–50 miles wide in the moister savannah forests farther south. It is not a question of planting forest belts as has been suggested for the United States, but is one of preserving strips of the natural vegetation.

Such a suggestion seems simple, but it is directly opposed to British Government policy in West Africa. The laudable aim of the British has been to interfere as little as possible with the habits of the people, and so shifting cultivation and indiscriminate grazing are permissible. Indeed, under the peaceful conditions of the British regime the people, their herds and flocks have all multiplied, and the evil has been intensified at an ever-increasing pace. It is essential that the state of affairs should be widely known amongst those concerned with education in West Africa—part of the remedy lies in their hands. L. D. S.

## Recent Aeronautical Research

THE annual report for 1934–35 of the Aeronautical Research Committee* summarises the progress made in the investigation of scientific questions and the dissemination of the knowledge made available during that period. The report takes the usual form of a general survey of the whole field with fourteen detailed supplements upon various divisions.

The outstanding technical achievement of the year is considered to be the designing of the *D H* Comet, which flew and won the race from Mildenhall to Melbourne, a distance of 11,300 miles, in less than three days. This performance was not due to any particular discovery made during that year, but simply to having put into practice principles that scientific research has gradually established over a period of many years. Among these are the necessity for clean design, avoidance of mutual interference of parts, use of variable pitched airscrews and retractable undercarriages, the application of reduced speed landing devices, engine-cooling with minimum drag, etc.

The report visualises further possible increases in aircraft performance due to the steadily maintained improvement in aero-engines, progress in engine cooling, fuller appreciation of the aerodynamic causes and effects of skin friction and the development of lighter methods of construction. When this increased efficiency is directed towards higher speeds, the possibilities of flutter of certain parts developing is increased, and it is suggested that a criterion for stiffness to limit this must rank of equal importance with that for structural strength. Also, high speeds necessitate the use of speed-reducing devices, such as flaps and slots, for landing, and while these are successfully used in an empirical manner, a more detailed knowledge of the flow of air over wings at slow speeds is needed before their behaviour can be understood and forecast.

Investigations into the meteorological conditions affecting aircraft, particularly the measurements of accelerations in gusts, have confirmed that, for average flying speeds of to-day, an additional loading equivalent to not more than twice the aircraft weight is the maximum likely to be met. Design strength regulations at present in use cover these cases sufficiently. Work is continuing on the design of instruments to be attached to high masts in order that a more comprehensive investigation into the velocity gradients extant upon the borders of large atmospheric disturbances can be completed.

The introduction of new research apparatus at the Royal Aircraft Establishment and the National Physical Laboratory appears to have resulted in a notable, although perhaps indirect, advance in knowledge. The explaining of certain apparent phenomena has led to a fuller investigation of the physical conditions of the experiments, which is reflected in the better co-ordination of the experimental results with actual practice.

Progress in certain directions has been made with regard to silencing of aircraft. Well-silenced engine exhausts, and the use of slow-running airscrews, has now reduced those sources of noise to an amount less than that due to the motion of the machine through the air. Thus the principal remaining cause of noise, air disturbances, will probably be reduced in time, as the efforts of designers towards aerodynamical efficiency result in machines that set up less disturbance in flight.

Investigations into the possibilities of large aircraft for civil aviation have led the Committee to the conclusion that there is no inherent difficulty in the construction of machines up to weights of two hundred tons. The flying boat or seaplane with six or eight engines appears to offer the most promising lines of development. Practical difficulties in the installation of such a large engine-power are to be expected, and the aerodynamic efficiency of a number of airscrews distributed along the wings will need investigation.

The most outstanding work in the engine section is that of reducing fuel consumption in flight by the perfection of an automatic mixture control functioning with altitude changes. Trials of this over extended periods have shown reductions up to thirty per cent in consumption. Apart from actual monetary saving, this will give greater air endurance for a given tankage, and relieve the pilot from the necessity of adjusting this control constantly, as is now necessary.

It has been discovered that ice formation in the carburettor can be prevented by the addition of alcohol to the petrol. A device has been produced for detecting automatically the need for, and supplying the necessary proportion of alcohol. There has been progress with compression-ignition engines, particularly with one of sleeve valve form, but as contemporary progress in the petrol engine more than keeps pace with this, there appears to be no immediate prospect of the adoption of this type, when the most important consideration is efficiency.

The supplements to the report deal with these and many other problems in greater detail.

The work of the Committee during the past year, as summarised in this report, has leaned towards consolidation and elaboration of detail, rather than anything leading towards new lines of thought.

* Aeronautical Research Committee. Report for the Year 1934–35. Pp. iv+74+4 plates. (London: H.M. Stationery Office, 1935.) 1*s*. 6*d*. net.

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## Mathematical Sciences in France a Century Ago

AT the annual public meeting of the Paris Academy of Sciences held on December 28, 1835, the president, Baron Charles Dupin, delivered a discourse on "Some Advance which the Mathematical Sciences have made in France since the Year 1830". A translation of this afterwards appeared in the *Magazine of Popular Science*, vol. 2, from which the following notes and extracts have been taken:

Commencing with references to the work of Fourier and Legendre, who had died in 1830 and 1833 respectively, Baron Dupin went on to speak of the researches of Poisson, of Poinsot, "the creator of the theory of couples which has so changed the face of statics and dynamics", of the young geometers Coriolis, Duhamel, Liouville and Sturm; of Prony, Poncelet and Morin, and also of the work of Pontecoulant and other French astronomers.

Turning to "those noble undertakings which are destined to describe mathematically the coasts, the territory and the soil of France", Dupin said: "After having undertaken and completed under the Empire, the hydrography of the coasts of Belgium, and of Holland, and next that of the shores of the ocean from Ushant to Spain, M. Beautemps-Beaupré, our colleague, is now continuing, on the same plan, the

hydrography of the shores of the Channel, and which will be followed by that of the Mediterranean. . . . A word will be sufficient to enable us to appreciate the magnitude of the undertaking. Two hundred thousand pounds, thirty years labour of the hydrographical corps, one half the life of its chief, and four hundred and fifty quarto volumes of observations and calculations, have been necessary to accomplish the hydrographical surveys of the coasts of France, to complete them in their two-fold relation to commerce and the naval interests, and to adapt them to the preparation of the grand atlas of the 'Pilote Français' ".

