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Air Survey and Empire Development.

THE growing call for the application of scientific knowledge in the development of the resources of the British Empire has found one response in the increased attention which is being paid to the survey of the Dominions and Colonies. In July last a conference of Empire surveyors was held in London. This was the first conference of its kind, and marked a great forward step in the mapping of the Empire. On that occasion the Secretary of State for the Dominions and Colonies emphasised the importance of maps in facilitating the development of new countries. A great deal has been done in late years, but only about 20 per cent of the Empire has been actually surveyed by modern methods on even comparatively large scales.

In a recent lecture to the Dominions section of the Royal Society of Arts, Col. H. L. Crosthwait dwelt on the value of air photography in this connexion. Ground surveys are slow and laborious. In many of the larger areas of the Empire, even if the steady flow of funds is available, years must elapse before the accurate maps made by topographical surveyors are available. Forest lands, which are numerous in many parts of the Empire, are difficult to survey and mean slow progress. Rugged and inaccessible areas present other serious problems. Most of these difficulties disappear when aerial survey is employed. A recent example was the speed with which certain forested deltaic lands in Burma were mapped by air, the whole occupying a few days instead of as many months. Air survey is being used effectively and comparatively cheaply in many parts of the Empire, and at home the Ordnance Survey has shown its value in the revision of maps. The prevalence of air survey in the future may even effect a change in the style of maps. The photographic map on which certain features are strengthened may replace the plan in town surveys. It would have its value in maps where the indication of the details of surface relief was not an essential.

The production of accurate large-scale maps is the aim of every survey department, but the work is necessarily slow even after the observations have been taken. The maps will be available in the course of time, but meanwhile the development of the Empire proceeds, and air photography can be of great assistance in reconnaissance and preliminary or local surveys for various purposes.

Col. Crosthwait spoke of various aspects of the work that have an immediate value in the development of new lands. He showed how a photographic survey of possible routes of a new railway through unmapped country might be of great service to the engineer who had to decide which route should

be surveyed in detail. The faulty alinement of a railway has more than once been a source of serious expense to a colony, and its avoidance by ground surveys of several possible routes is not only a costly matter but also always entails the possibility of the best route being overlooked if a feasible one be found. For such a purpose no detailed work is required until the engineers have chosen the most useful route, which then of course has to be surveyed in detail. Air photography has also been used with success, particularly in the United States, in coastal surveys for the exploration of obstructions to navigation in deltaic waters and on rocky coasts. Aeroplanes have been employed by the government of Canada in surveying the distribution and movements of ice in Hudson Strait in connexion with the opening of the new trade route via Hudson Bay to Churchill, which is to be a wheat port for the west of Canada.

Air survey can also be used in the investigation of water-power development, and water storage for irrigation purposes. The feasibility of a power scheme based on the storage of water which necessitates the submergence of large areas of land can be ascertained by stereoscopic photographs. They provide the preliminary reconnaissance at a low cost and in a short time. The photographs taken for the preliminary investigations can then be used for the final plans merely by the addition of ground control. The location surveys required for electric power cables and pipe lines can rapidly be made from the air.

Air photography can also supply much useful information with regard to mineral resources. It cannot be used for detached geological survey, but it can give geological indications by means of land forms which will afford useful suggestions to the surveyor and point to localities where close investigation might be profitable. Air photographs of vegetation serve as a useful guide in a survey of soils and the possibilities of cultivation of various crops, and in forest survey they serve to indicate areas of value for commercial purposes. As a result of recent work in Northern Rhodesia, during which air surveys were extensively used, Mr. R. Bourne, of the Imperial Forestry Institute at Oxford, emphasised all these among other uses to which air photographs can be put.

The aeroplane has also been found useful in combating insect pests. Successful operations in the cotton fields of the United States prompted the Canadian authorities to try the experiment of scattering insecticides from an aeroplane over spruce forests in Nova Scotia. The first year's experiments were very promising.

There is, in fact, a wide scope for the use of aeroplanes in all parts of the Empire quite apart

from the transport facilities they provide. They afford another example of the value of scientific application in the development of the resources of new lands, and can be employed for many useful purposes at comparatively small cost.