"The application of the mathematical sciences to those which are designated the natural ones—to the wants of the productive arts—to public works, of which we have presented such fine examples from works over which the Academy presides, forms the most remarkable characteristic in the actual progress of human knowledge. . . . The theory of heat promulgated by Fourier still excites attention. It has been made the subject of a large work by M. Poisson. . . . Effects which the reduction of heat by chemical means cannot produce are now accomplished by mechanical agency. In 1830 the Academy rewarded the gas compressing machine of M. Thilorier. A corresponding member of the Academy, M. Melloni, has communicated to us new facts relating to radiant heat."

From the midst of those philosophers devoted to electricity, "M. Becquerel has opened a path for himself. He has attacked chemistry with weapons of his own preparation, to subdue her to the dominion of mathematical laws. . . . Gifted by nature with extreme delicacy of the organs of sense, and exquisite power of observation, we may justly entitle him the Wollaston of France".

In other branches of investigation, "M. Majendie has borrowed from mechanical laws his explanation of the sounds of the human heart. . . . M. Flourens seeks in the mechanical pressure exercised upon the brain, an explanation of the condition of those persons who undergo the operation of trepanning . . . and M. Dutrochet who has communicated to us so many facts, the fruit of his ingenious observations on the internal dynamics of vegetables, has pushed his investigations into the mechanism of the respiration of insects, both aquatic and aerial".

In concluding his discourse, Baron Dupin said: "I am far from having enumerated all the recent modes in which mathematics have been applied to natural science. I have not even hinted at its application to that of politics, and of social economy, nor to the subject of population. Having individually taken a part in these discussions I shall pass them unnoticed".

"But in this sketch rapid, incomplete, imperfect, I ask with confidence, Do you not recognise the ever-increasing utility of science, the extent of her benefits, the sublimity of her titles, even during the short, embarrassed and turbulent period to which I have confined myself? The sciences must have therefore of necessity, a vital energy peculiar to themselves; a progressive power, superior to the obstacles of time, of things, and of man. Human passions, vulgar ambitions, and party-interests, pass away, but the labours of science, the sacrifices made for her sake, the victories borne off in her name, remain, and contribute to the enlargement of that splendid and profitable heritage on which, at the present day, is based her real grandeur."

## Societies and Academies

### PARIS

Academy of Sciences, November 25 (*C.R.*, 201, 997–1072). LUCIEN DANIEL: An accidental crossing of the bean. A detailed account of a hybrid bean, the descendants of which do not appear to be in agreement with the Mendel scheme. DIMITRI RIABOUCHINSKY was elected *Correspondant* for the Section of Mechanics in the place of the late M. de Sparre. NICOLAS KRYLOFF and NICOLAS BOGOLIOUBOFF: Some theorems of the general theory of measure. PAUL VINCENSINI: The curvature of congruences of spheres. ENRICE BOMPIANI: A system of curves of a surface invariant by projectivities. D. VAN DANTZIG: The idea of the derivative of a functional. DAVID WOLKOWITSCH: The theoretical problem of balancing rotating parts. ALFRED ROSENBLATT: Certain classes of movements symmetrical with respect to an axis of an incompressible viscous liquid. ANDRÉ AURIC: A cosmogonic hypothesis. CHARLES VALLOT: A new map of the Mont Blanc massif by Henri, Joseph and Charles Vallot on the scale of 1 : 20,000. PIERRE MARTI: A gravimetric cruise of the submarine *Fresnel* in the north-west part of the Mediterranean basin in 1933–34. Work done with the Vening-Meinesz apparatus for the determination of $g$ at sea on the coasts of France, Spain, Corsica and the Balearic Islands. An outline of the results, with a chart, is given: a full account of the results will be published elsewhere. REZA RADMANECHE: The action of the ultra-violet rays on the electrical conductivity of quartz. The experimental results are summarised in a diagram. MAURICE LAMBREY: A system of transformation with logarithmic argument for continuous current. JEAN LAGRULA: An error in photographic photometry. Discussion of the effect of the inequality of the surfaces of the photographic plates and means of avoiding the errors thus produced. LOUIS D'OR: The absorption spectra of sulphur vapour. The author concludes from his experiments that sulphur vapour contains at least four species of molecules, excluding $S_1$. The spectrum described by Graham, Dobbie and Fox, and by Rosen is not due to $S_8$ (Graham) or $S_2$ (Rosen) but to an intermediate molecule, probably $S_4$. JEAN TERRIEN: The rotation structure of the $D$ and $E$ systems of bands of cuprous chloride. MICHEL KANTZER: The influence of pressure and of foreign gases on the optical absorption of chromyl chloride. A. VILA and F. TESSON: The measurement of the mechanical properties of plastic films. JACQUES BANCELIN and YVES CRIMAIL: Substances inhibiting the corrosion of iron by acids. A comparison of the effects produced by the addition of rhodamine and of thiourea to the acid solution showed that whilst the anti-corrosion effect of rhodamine increased with the concentration, there was a certain concentration of thiourea for which the corrosion of the iron was a minimum. O. BINDER: The decomposition of pentahydrated copper sulphate by heat. Crystallised copper sulphate heated to 650° C. gives a basic sulphate $2CuO.SO_3$, proved by chemical analysis and by a study of the X-ray spectrum to be a definite compound. EMILE CARRIÈRE and MLLE. LUCY FAYSSE: The comparative action on sodium thiosulphate of oxygen compounds of chlorine and of the corresponding oxygen compounds of iodine. JOSEPH MAGROU: Attempts at the culture of mycorrhizal fungi. ANTOINE DE CUGNAC: Remarks

on the meaning of certain polymorph species in the Gramineæ. PH. JOYET-LAVERGNE : The relations between vitamin A and the plastids. The author concludes that vitamin A is an essential constituent of the chondriome, and this is verified for plastids in the course of their evolution. MLLE. GILBERTE MOUROT : Nitrogenous metabolism in protein starvation. DAVID BROUN and HERMANN SCHEINER : The physico-chemical state of acetylcholine in the blood. E. LÉVY-SOLAL and M. SUREAU : Graphical study of the work of accouchement. RAYMOND HAMET : A new true sympathicolytic : Koepfli's rauvolfine. BERNARD TROUVELOT and GRISON : Variations of fertility of *Leptinotarsa decemlineata* with the tuber producing *Solanum* consumed by the insect. Experiments with six species of *Solanum* showed that the fertility of the insect varied considerably with the species of plant. ETIENNE WOLFF : The experimental transformation of genetic females into intersexuals, produced by the injection of male hormone into fowl embryos. Intersexuality can be obtained regularly in the embryo of the fowl by androsterone injection of genetically female individuals. A. GUILLAUME and G. TANRET : The hydrolysis of the glucosides and of some organic compounds by ultra-violet rays. The ultra-violet rays possess a clear hydrolysing action, especially marked with glucosides and esters. ROBERT BONNET and MLLE. BERTHE NATAF : The destruction of certain hydrolysing diastases in the course of their action. Seven diastases were studied, and all showed decreased activity with time. It is concluded that there is a real autodestruction of the enzyme. ANDRÉ PAILLOT : A new ultra-virus parasite of *Agrostis segetum* causing a proliferation of the infected tissues. AUGUSTE TRILLAT : Attempts at vaccination for fowl cholera. MAURICE LEMOIGNE, PIERRE MONGUILLON and ROBERT DESVEAUX : The characterisation of hydroxylamine in autolysed green leaves.

### CAPE TOWN

Royal Society of South Africa, October 16. W. J. COPENHAGEN : Variation in the phytoplankton of Table Bay, October 1934–October 1935, with a note on the chemical analysis of *Chaetoceras*. The quantitative catch was estimated in terms of 'colour units' (plant pigments) : Harvey's method. It would appear that *Chaetoceras* was dominant on over more than seventy per cent of the occasions when catches were obtained. A suggestion is tentatively made that the available energy of a cubic metre of sea-water be expressed in terms of calories. D. B. HODGES and B. F. J. SCHONLAND : Relation between thunderstorms and atmospherics in South Africa. A short description was given of the cathode ray direction finder, as installed at the University of Cape Town. The results obtained with the instrument during part of September and October 1935 have been compared with meteorological maps for the same period. The results show close agreement between the bearings of thunderstorms within a distance of about 1,000 miles as recorded on the maps, and directions of arrival of signals at the apparatus at corresponding times. Variations in the amplitude of atmospherics with distance, and with time of day or night, have been studied. A satisfactory correlation of atmospherics from sources over the sea with depressions in the same areas has been made, particularly in the case of depressions off the south-west coast. The experiments indicate the value of this device both for meteorological forecasting and for information on disturbed weather areas for aircraft. B. F. J. SCHONLAND, D. J. MALAN and H. COLLENS : Recent progress in the study of the lightning discharge. The leader – return stroke sequence is present in practically every case. The effective velocity of the stepped leader is that to be expected from electron-avalanche drift in the critical field for breakdown ($2 \times 10^7$ cm./sec.). It is suggested that an actual pilot streamer, carrying too small a current to be photographed, provides the necessary ionisation for the luminous heavy-current step which follows it with a velocity of about $5 \times 10^9$ cm./sec. The latter catches up the pilot streamer, and the absence of further ionisation ahead of the step then causes a pause in which the high conductivity leader streamer is reorganised and during which the pilot forges ahead. D. J. MALAN : Intensity variations in the main return lightning stroke. The variation in intensity in return lightning strokes was determined by examining photographs obtained with a Boys camera by means of a recording microphotometer. The main stroke intensity fluctuates in such a manner as to cause the return channel luminosity to be divisible into a series of component discharges, all apparently passing upwards from the ground. A maximum of six such component discharges comprising a complete return stroke has been observed (see NATURE, Nov. 23, p. 831). J. L. B. SMITH : Several new Gobioid and fresh-water fishes from South Africa. Five new species are described and figured. A. V. DUTHIE and S. GARSIDE : Studies in South African Ricciaceæ. (1) Three annual species. This paper is the first of a proposed series dealing with South African Ricciaceæ. It includes a discussion of the taxonomic history of the family, and a detailed account of three annual species which are common in the Cape and Stellenbosch Divisions, but have hitherto been confused. One of the above, *R. crystallina*, is cosmopolitan, another, *R. Curtisii*, is fairly abundant in parts of America, but has not previously been known to occur in South Africa, while the third, *R. cupulifera*, is here described as new.

### GENEVA

Society of Physics and Natural History, November 7. E. BRINER, B. SUSZ and E. ROD : The maximum concentration of ozone and of nitric oxide at high temperatures of endothermic bodies. Calculations based on the most exact data have given for the maximum concentrations : ozone $2{\cdot}2 \times 10^{-5}$ per cent at 3,500° C., nitric oxide 5·9 per cent at 3,500° C. These are lower values than those previously obtained. J. and L. DESHUSSES : The presence of *Ceratitis capitata* (fruit fly) at Geneva. J. and L. DESHUSSES : The noxious insects of Switzerland : statistics. Considering only as noxious well-known insects which have caused important economic losses, it is shown that 35 per cent of these parasites are Coleoptera, 25·9 per cent Lepidoptera, 14·1 per cent Hymenoptera, 12·1 per cent Hemiptera, 11·8 per cent Diptera and 1·1 per cent Orthoptera. The proportion of the insects enumerated in the various types of cultivation depends on the state of our knowledge, and may not be exact. P. ROSSIER : The analytical representation of the chromatic sensibility of ordinary photographic plates. The author compares a certain function with the sensibilities observed. The sensibility curves obtained for a given plate by different methods differ between themselves

more than the differences between the results of calculation and observation. VUAREMBON: The influence of ethyl alcohol on maltase.

November 21. A. AMSTUTZ: Preliminary note on the structure of the Pennides to the south of Aosta. E. PAREJAS: The organism of B. de Joukowsky and Favre. DON ZIMMET: A nickel-nitroprusside reaction for reduced glutathione. B. SUSZ and PERROTTET: The Raman spectra for the eugenol and estragol groups.

LENINGRAD

Academy of Sciences (*C.R.*, 3, No. 5; 1935). I. VINOGRADOV: New calculations of the Weyl sums. S. A. TCHOUNIKHIN: Some problems of the group theory. B. V. NUMEROV: The photographic meridian circle. L. S. LEIBENSON: The flexual centre of closed thin-walled sections. A. V. MITKEVITCH: The separation of magnetic viscosity and eddy current lag. N. A. and V. A. PREDBRAZHENSKIJ: Alkaloids of the leaves of jaborandi (*Pilocarpus*). (7) The splitting up of the unstable ethyl-paraconic acid (racemic pilopic acid) into optical isomers. A. E. FERSMAN: The geochemical characteristics of protocrystallisation. V. T. MALYSHEK and A. A. MALIANG: Sulphur bacteria in the 'pink' waters of the Surukhani oil-fields and their significance in the geochemistry of water. B. A. RUBIN and V. E. TRUPP: (1) Variations in keeping qualities of different varieties of vegetables, and the reasons for them. (2) Characteristics of the amylase of cabbage. N. ANNENKOVA: On *Dyspohetus pygmæus*, Levinsen, and *Euzonus arcticus*, Griebe (Polychæta). S. S. SMIRNOV: The occurrence of *Acartia tonsa* (Copepoda) in the Bay of Finland.