#### Evolution and Fundamentalism.

THE illegitimate use of the minor discussions of scientific workers to cast doubt upon the whole question of evolution is well known and can be guarded against only by extreme caution in our words. This is illustrated in an article in the Catholic review, *America* (Nov. 10, 1928), entitled "Neanderthal—a Slippery Ancestor." The writer pits against each other the views of Hrdlička and Elliot Smith (with quotations from *NATURE*) regarding the significance of Neanderthal man in human evolution, and because a divergence of opinion exists, he suggests that science should be looked on askance. "Draw up to the curb of common-sense and Revelation," he says, . . . "because very often 'scientists' are but a 'We-Too' gathering, all, despite their protestations of independent thinking, following some leader in beating the tomtom of Evolution." But, of course, on the fundamental question of evolution or non-evolution amongst all living things, including man, the two distinguished scientific workers named are in agreement.

While such articles show that the fire of dissent is still alight, a recent *Daily Science News Bulletin*, issued by Science Service of Washington, points to a distinct smouldering at the present time. In universities and other centres of higher education in Tennessee and elsewhere, anti-evolution legislation is "more honoured in the breach than in the observance," but in the lower schools, particularly in smaller places, no amount of theoretical freedom of teaching can prevent local school boards from rejecting candidates for positions when they do not approve of their theological views. Biologists have come to accept these two conditions as actualities of their profession.

Since the Scopes trial at Dayton, Tennessee, in 1925, no serious effort has been made to get a test case of the anti-evolution statutes in Tennessee or Mississippi, the only two States which have passed such laws up to now. Perhaps this is partly due to the indefiniteness of the law itself, for in its decision on the appeal of the Dayton case, the Tennessee Supreme Court rendered three distinct opinions, all of which left the interpretation of the law in a state of confusion. In spite of this enforced truce, it would be unwise, however, to imagine that the smoking flax of anti-evolutionism is anywhere near the quenching stage.

By an overwhelming majority Arkansas has adopted an anti-evolution law, so that it is now

illegal in every tax-supported school of the State to teach that "man has ascended or descended from any lower order of animals." Furthermore, it is believed in well-informed circles in the United States that if similar anti-evolution laws were submitted to popular referendum in every other available State, the result would in every case be the same under present conditions. There are nineteen other States open to fundamentalist attack by way of initiative and referendum, and in due course each is to be tackled.

One of the present conditions with which the journal *Evolution* finds fault is the aloofness of the body of men of science. In Arkansas, according to a leading article, they kept silent, under the idea partly that "the way to defeat the anti-evolution law is to keep the people from finding out what evolution really means," and partly that what "the masses" think or believe is of no consequence. The first notion surely cannot be held by any true man of science, but the second is familiar enough. Yet it cannot be justified, for it indicates a lack of social responsibility, and may lead to a very real curtailment of the opportunities of science through the pressure of the very masses whose education is wilfully ignored.

The plea of the fundamentalist is a practical one—the old story of he who pays the piper calls the tune. The only way to meet such opposition is not by raking up an equal number of adverse votes, but by enlightenment, and that is a slow process unless the men of science as a body are prepared to leave the laboratory bench and go out into the wilderness preaching their gospel of truth and progress.

We are of opinion, however, that *Evolution* tends to follow a line of propaganda which must have unfortunate reactions. It must be assumed that the fundamentalists are sincere in their views. Sarcastic references and polemic articles can only embitter the contest. The old ideas have a strong hold and have behind them the sanction of ages: only by gentle stages can they be shaken, and the science propagandist must temper his wind to the shorn lamb of fundamentalist ignorance.

Nevertheless, the conclusion reached by *Evolution* is sound. If ignorance is to be dispelled before the mischief is done, "every opportunity should be utilised to educate the public as to what evolution means." "Not only through the class-room, but also through the platform, radio, movie, magazines, and newspapers, ten thousand spokesmen of science should lift their voices, so that an understanding of the method of science may replace popular superstition and bigoted belief." But are there ten thousand, nay, one thousand men of science, who can carry on the propaganda as it should be carried on to win a popular victory?

### Eugenics Now and Hereafter.

- (1) *Organic Inheritance in Man*. (University of Birmingham, Faculty of Medicine: William Withering Memorial Lectureship.) By Dr. F. A. E. Crew. Pp. xxviii+214. (London and Edinburgh: Oliver and Boyd, 1928.) 12s. 6d. net.
- (2) *Being Well-Born: an Introduction to Heredity and Eugenics*. By Prof. Michael F. Guyer. Second edition. Pp. xv+490+9 plates. (London: Constable and Co., Ltd., 1928.) 21s. net.

HERE we have two more works added to the long list, which claim to enlighten man on the facts of his inheritance and to indicate—at any rate in brief outline—how these facts may be applied to racial betterment. It has become a custom, almost a necessity, we might say, for every professor of biology, be he zoologist or botanist, to publish a treatise on eugenics. The subject has become fashionable, and his pupils demand instruction; the academic lectures are given, and later the book appears. In the beginning of last century, every medical man, from Erasmus Darwin downwards, held himself to be a trained biologist; in the latter half of the century every anatomist was *ipso facto* an anthropologist, and in this new century every biologist must of necessity publish his views on eugenics.

Biology and anthropology have survived this handling, and it may be anticipated that eugenics will do so likewise and become ultimately a definite discipline with well-defined frontiers, and its own independent academic laboratories, even if they remain in close association with those in which animal genetics, anthropology, medical research, and statistics are topics of investigation. No eugenic investigator can work effectively without some fundamental knowledge on these allied sciences; but it is equally true that a worker in any isolated one of them is not of necessity an authority on eugenics as a science, although he may contribute material which will be of service to the eugenicist.

(1) Dr. Crew's book on "Organic Inheritance in Man" embodies the subject matter of a course of lectures he gave in the University of Birmingham to medical men, and especially general practitioners, as the first William Withering Memorial lecture. To those who have read Morgan's writings at first hand, or even are familiar with Baur and Lenz's "Menschliche Erblichkeitslehre," there will be small difficulty in following the bulk of Dr. Crew's work. But to those who have not, we

doubt if pp. 23-92 will form a very lucid introduction to the subject. The author's treatment seems to us to lack the lucidity requisite in a semi-popular lecture, and yet it fails to provide the explanatory detail requisite in a text-book.

This criticism can be easily illustrated. Over and over again we meet with statements that in the present reviewer's opinion are exceedingly doubtful; he knows papers in which they have been made, but he must suppose Dr. Crew to judge his material qualitatively as well as quantitatively, and possibly to have seen unexceptional material of which the reviewer is ignorant. He wishes to turn for information to the sources from which the statements are drawn. The reviewer's case must be that of many readers, and it is not in one, but innumerable examples, that this desire will arise. Not a single authority is quoted in the book, but the reader is told that the references if desired by the reader can be obtained from the author! For example, in the list of hereditary human defects on pp. 139-144, we have had to place queries requiring further information in between thirty and forty cases, where the statement seems to us doubtful. It is not feasible to give a list of these, and one illustration must suffice: "split hand," we are told (p. 144), is *recessive*, "split foot" is *dominant*. Now we happen to know a woman with both hands and feet split, who married a normal non-consanguineous husband; some of her children are normal, some have either split hand or split foot, and some have both. Those who have studied such cases know how highly correlated the two conditions are, and that one should be a Mendelian recessive and that the other should be a dominant, certainly requires some very weighty authority to be cited before a reader acquainted with the facts can accept such a statement.

As another illustration of where we want much more enlightenment, let us take the case of a single pedigree of twinning on p. 199. There is no doubt the family is a twinning family—we have seen many such pedigrees. There are six pairs of twins in this family; in only one case is there a cousin marriage; in the other five cases, in order to draw the inference that twinning is recessive, we must suppose that the members of the family married into other twinning families. This involves the occurrence of as much assortative mating in twinning families as exists among deaf-mutes! Indeed, little can be learnt from a collection of selected isolated pedigrees such as Dr. Crew provides on pp. 184-212. We need to analyse *many* pedigrees of each class of defect before we can assert that

a particular defect obeys Mendelian laws, which involve of necessity Mendelian average ratios. Looking at a single short pedigree, it is generally easy to assert that the disease is recessive or dominant, though it becomes somewhat unsatisfactory when we find one and the same disease in three different small pedigrees labelled: Dominant, all affected individuals heterozygous, recessive, and finally recessive, sex-linked. Indeed, the number of pedigrees Dr. Crew describes by the words "all affected individuals heterozygous," makes one wonder how one can be certain of the existence of dominance at all in these cases. When the Mendelian theory does not work very well, then the pedigrees are labelled as in the case of epilepsy: dominant (irregular), which certainly leaves us free, as on p. 141, to find that epilepsy may also be recessive and sex-linked.<sup>1</sup>

Albinism, we are told, is a recessive, but what actually determines that an individual is an albino we are not informed. Possibly when two albinos breed true, they are true albinos, and when they do not, then they are not. But this is not very helpful for *a priori* prediction, or as a physiological definition of albinism from which the genetic rules as to albinism follow *ipso facto*.