ROME

Royal National Academy of the Lincei, June 16. TH. MOTZKIN: Some characteristic properties of limited, non-convex ensembles. V. BERNSTEIN: Observations on a theorem of Fabry. F. CONFORTO: The calculation of a particular functional for the functions which render it stationary. G. POMPILI: Algebraic surfaces with plane hyper-elliptic sections of the species $p \geq 2$. L. TOSCANO: Permutable operators with the power of a special linear operator. MARIA PASTORI: Tensors linked to a system of geodetics. G. BOZZA: Decantation of crystalline suspensions (3). Continuous cylindrical decantors. L. MAZZA: Magnetic susceptibility of mixed oxides of the rare earths: mixtures of neodymium with praseodymium or samarium (1). With mixtures of $Nd_2O_3$ and $Sm_2O_3$, the magnetic susceptibility varies linearly with the composition. With $Pr_6O_{11}-Nd_2O_3$, however, the susceptibility is greater than that calculated additively for 0–25 per cent of $Pr_6O_{11}$ and less for higher proportions. G. DEVOTO: The structure of antipyrin in aqueous solution. The results of measurements of the dielectric constants of antipyrin and pyramidon in aqueous solutions are not in accord with amphoteric polar formulæ for these compounds, and do not confirm the classical formulæ with double linkings. V. FAMIANI: The action of bromine on the growth and metamorphosis of the larvæ of *Bufo vulgaris*. Suitable small proportions of bromine cause the metamorphosis to begin earlier; but also render it distinctly out of adjustment. Indeed, if no corrective is applied, the life of the animal may be endangered.

## Forthcoming Events

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

Sunday, December 29

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—M. A. Phillips: "Fossil Reptiles".*

Monday, December 30

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—M. Burton: "Microscopic Animals and Man".*

Tuesday, December 31

BRITISH PSYCHOLOGICAL SOCIETY (EDUCATION SECTION), at 2.30.—(at University College, Gower Street, W.C.).—Sir Philip Hartog: "Some Aspects of the Validity and Reliability of Examinations".

Wednesday, January 1

ROYAL SOCIETY OF ARTS, at 3.—Prof. David Katz: "Animal Intelligence" (Dr. Mann Juvenile Lectures. Succeeding lecture on January 8).

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GEOGRAPHICAL ASSOCIATION, January 1–3. Annual Conference to be held at the London School of Economics, Houghton Street, Aldwych, London, W.C.2.

J. Fairgrieve: "Can We Teach Geography Better?" (Presidential Address).

SCIENCE MASTERS' ASSOCIATION, January 1–4. Thirty-sixth annual meeting to be held in the Chemistry Department, Imperial College of Science and Technology, South Kensington, London, S.W.7.

Sir William Bragg: "School Science after School" (Presidential Address).

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## Official Publications Received

### Great Britain and Ireland

Fire Offices' Committee. Testing Station, Boreham Wood, Elstree, Herts. Pp. 32. (London: Fire Offices' Committee.) [312

The Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), No. 27: On a Recent Bog-Flow in the County Clare. By G. F. Mitchell. Pp. 247–251. 6*d*. Vol. 21 (N.S.), No. 28: The Application of the Catalase Test to Butter. By George Cruess-Callaghan. Pp. 253–255. 6*d*. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) [312

Technical Publications of the International Tin Research and Development Council. Series A, No. 23: Striations in Tin Coatings on Copper. By Dr. Bruce Chalmers and Dr. W. D. Jones. Pp. 8. (London: International Tin Research and Development Council.) Free. [412

The Royal Technical College, Glasgow. Annual Report on the One Hundred and Thirty-ninth Session, adopted at the Annual Meeting of Governors held on the 15th October 1935. Pp. 84. (Glasgow: Royal Technical College.) [412

### Other Countries

Society of Biological Chemists, India. Influence of Light on some Biochemical Processes. By Dr. N. R. Dhar. Pp. iv+73. (Bangalore: Indian Institute of Science.) 1 rupee. [912

Beiträge zur Erforschung der baulichen Struktur der Backenzähne des Hausrindes (*Bos taurus* L.): Die Prämolar- und Molarentwicklung auf Grund röntgenologischer, histogenetischer und morphologischer Untersuchungen: Die gegenseitigen Beziehungen der einzelnen Gebiss-konstituenten und ihre Heranzichung zur physiologischen Leistung. Von Max Küpfer. (Denkschriften der Schweizerischen Naturforschenden Gesellschaft, Band 70, Abh. 1.) Pp. ix+218+78 plates. (Zürich: Gebrüder Fretz A.-G.) [912

The Academy of Natural Sciences of Philadelphia. Monographs, No. 1: The Scrophulariaceæ of Eastern Temperate North America. By Francis W. Pennell. Pp. xiv+650. (Philadelphia: Academy of Natural Sciences.) [1212

The Rockefeller Foundation: International Health Division. Annual Report, 1934. Pp. iv+235. (New York: The Rockefeller Foundation.) [1212

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 161: Sugar Cane Breeding in Egypt; a Progress Report. By Arthur H. Rosenfeld. Pp. 21+3 plates. (Cairo: Government Press.) 3 P.T. [1212

The Nucleus of the Atom and its Structure. (Sigma XI Symposium, Ohio State University.) Pp. 104. (Columbus, Ohio: Ohio State University). 1 dollar. [1212

Thalès: recueil annuel des travaux de l'Institut d'Histoire des Sciences et des Techniques de l'Université de Paris. Année 1, 1934. Pp. xix+184. (Paris: Félix Alcan.) 30 francs. [1212

# Recent Scientific and Technical Books

*Volumes marked with an asterisk (*) have been received at "NATURE" Office*

## Mathematics: Mechanics: Physics

**Abbagnano, N.** La fisica nuova: fondamenti di una teoria della scienza. Cr. 8vo. Pp. xii +128. (Napoli: Alfredo Guida, 1935.) 7 lire.

**Altshiller-Court, Nathan.** Modern Pure Solid Geometry. Demy 8vo. Pp. xi +311. (New York: The Macmillan Co., 1935.) 3.90 dollars.*

**Dänzer, H.** Grundlagen der Quantenmechanik. (Wissenschaftliche Forschungsberichte: Naturwissenschaftliche Reihe, herausgegeben von Raphael Ed. Liesegang, Band 35.) Med. 8vo. Pp. xi +163. (Dresden und Leipzig: Theodor Steinkopff, 1935.) 12 gold marks.*

**Datta, Bibhutibhusan,** and **Singh, Avadhesh Narayan.** History of Hindu Mathematics: a Source Book. Part 1: Numeral Notation and Arithmetic. Demy 8vo. Pp. xx +261. (Lahore: Motilal Banarsi Das, 1935.) 6 rupees. 10*s.* 6*d.**

**Dyson, F.** Principles of Mechanism. Second edition. Demy 8vo. Pp. vii +323. (London: Oxford University Press, 1935.) 12*s.* net.*

**Froin, Georges.** Pression solaire et atomes: la circulation de l'énergie. Roy. 8vo. Pp. iii +252. (Paris: Louis Arnette, 1935.) 25 francs.*

**Jouquet, Marc.** Le champ électromagnétique. (Collection Armand Colin: Section de physique, No. 189.) Gl. 8vo. Pp. iii +220. (Paris: Armand Colin, 1935.) 10.50 francs.*

**Krull, Wolfgang.** Idealtheorie. (Ergebnisse der Mathematik und ihrer Grenzgebiete, Band 4, Teil 3.) Roy. 8vo. Pp. 152. (Berlin: Julius Springer, 1935.) 17.50 gold marks.

**Meissner, W.** Elektronenleitung, galvanomagnetische, thermoelektrische und verwandte Effekte. (Handbuch der Experimentalphysik, herausgegeben von W. Wien und F. Harms, Band 11, Teil 2.) Unter Mitwirkung von M. Kohler und H. Reddemann. Sup. Roy. 8vo. Pp. xii +547. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1935.) 44 gold marks.*

**Radley, J. A.,** and **Grant, Julius.** Fluorescence Analysis in Ultra-Violet Light. (Monographs on Applied Chemistry, Vol. 7.) Second edition. Demy 8vo. Pp. xi +326 +29 plates. (London: Chapman and Hall, Ltd., 1935.) 21*s.* net.*

**Ramsauer, Rembert.** Die Atomistik des Daniel Sennert: Ansatz zu einer deutschartig-schauenden Naturforschung und Theorie der Materie im 17 Jahrhundert. Sup. Roy. 8vo. Pp. viii +123. (Braunschweig: Friedr. Vieweg und Sohn, 1935.) 6 gold marks.*

**Rast, Karl.** Modern Views of Atomic Structure. Translated from the German by W. O. Kermack. Demy 8vo. Pp. x +156. (London: Frederick Muller, Ltd., 1935.) 7*s.* 6*d.* net.*

**Renwick, E. M.** The Case against Arithmetic. Ex. Cr. 8vo. Pp. viii +167. (London: Simpkin Marshall, Ltd., 1935.) 5*s.* net.*

**Schmidt, Harry.** Einführung in die Vektor- und Tensorrechnung: unter besonderer Berücksichtigung ihrer physikalischen Bedeutung. Ex. Cr. 8vo. Pp. vi +125. (Leipzig: Max Jänecke, 1935.) 5.80 gold marks.*

**Sutherland, G. B. B. M.** Infra-Red and Raman Spectra. (Methuen's Monographs on Physical Subjects.) Fcap. 8vo. Pp. xi +112. (London: Methuen and Co., Ltd., 1935.) 3*s.* net.*

**Tombrock, W.** Force and Matter, Anno 1935. Demy 8vo. Pp. xii +27. (Oxford: Shakespeare Head Press, 1935.) 2*s.**

**Trendelenburg, Ferdinand.** Klänge und Geräusche: Methoden und Ergebnisse der Klangforschung, Schallwahrnehmung, Grundlegende Fragen der Klangübertragung. Roy. 8vo. Pp. viii +235. (Berlin: Julius Springer, 1935.) 25.80 gold marks.*

**Weber, Erna.** Einführung in die Variations- und Erblichkeits-Statistik. Med. 8vo. Pp. iii +255. (München: J. F. Lehmann, 1935.) 11 gold marks (abroad, 8.25 gold marks).*

**Wilson, Duncan K.** The History of Mathematical Teaching in Scotland: to the end of the Eighteenth Century. Med. 8vo. Pp. viii +99. (London: University of London Press, Ltd., 1935.) 5*s.* net.

## Engineering

**Burnham, T. H.** Engineering Economics. (Pitman's Engineering Degree Series.) Book 2: Works Organization and Management. Third edition. Demy 8vo. Pp. x +312. (London: Sir Isaac Pitman and Sons, Ltd., 1935.) 8*s.* 6*d.* net.*

**Cowdrey, Irving H.,** and **Adams, Ralph G.** Materials Testing: Theory and Practice. Second edition. Med. 8vo. Pp. vii +144. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 8*s.* 6*d.* net.*

**Degler, Howard E.** Diesel and other Internal-Combustion Engines: a Practical Text on the Development, Principles of Operation, Construction, Details and Performance of Stationary and Portable Diesel, Gas and Gasoline Engines. Ex. Cr. 8vo. Pp. vii +237 +5. (Chicago: American Technical Society; London: Crosby Lockwood and Son, Ltd., 1935.) 10*s.* 6*d.* net.*

**Gorky, Maxim; Auerbach, L.,** and **Firin, S. G.,** Edited by. The White Sea Canal: being an Account of the Construction of the New Canal between the White Sea and the Baltic Sea. English edition prepared from the Russian version and edited, with a special Introduction, by Amabel Williams-Ellis. Demy 8vo. Pp. xvii +356 +28 plates. (London: John Lane, The Bodley Head, Ltd., 1935.) 15*s.* net.*

**Gulliksen, F. H.,** and **Vedder, E. H.** Industrial Electronics. Med. 8vo. Pp. xiv +245. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 17*s.* 6*d.* net.*

**Knight, Bernard H.** Road Aggregates: their Uses and Testing. (The Roadmakers' Library, Vol. 3.) Med. 8vo. Pp. x +264. (London: Edward Arnold and Co., 1935.) 21*s.* net.*

**Maurer, Edward R.,** and **Withey, Morton O.** Strength of Materials. Second edition. Med. 8vo. Pp. xi +382. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 17*s.* 6*d.* net.*

## Chemistry: Chemical Industry

**Clayton, William.** The Theory of Emulsions: and their Technical Treatment. Third edition. Roy. 8vo. Pp. ix +458. (London: J. and A. Churchill, Ltd., 1935.) 25*s.**

**Deming, Horace G.,** and **Arenson, Saul B.** Exercises in General Chemistry and Qualitative Analysis. Fourth edition, rewritten and revised. Demy 8vo. Pp. xv +326. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 9*s.* net.*