The general practitioner called upon to advise with regard to a particular marriage might well feel somewhat puzzled were he to seek help from Dr. Crew's work! He might, for example, read such a passage as the following:

"Cancer in the experimental animals is, in all respects, the same disease as cancer in the human. The fundamental laws of genetics apply to all forms, experimental animals and men alike. Many records of human cancer point to the conclusion that its mode of inheritance is the same as that which obtains in the case of cancer among experimental quickly reproducing forms. Other characters, normal and abnormal, are inherited in a significantly orderly fashion in the human, and so there is reason to hold that the human hereditary mechanism is the same as that which has been shown to exist in experimental forms" (p. 172).

This appears a clear-cut and logical statement, and the general practitioner will next expect to be told what is the hereditary mechanism of cancer among experimental quickly reproducing forms. Instead of that he will read on:

"The statistical data concerning cancer can be reconciled with the finding that the tendency to develop cancer is a genetic recessive character. It should be stated, however, that there are

<sup>1</sup> A similar case is that of myopia, which is recessive according to Clausen, and dominant according to Jablowski.

pedigrees in which carcinoma of the stomach behaves in inheritance as a dominant."

All references, as usual, are missing. Some statisticians have failed to find any inheritance of cancer in man; Levin found evidence of resistance to cancer being a Mendelian dominant, while other inquirers content themselves by stating that various families possess different degrees of susceptibility. Where are the precise genetic laws which cancer follows in quick-breeding mammals to be found? We refer the general practitioner to the papers of Miss Maud Slye, and, if he has a logical mind, we believe he will agree with us that, for lack of necessary information, her vast experimental researches fail to provide those precise genetic laws which are supposed to govern cancer in mice and men. Once admit that individual families or stocks can possess every grade of susceptibility to cancer from 0 per cent to 100 per cent, and the reconciliation of this result with a simple dominant or recessive Mendelism becomes very obscure. To make susceptibility to cancer a unit character appears to the present reviewer as unwise as to force that finely graded character feeble-mindedness into the same category. It is covering our ignorance by a verbalism, which may check further inquiry into the complicated conditions under which these abnormalities and pathological tendencies are actually inherited.

There is much good material in Dr. Crew's last chapter, which, if not novel, is often well put; for example:

"The supreme duty of society is to weed out its worst qualities and to nurture its best. Racial improvement is to be achieved under conditions in which the physical and intellectual improvement of the individual does not interfere with his racial and ethical obligations and in which the promotion of human betterment is undertaken by society as its greatest work. Individual improvement is a necessary concomitant of racial betterment, and the first duty of the individual is to transmit unimpaired and undefiled a noble heritage to generations yet unborn" (p. 177).

The only comment we have to make on this is that all racial and ethical obligations are relative to their age, and our conception of moral and national duties will be remoulded step by step as eugenic principles become more widespread. Incest in a family with manic-depressive insanity will remain for ever a crime; it might actually become a virtue, a national duty in the case of a family of surpassing genius, which had a sound and healthy pedigree.

The book is preceded by an interesting biography

and portrait of William Withering, M.D. (1741-1799), which carries us back to the days of Samuel Galton, Erasmus Darwin, Priestley, and the Lunar Society.

(2) The second book on our list is by the professor of zoology in Wisconsin. It is a more ambitious work than that of Dr. Crew, being intended as an elementary text-book of heredity and eugenics. It suffers, however, from some of the defects of the latter; thus, while it takes a step in advance by giving the *names* of investigators, in very many, possibly the majority of cases, there is no reference to the locus of the original researches. Yet even with its greater price, we believe Guyer's work would be the more serviceable of the two to the medical man seeking to know the bearing of eugenics on his own field of activity. On the other hand, to the reader impartial as to any theory of heredity as long as it suffices to describe the observed facts, there is as usual much in Guyer's as in Crew's work to which exception must be taken; in both cases it arises from the common Mendelian training, which too often fails to recognise the extreme limitation at best of the independent unit-factor hypothesis. Let us cite a few lines from p. 14.

"A tremendous impetus was given to the method of experimental breeding when it was realised that we can itemise many of the parts or traits of an organism into entities which are inherited independently one of another. Such traits, or as we have already termed them unit-characters, may be not only independently heritable, but independently variable as well. The experimental method seeks to isolate and trace through successive generations the separate factors which determine the individual unit-characters of the organism" (p. 14).