**Edlbacher, S.** Kurzgefasstes Lehrbuch der physiologischen Chemie. Dritte umgearbeitete Auflage. Roy. 8vo. Pp. vi +286. (Berlin und Leipzig: Walter de Gruyter und Co., 1936.) 8.50 gold marks.*

**Freundlich, H.** The Chemistry of Rubber. (Methuen's Monographs on Chemical Subjects.) Fcap. 8vo. Pp. xi +72 +3 plates. (London: Methuen and Co., Ltd., 1935.) 2*s.* 6*d.* net.*

**Gaddum, J. H.** Gefässerweiternde Stoffe der Gewebe. Eingeleitet von H. H. Dale. (Monographien zur Pharmakoolgie und experimentellen Therapie, herausgegeben von Philipp Ellinger.) Sup. Roy. 8vo. Pp. xii +200, (Leipzig: Georg Thieme, 1936.) 18 gold marks.*

**Martindale and Westcott.** The Extra Pharmacopoeia of Martindale and Westcott. (Published by direction of the Council of the Pharmaceutical Society of Great Britain.) Twentieth edition. Fcap. 8vo. Vol. 2. Pp. xxxvi +889. (London: The Pharmaceutical Press; H. K. Lewis and Co., Ltd., 1935.) 22*s*. 6*d*. net.*

**Oppenheimer, Carl.** Die Fermente und ihre Wirkungen. Supplement. Lieferung 2 (Band 1, Specialler Teil, Hauptteil 8.) Demy 4to. Pp. 161-320. (Den Haag: W. Junk, 1935.) 28*s*.*

**Penney, W. G.** The Quantum Theory of Valency. (Methuen's Monographs on Chemical Subjects.) Fcap. 8vo. Pp. vii +95. (London: Methuen and Co., Ltd., 1935.) 2*s*. 6*d*. net.*

**Prideaux, E. B. R.,** and **Laxton, F. C.** A Laboratory Course in Elementary Chemistry. Cr. 8vo. Pp. xiv +258. (London: William Heinemann, Ltd., 1935.) 3*s*.*

**Sartori, Mario.** Die Chemie der Kampfstoffe. Aus dem Italienischen übersetzt von Hans Klumb. Roy. 8vo. Pp. viii +259. (Braunschweig: Friedr. Vieweg und Sohn, 1935.) 18 gold marks.*

**Schülein, Julius.** Die Bierhefe als Heil-, Nähr- und Futtermittel. (Technische Fortschrittsberichte: Fortschritte der chem. Technologie in Einzeldarstellungen, herausgegeben von B. Rassow, Band 35.) Med. 8vo. Pp. viii +194. (Dresden und Leipzig: Theodor Steinkopff, 1935.) 9 gold marks.*

**Treadwell, F. P.,** Based on the Text of. Analytical Chemistry. Translated, enlarged and revised by William T. Hall. Vol. 2: Quantitative Analysis. Eighth edition, rewritten and reset. Med. 8vo. Pp. xiii +858. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 30*s*. net.*

## Technology

**Collings, George.** Roof Carpentry: the Framing of Wood Roofs, for Working Carpenters. Cr. 8vo. Pp. 160. (London: The Technical Press, Ltd., 1935.) 2*s*. 6*d*. net.

**Department of Scientific and Industrial Research: Fuel Research.** Technical Paper No. 43: Further Experiments upon the Water-Gas Process. By J. G. King, B. H. Williams and R. V. Thomas. Roy. 8vo. Pp. vi +58. (London: H.M. Stationery Office, 1935.) 1*s*. net.*

**Dwyer, P.** Gates and Risers for Castings: Function and Application of Gates and Risers in the production of Castings of Grey Iron, Brass, Bronze, Aluminium, Steel and Malleable Iron. 8vo. Pp. 364. (Cleveland, Ohio: Penton Publishing Co., 1935.) 13*s*.

**Fraprie, Frank R.,** Edited by. The American Annual of Photography, 1936. Vol. 50. Cr. 4to. Pp. 328 +Adv. 44. (Boston, Mass.: American Photographic Publishing Co.; London: Chapman and Hall, Ltd., 1935.) Paper, 8*s*. 6*d*. net; cloth, 12*s*. 6*d*. net.*

**Mason, John.** A Practical Course in Bookcrafts and Bookbinding. Demy 8vo. Pp. 228. (Leicester: G. H. Gee; London: B. T. Batsford, Ltd., 1935.) 8*s*. 6*d*. net.

**Medworth, Frank.** Animal Drawing. Pott 4to. Pp. 231. (London: Faber and Faber, Ltd., 1935.) 12*s*. 6*d*. net.*

**Seeger, G.** Wirkung von Druckvorspannungen auf di. Dauerfestigkeit metallischer Werkstoffe. 8vo. Pp. 56 + 13 plates. (Berlin: V. D. I. Verlag, G.m.b.H., 1935.) 5 gold marks.

**Shirley, Alfred J.** Elementary Craftwork in Metal: an Introduction for the use of Teachers, Students and Workers. Second edition. Demy 8vo. Pp. viii +126. (London: B. T. Batsford, Ltd., 1935.) 5*s*. net.

**Warren, W. G.** Handbook of Perspective. Sup. Roy. 8vo. Pp. xiii +60. (London: Crosby Lockwood and Son, Ltd., 1935.) 7*s*. 6*d*. net.

## Astronomy

**Bernhard, Hubert J.; Bennett, Dorothy A.; Rice, Hugh S.,** Editors. Handbook of the Heavens. (Sponsored by the American Museum of Natural History.) Med. 8vo. Pp. xvi +131. (New York and London: McGraw-Hill Book Co., Inc., 1935.) 5*s*. net.*

**Russell, Henry Norris.** The Solar System and its Origin. Imp. 16mo. Pp. vii +144. (New York: The Macmillan Co., 1935.) 8*s*. 6*d*. net.*

## Meteorology: Geophysics

**Brooks, Charles Franklin,** with the collaboration of **Brooks, Eleanor Stabler,** and **Nelson, John.** Why the Weather? Revised and enlarged. Ex. Cr. 8vo. Pp. xvii +295 +32 plates. (London: Chapman and Hall, Ltd., 1935.) 10*s*. 6*d*. net.*

**Herchenroder, Marc.** La pluie à l'île Maurice: étude de soixante années d'observations. Demy 8vo. Pp. vii +55 +51 plates. (Port Louis: General Printing and Stationery Co., Ltd., 1935.) 5 rupees.*