We could wish that Prof. Guyer would 'itemise' the skeletal parts of any organism, most of which are very highly correlated with one another. Does each bone correspond to a unit-factor, or is there a determiner for the skeleton as a whole? If the latter, then how can 'lobster claw' affecting some twenty to thirty bones of the skeleton only be a unit-factor? If the former, how can we speak of unit-factors being independent, when it is clear that in perhaps the most fundamental part of the organism they are highly dependent one on the other? And, be it remembered, the soft parts must be highly correlated with the skeletal—indeed, it is the brain which determines the brain case. In truth, Horatio, there be many things undreamt of in thy philosophy! Would it not be better at an early stage to hint to the puzzled beginner that

independent unit-characters can carry us only a very little way when we come to study the heredity of abnormalities in man. There is small illumination to be obtained by classifying such abnormalities even of the same class by different Mendelian terms according to the isolated individual pedigree!

Guyer sees, however, further than Crew; he endeavours to give some account of statistical methods, and preaches the excellent doctrine that "Intelligent combination of all methods—embryological, experimental, statistical—is necessary in modern genetics" (p. 23). But, alas! his practice is worse than his profession, for he writes:

"Since, in spite of Galton's attempt to establish a hypothetical mid-parent, there is no satisfactory method of determining in a single measurement the relation between children and both parents, it is obvious that information derived from the coefficient of correlation between child and parent is deficient in that it takes into account only one parent. The correlation with the other parent, though just as important, has to be determined separately" (p. 22).

The astonished statistician will ask: How comes Prof. Guyer to write on evolution and eugenics, which must inevitably deal in large part with mass changes, if his statistical knowledge has stopped short of multiple correlation? Can he be unaware that the formula for biparental inheritance, or indeed for inheritance from any number of ancestors, is just as valid, or just as invalid, as that for a single parent? They stand on exactly the same theoretical basis. We fear he has had no training in the tool he professes to describe, for on the very same page he seems to think that the statistical method cannot discriminate between the effects of environment and heredity; he suggests that knowledge on this point can only be gained by direct experiment on animals. This not only indicates that the author is essentially ignorant of such a powerful tool as partial correlation, but also of all the literature which has been published on the relative influence of heredity and environment in man. Indeed, the influence of environment as a quantitatively determinable factor scarcely appears in the work; it is only discussed in the chapters which deal with the problem of whether somatic characters are inherited—good readable chapters, we may remark, and written without dogmatic partisanship.

The same may be said of our author's treatment of the pure line. It is true that he does not appear to have read the fatal criticism made of Johanssen's

original research and of later investigations on *Hydra*, namely, that the pure line theory demands that the offspring shall be as highly correlated with the grand-maternal or the materteral organism as with the maternal, and that this condition was satisfied in neither case. Prof. Guyer describes Jennings's researches on *Paramecium*, which were widely supposed to have firmly established Johanssen's conclusions. He gives, however, the remarkable recantation provided by Jennings himself as a result of his later experiments on *Diffugia*, who summarised his results in the words:

"The hereditary variations which arose were of just such a nature as to produce from a single strain the hereditary strains that are found in nature."

The results from *Diffugia* were more significant than those from *Paramecia*, because of the greater abundance and definiteness of the characters of the former. Yet the pure line still continues to flourish in many text-books, it being invariably easier to propound a theory than to kill it. It must be a satisfaction, however, to those who have faith in the power of statistical methods, to know that their criticism of the pure line hypothesis on the basis of the propounders' own data has been justified, and that Jennings and his pupils have demonstrated that at least for certain species where the variations are as continuous as can be detected, it is possible to create separate true breeding strains from a 'pure line.'

Much of the earlier part of Prof. Guyer's book is given up to a repetition of the familiar facts of reproduction, development, and elementary cytology, all, however, put with considerable lucidity and good illustrations. Then follow seventy pages of simple and complex Mendelism as applied to various characters in different organisms. Here the reader will feel in smaller or greater states of doubt according as he has not or has conducted similar experiments himself. The statements and diagrams are conventional, but are clearly, if occasionally with slight dogmatism, restated. Prof. Guyer is the redoubtable Michael, rather than the doubting Thomas!

When our author comes to deal with human heredity, we regret to find that he is as distinctly uncritical as Dr. Crew. He largely accepts without questioning. The present reviewer once asked a distinguished zoologist why he had incorporated into his work results which a little inquiry would have shown him to be idle. He replied: "Because in biology we unhesitatingly accept the results of our

fellow-workers, until they are demonstrated to be false by another of us." It is this lack of a healthy spirit of doubt, of sane criticism, which seems to us the root of much evil in works of the present kind. Let us illustrate it; we cite from p. 202:

"*Eye-colour in Man.*—Of normal characters in man which follow the Mendelian formula perhaps eye-colour is the best established. Brown or black eye-colour is due to a *melanin* pigment absent from the blue or grey eye. That is, a brown eye is practically a blue eye plus an additional layer of pigment on the outer surface of the iris. The different shades of brown are due to the relative abundance of this pigment. Grey colour and the shades of blue seem to be a modification of an original dark blue, due to structural differences in the fibrous tissues of the iris."

Then follows, as in Crew's work, the usual interpretation of the brown eye being dominant and the blue eye with its lack of anterior pigment being recessive. No authorities *whatever* are cited for this 'best established' example of Mendelian inheritance; only later Winge is mentioned as a hint that this is not quite the whole story. Now what is really the history of this "best established" example? So far as we know, Alphonse de Candolle, in Geneva in 1884, was the first to make the statement about brown-eyed parent mating with brown-eyed parent in certain cases giving only brown-eyed children. His material was collected from France, Switzerland, Sweden, Germany, etc., and his correspondents were requested to leave out parents whose eyes were not distinctly brown or blue and families with doubtful eyed children! Further, as he paid no attention to earlier ancestors, and neglected the marked racial differences of his population, he not un-naturally failed to convince anybody. Next, in May 1886, Galton took the matter up, and collected by aid of schedules a vast amount of material from English middle and upper class families, reaching in a number of cases to four generations. Then Mendelism became the mode; the fact that there are blue-eyed races which breed true, and brown-eyed races which do so also, suggested that this might be an easy and popular illustration of the simplest form of Mendelian theory. Galton's material was investigated from this point of view and failed to obey Mendelian theory.

Davenport in the United States next proceeded to collect material—apparently by issuing schedules in Galton's manner—and came to the definite conclusion that eye colour *did* obey this theory. Shortly after, Hurst came upon the scene,

and stating that it is impossible to judge by mere inspection whether an eye has anterior pigment or not, used a lens to answer this question. He established to his own satisfaction the Mendelian character of eye colour; the lack of anterior pigment as judged by a lens, denotes that the eye is true blue and that the zygotes of that individual are Mendelian recessives. Now Davenport and Hurst are the authorities on whom this "best established" example is founded, and when any reference is given at all for it in the elementary text-books, which is not frequently done, they are cited indifferently, although Hurst had repudiated Davenport's method, that of macroscopic inspection, as incapable of determining the absence of anterior pigment.

Quite a number of years ago the present reviewer asked a distinguished ophthalmologist with a large hospital practice to examine most carefully both eyes of blue-eyed patients with a lens, and when no anterior pigment whatever could thus be found, then when one eye had to be excised, to preserve it for examination. In this way some dozen blue eyes were obtained, sectioned, and examined microscopically. In no *single* case was there an entire absence of anterior melanine pigment granules. What, then, is a true blue eye? Does the eye begin to be recessive when only a certain grade of pigmentation just not ascertainable by a lens—and a lens of Hurst's magnification—occurs? The difficulty is just the same as in the corresponding definition of the albinotic eye as an eye possessing no melanine pigment at all. Albinos of nearly all species (mouse so far excepted) show such pigment, if in some cases in small quantities, and yet as a rule breed true.

So long as eyes exhibit every grade of pigmentation, we are not at the bottom of the laws of eye-colour inheritance, when we try to force them into the categories of simple dominance and recedence. If this is perhaps the "best established" example of the application of Mendelian theory to man, what must we say of its application to abnormalities, not to cite such diseases as cancer and tuberculosis? Of a truth, fashion in science is often its greatest danger; men, instead of searching deeply into the original facts and seeking for their explanation, blindly apply the current notions to ill-digested data, simply because a greater mind has propounded a novel truth and, perhaps, after all only a half truth.

We cannot, however, leave Prof. Guyer at his chapter on "Human Inheritance" without a word of high praise for his final chapters on prenatal

influences, human conduct, crime and race-betterment. Therein he shows himself an enthusiastic if sober advocate of eugenics.

"Shall we as a people continue to be confronted at every turn by the dull countenance of the imbecile, the inevitable product of a bad parental mating, or the feeble body and clouded intellect of the child sprung from a parentage of polluted blood; or the furtive cunning of the young delinquent, the will-less mind of the born degenerate, or the shiftless spawn of the pauper? Or shall it be a type with laughing face, with bounding muscles, with unclouded brain, overflowing with health and happiness—in short, *the well-born child*?"

"The answer is in our own hands. The fate of many future generations is ours to determine, and we are false to our trusteeship if we evade the responsibility laid before us. How conscientiously we heed known facts, how actively we acquaint ourselves with new facts, and how effectively we execute the obvious duties demanded by these facts will give us the answer" (p. 441).