**Snellius-Expedition.** The Snellius-Expedition in the Eastern Part of the Netherlands East Indies, 1929-1930, under Leadership of P. M. van Riel. Vol. 2: Oceanographic Results. Part 2: Soundings and Bathymetric Charts. Chapter 1: Depth Determinations. By Comdr. F. Pinke. Med. 4to. Pp. iii +68. Chapter 2: The Bottom Configuration in relation to the Flow of the Bottom Water. By P. M. van Riel. Med. 4to. Pp. iii +63 +6 plates +16 charts. (Utrecht: Kemink en Zoon N.V., 1935.)*

## Geology: Mineralogy

**Bubnoff, Serge von.** Geologie von Europa. (Geologie der Erde, herausgegeben von Erich Krenkel.) Band 2: Das ausseralpine Westeuropa. Teil 2: Die Entwicklung des Oberbaues. Sup. Roy. 8vo. Pp. ix +693-1134 +9 plates. (Berlin: Gebrüder Borntraeger, 1935.) 32 gold marks.*

**Dacqué, Edgar.** Organische Morphologie und Paläontologie. Sup. Roy. 8vo. Pp. viii +476. (Berlin: Gebrüder Borntraeger, 1935.) 30 gold marks.*

**Geological Survey and Museum.** British Regional Geology: North Wales. By Bernard Smith and T. Neville George. Roy. 8vo. Pp. vi +92 +12 plates. (London: H.M. Stationery Office, 1935.) 1*s*. 6*d*. net.*

**Hoffmann, A.,** Bearbeitet von. Die Braunkohlenvorräte des Deutschen Reichs. (Archiv für Lagerstättenforschung, Heft 61.) Roy. 8vo. Pp. 49 +12 plates. (Berlin: Preussischen Geologischen Landesanstalt, 1935.) 5 gold marks.

**Schmidt, Walter,** und **Baier, E.** Lehrbuch der Mineralogie. Med. 8vo. Pp. vi +320. (Berlin: Gebrüder Borntraeger, 1935.) 14 gold marks.*

**Schuchert, Charles.** Historical Geology of the Antillean-Caribbean Region: or the Lands bordering the Gulf of Mexico and the Caribbean Sea. Med. 8vo. Pp. xxvi + 811 +34 plates. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 50*s*. net.*

**Snellius-Expedition.** The Snellius-Expedition in the Eastern Part of the Netherlands East-Indies, 1929-1930, under Leadership of P. M. van Riel. Vol. 5: Geological Results. Part 1: Geological Interpretations of the Bathymetrical Results. By Ph. H. Kuenen. Med. 4to. Pp. iii +124 +9 plates. (Utrecht: Kemink en Zoon N.V., 1935.)*

## Geography: Travel

**Cunningham, Floyd F.** Laboratory Manual in the Geography of North America: for College Students. Second edition revised. To accompany the second edition of the "Geography of North America", by Miller and Parkins. Roy. 4to. Pp. ix +49. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 6*s*. net.*

**Hedin, Sven.** A Conquest of Tibet. Translated from the Swedish by Julius Lincoln. Roy. 8vo. Pp. 400. (London: Macmillan and Co., Ltd., 1935.) 15*s*. net.*

**Huxley, Julian,** Edited from the Unpublished MS., by. T. H. Huxley's Diary of the Voyage of H.M.S. *Rattlesnake*. Roy. 8vo. Pp. viii +372 +13 plates. (London: Chatto and Windus, 1935.) 15*s*. net.*

**Mikhaylov, N.** Soviet Geography: the New Industrial and Economic Distributions of the U.S.S.R. Demy 8vo. Pp. xviii +232. (London: Methuen and Co., Ltd., 1935.) 10*s*. 6*d*. net.*

**Rose, J. Holland.** Man and the Sea: Stages in Maritime and Human Progress. Demy 8vo. Pp. xi +288 +25 plates. (Cambridge: W. Heffer and Sons, Ltd., 1935.) 10*s*. 6*d*. net.*

**Schott, Gerhard,** Im Auftrage der Deutschen Seewarte verfasst von. Geographie des indischen und stillen Ozeans. Mit einem Beitrag von Ernst Hentschel und Wolfgang Schott. Demy 4to. Pp. xx +413 +38 plates. (Hamburg : C. Boysen, 1935.) 36 gold marks.*

**Shearmur, E. R.** The World and its Peoples : showing the Influence of Nature upon Man in different parts of the World. Fourth edition. Cr. 8vo. Pp. 160. (Edinburgh : W. and A. K. Johnston, Ltd., 1935.) 1*s.* 9*d.*

**Stembridge, Jasper H.,** and **Williams, S. Ewart.** World-Wide Geography Practical Note Books for Senior Schools. Gl. 4to. Book 1 : North and South America. Pp. 40. Book 2 : Africa, Asia and Australia. Pp. 48. Book 3 : Europe. Pp. 36. Book 4 : The British Isles. Pp. 28. (London : Oxford University Press, 1935.) 9*d.* each.

## General Biology : Natural History Botany : Zoology

**Bews, J. W.** Human Ecology. Demy 8vo. Pp. xii + 312. (London : Oxford University Press, 1935.) 15*s.* net.*

**Borradaile, L. A.** A Manual of Elementary Zoology. (Oxford Medical Publications.) Eighth edition. Cr. 8vo. Pp. xv +747. (London : Oxford University Press, 1935.) 16*s.* net.*

**Boulenger, E. G.** A Natural History of the Seas. Demy 8vo. Pp. 215 +8 plates. (London : Gerald Duckworth and Co., Ltd., 1935.) 7*s.* 6*d.* net.*

**British Museum (Natural History).** Economic Series, No. 14 : Clothes Moths and House Moths ; their Life-History, Habits and Control. By Major E. E. Austen, assisted by A. W. McKenny Hughes. Second edition, revised by A. W. McKenny Hughes and H. Stringer. Demy 8vo. Pp. 50. (London : British Museum (Natural History), 1935.) 6*d.**

**Chalmers, Patrick.** Birds Ashore and A-Foreshore. Roy. 4to. Pp. 180. (London : Wm. Collins, Sons and Co., Ltd., 1935.) 21*s.* net.