These are not mere fine words from Prof. Guyer; the careful reader of his book will find that if it does not lack faults there is at back earnest conviction. He reaches the boundary whereat eugenics passes from science to a national faith, or what Galton termed the true religion of the future. Here, at least, we feel entirely in unison with his statements.

KARL PEARSON.

### The Geology of Africa.

*Geologie der Erde: Geologie Afrikas.* Von Prof. Dr. Erich Krenkel. Teil I. Pp. x+461+22 Tafeln. (Berlin: Gebrüder Borntraeger, 1925.) 34·50 gold marks.

STUDENTS of African geology are under a great debt of gratitude to Prof. Krenkel for his masterly summary of its scattered and polyglot literature. The first of his three volumes begins with a general survey of the physiography and geology of the continent as a whole, and then deals in detail with the north-eastern and eastern areas and the African islands of the Indian Ocean. The second volume is devoted to South Africa, and the third will apparently cover west equatorial and north-western Africa. The book is the result of an exhaustive study of the literature which has been digested with such critical and cautious judgment that it helps the interpretation of the evidence as well as its systematic arrangement and tabulation.

The first chapter summarises the physical features of Africa and divides the continent into three sections—the African Highlands, which include all

the eastern and southern parts of the continent; the African Lowlands, which include the basins of the Congo and of north-western Africa, and the intervening uplands; and 'Little Africa,' which consists only of the Atlas region. The relief of the continent is related to that of the adjacent oceans, and an instructive diagram shows that the distribution of the main oceanic and continental depressions is like the spaces in a network; from this arrangement Prof. Krenkel infers their formation by subsidence between more stable intervening bands.

This explanation of the distribution of the Atlantic deeps agrees with the view of Leuchs that they are due to vertical subsidence rather than with that of Pratjé, who holds that they are dependent upon crustal folds. The South Atlantic basin, Prof. Krenkel declares, has not been a permanent feature in the earth's geography. He says it dates only from the Cretaceous, although he accepts (p. 24) the entry of a Permian sea into the South Atlantic on the evidence of some reported marine rocks in south-west Africa. The occurrence of these marine fossiliferous beds overlying the Upper Palæozoic glacial beds would be so important that it is unfortunate that the evidence is not fully convincing; but its acceptance by Prof. Krenkel shows that more weight should be attached to it.

The sections of the continent dealt with in the first volume are divided into Egypt and Nubia, Abyssinia and Somaliland, and eastern Africa, including Kenya Colony, Uganda, Tanganyika Territory, Portuguese East Africa, and Nyasaland. There are also chapters on the African islands in the Indian Ocean, and on the economic geology. The author includes in this volume, as geologically African, Syria, Palestine, and Arabia, which he groups under the composite name of Syrarabien. The inclusion of this region enriches the volume with its frontispiece and other aeroplane photographs of the Wadi Araba, the land continuation of the Gulf of Akaba. These illustrations well show the features of the East African rift valleys.

The author's judgments on the major problems of African geology are noteworthy. Thus the theory that the Atlantic was formed by the westward drift of South America away from Africa is rejected emphatically. In his discussion of the nature of the Rift Valleys he concludes that they are all due to 'Zerrung' (p. 240), and he describes them as bounded by faults which are always normal and not reversed. He rejects the view of Uhlig that some of the fractures that bound these valleys are overthrust faults. He remarks that the tectonic



origin of the rift valleys is proved alike by the evidence of earthquakes, gravity anomalies, and volcanic distribution. He contrasts what he terms the 'Zerrungstheorie' against the 'Antiklinaltheorie,' which he attributes to de Martonne.

The distinction between the two theories is not clear. The explanation put forward by the reviewer in 1896 was that the rift valleys were due to a raised band of country that extended north and south throughout East Africa, having been torn asunder by parallel fractures, along which bands of the crust subsided. As remarked later (*Geog. Jour.*, July 1920, p. 39), Africa, during the formation of the rift valleys, 'was in tension,' and fractures led to the sinking of long strips between parallel faults. The term 'Zerrung' presumably comes from 'zerren,' to pull. If the 'Zerrungstheorie' means that the whole valley is due to the two sides being pulled apart, it would be inconsistent with the facts; for the main formation was due, as is clearly shown by Prof. Krenkel's diagrams, to subsidences between parallel faults. The difference between the two theories appears to lie in the stress laid on the movements before the faulting. The so-called 'Antiklinaltheorie' implies that the rift valleys occur along a broad belt of highland, and therein agrees with Prof. Krenkel's description of the area traversed as 'Hochafrika.' How that 'Hochafrika' was formed is immaterial; it may be described as a geanticline, as Haug has called the area to the east a geosynclinal. Prof. Krenkel's view fully supports the view that the rift valleys are tectonic, and due to tensional fractures on this highland belt.