**Coulter, Merle C.** The Story of the Plant Kingdom. Med. 8vo. Pp. ix +270. (Chicago : University of Chicago Press ; London : Cambridge University Press, 1935.) 13*s.* 6*d.* net.*

**Crew, F. A. E.,** and **Lamy, Rowena.** The Genetics of the Budgerigar. Cr. 8vo. Pp. x +122. (Edinburgh : The Authors, Institute of Animal Genetics, University, 1935.) 5*s.**

**Dahl, Friedrich,** Begründet von. Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise. Teil 30 : Urtiere oder Protozoa. 1 ; Wimpertiere oder Ciliata (Infusoria) : eine Bearbeitung der freilebenden und ectocommensalen Infusorien der Erde, unter Ausschluss der marinen Tintinnidae. Von A. Kahl. 4 : Peritricha und Chonotricha. Roy. 8vo. Pp. 651–886 +v. (Jena : Gustav Fischer, 1935.) 21 gold marks.

**Ditmars, Raymond L.,** and **Bridges, William.** Snake Hunters' Holiday : Tropical Adventures in Search of Bats and the Bushmaster. Demy 8vo. Pp. 318. (New York and London : D. Appleton-Century Co., Inc., 1935.) 12*s.* 6*d.* net.

**Franz, Victor.** Der biologische Fortschritt : die Theorie der organismengeschichtlichen Vervollkommnung. Roy. 8vo. Pp. vii +82. (Jena : Gustav Fischer, 1935.) 3.80 gold marks.

**Grimpe, G.,** und **Wagler, E.,** Gegründet von. Die Tierwelt der Nord- und Ostsee. Herausgegeben von G. Grimpe. Lieferung 28. Teil 5.b : *Nematoda errantia,* von J. H. Schuurmans Stekhoven, Jr. ; Teil 5.c : *Nematoda parasitica,* von J. H. Schuurmans Stekhoven, Jr. Med. 8vo. Pp. 173 +50. (Leipzig : Akademische Verlagsgesellschaft m.b.H., 1935.) 20 gold marks.*

**Henry, G. M.** Coloured Plates of the Birds of Ceylon. With a short Description of each Bird by W. E. Wait. Roy. 4to. Part 4. Pp. iii +16 +16 plates. (Colombo : Colombo Museum ; London : Dulau and Co., Ltd., 1935.) 30*s.**

**Johns, Rowland,** Edited by. Our Friends the Old English and Shetland Sheepdogs. Cr. 8vo. Pp. 95. (London : Methuen and Co., Ltd., 1935.) 2*s.* 6*d.* net.

**Jones, H. E.** The Life, Growth and Disintegration of Cells : and the Decomposition of Water and Organic Material. Demy 8vo. Pp. 86. (Glasgow : John Smith and Son (Glasgow), Ltd., 1935.)*

**Kolkwitz, R.,** Herausgegeben von. Pflanzenforschung. Heft 18 : Das Genus Cosmocladium. Von J. Heimans. Roy. 8vo. Pp. ii +132 +8 plates. (Jena : Gustav Fischer, 1935.) 11 gold marks.

**Krafft, Carl F.** The Mechanistic Autonomy of Nature. Ex. Cr. 8vo. Pp. 120. (Washington, D.C. : Carl F. Krafft, 1935.) 1 dollar.*

**Leach, William.** A Textbook of Practical Botany : for Intermediate and Higher School Certificate Students. Cr. 8vo. Pp. x +160. (London : Methuen and Co., Ltd., 1935.) 4*s.**

**Mannering, Rosslyn.** Fishponds and Aquaria. Cr. 8vo. Pp. 112 +8 plates. (London, New York, Toronto and Melbourne : Cassell and Co., Ltd., 1935.) 1*s.* 6*d.* net.

**Nature in the Wild :** a Selection of the World's Finest Photographs. Cr. 4to. Pp. 96. (London : *Country Life,* Ltd., 1935.) 5*s.* net.

**Rowland, T. J. S.** The Living Things Around Us. Demy 8vo. Book 1. Pp. 144. Book 2. Pp. 144. Book 3. Pp. 144. (London, New York, Toronto and Melbourne : Cassell and Co., Ltd., 1935.) Limp cloth, 1*s.* 6*d.* each ; cloth boards, 1*s.* 9*d.* each.

**Wardle, C. Francis.** All Dogs. Demy 4to. Pp. 213. (London : Herbert Jenkins, Ltd., 1935.) 25*s.* net.

**Watkins, Arthur Ernest.** Heredity and Evolution. Ex. Cr. 8vo. Pp. viii +243 +2 plates. (London : John Murray, 1935.) 7*s.* 6*d.* net.*

**Wilson, Douglas P.** Life of the Shore and Shallow Sea. Cr. 4to. Pp. 150 +53 plates. (London : Ivor Nicholson and Watson, Ltd., 1935.) 12*s.* 6*d.* net.*

## Horticulture : Agriculture : Forestry

**Brown, Nelson Courtlandt.** A General Introduction to Forestry in the United States : with Special Reference to Recent Forest Conservation Policies. Med. 8vo. Pp. xix +293. (New York : John Wiley and Sons, Inc. ; London : Chapman and Hall, Ltd., 1935.) 16*s.* net.*

**Jerram, M. R. K.** A Text-Book on Forest Management. Demy 8vo. Pp. x +156. (London : Chapman and Hall, Ltd., 1935.) 10*s.* 6*d.* net.*

**Leighton, Clare.** Four Hedges : a Gardener's Chronicle. Ex. Cr. 4to. Pp. 167. (London : Victor Gollancz, Ltd., 1935.) 10*s.* 6*d.* net.

**Macself, A. J.,** Edited by. *Amateur Gardening* Annual, 1936 : a Review of the Year's Work in Garden and Greenhouse. Med. 4to. Pp. 122. (London : W. H. and L. Collingridge, Ltd., 1935.) 2*s.* 6*d.* net.

**Stapledon, R. G.** The Land : Now and To-morrow. Demy 8vo. Pp. xviii +336 +12 plates. (London : Faber and Faber, Ltd., 1935.) 15*s.* net.*

**Stout, Mary.** Gardening for Egypt and Allied Climates. (Published under the auspices of the Egyptian Horticultural Society.) Ex. Cr. 8vo. Pp. 286. (London : Wheldon and Wesley, Ltd., 1935.) 10*s.* net.*

**Willcox, O. W.** Nations can live at Home. Ex. Cr. 8vo. Pp. 279. (London : George Allen and Unwin, Ltd., 1935.) 10*s.* net.*

## Anatomy : Physiology

**Bradley, O. Charnock.** Topographical Anatomy of the Dog. Third edition. Roy. 8vo. Pp. xii +284. (London and Edinburgh : Oliver and Boyd, 1935.) 25*s.* net.*

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