The section of this volume of most special value is that on Tanganyika Territory; to knowledge of which the author has himself made important contributions. He clearly summarises the excellent work of the German geologists there and the results of the excavations in the Tendaguru area, which have enriched the Berlin Museum with a collection of giant Mesozoic reptiles. In dealing with this region, and also with the Red Sea, Prof. Krenkel gives a valuable account of the gravity surveys and their bearing on the structure of East Africa. The author maintains that the pendulum observations do not show that the ocean floors expose the heavy sima shell. The chapters are each accompanied by a well-selected bibliography, and the book is illustrated by beautiful photographs and many clear diagrams and maps. So far as can be judged from the first volume, the book will take its place as the standard work of reference on the geology of Africa.

J. W. G.

### Our Bookshelf.

*Handbuch der biologischen Arbeitsmethoden.* Herausgegeben von Prof. Dr. Emil Abderhalden. Lieferung 245. Abt. 2: *Physikalische Methoden*, Teil 2, Heft 6. *Mikrophotographie*. Von August Köhler. Pp. 1691-1978. (Berlin und Wien: Urban und Schwarzenberg, 1927.) 15 gold marks.

A REMARKABLE library of practical information concerning the methods of biology has for some time been in preparation under the editorship of Prof. Abderhalden, of the University of Halle. Already nearly three hundred parts have appeared or are in the press. This particular part, although devoted to the comparatively limited subject of photomicrography, contains no less than one hundred thousand words. There can be few details of the art and practice of the subject that are not dealt with in this comprehensive compilation.

It is essentially a work of reference, of, however, a readable nature, as the information, which is largely of a descriptive character, is presented without resort to mathematics of an abstruse kind. The work presents a somewhat limited outlook so far as much of the material and many of the illustrations, which refer to the products of one particular firm, are concerned. No knowledge whatever is assumed on the part of the reader. The operation of the simplest mechanical elements usually taken for granted and the arrangements of parts self-evident from the illustrations are described at length. Without adversely affecting its usefulness, the book might well have been reduced to half its size.

No introduction whatever has been provided: the book commences with a mechanical description of a particular microscope equipment. Neither is there any indication of the contents, nor any index—so essential to a work of reference. Presumably for these omissions the editor, not the author, is responsible. Indexes, apparently, are only published on the completion of parts, each of which comprises a considerable number of volumes. Until these are available, the reader must search for the information he requires with only the assistance of the section headings, which do not afford complete guidance.

J. W. F.

- (1) *The Book of Woodcraft and Indian Lore.* By Ernest Thompson Seton. Pp. xxiii + 567. (London: Constable and Co., Ltd., 1927.) 7s. 6d. net.
- (2) *White's Selborne for Boys and Girls.* Edited by Marcus Woodward. With reproductions of Bewick's Woodcuts. Pp. xvi + 308 + 8 plates. (Oxford: Basil Blackwell, n.d.) 7s. 6d. net.

(1) ONE of the most interesting and informative boy's books we have read. It discusses all manner of subjects likely to touch upon woodcraft, and that in a summary and practical fashion which gives a business-like touch to its instructions and comments. The principles of scouting, the Indian way, its ceremonies and disciplines, signalling, handcraft stunts and makeshifts, the wild life of the woods, tracking animals, the summer camp, and so on;

from every angle the open-air movement is looked upon and guided by hints gained through long experience. Five hundred drawings by the author illustrate the text, and though the work is founded upon an American basis, most of its tips are applicable to scouting in Great Britain, and the remainder are well worth knowing about in any case.

(2) Although Gilbert White's "Natural History of Selborne" used often to be, and may still be, a prize frequently given to schoolboys, we can scarcely imagine that it is received with due appreciation. Neither the form in which the information is cast nor the style of expression is likely to appeal to a boy, who demands either concise and clear-cut descriptions or a Nature tale adventurous and imaginative. Mr. Woodward, having perceived the difficulty, has endeavoured to solve it by reproducing selected passages, in which the text has been simplified, punctuation put to rights, too heavy sentences broken up, and difficult words translated. Some of Bewick's cuts, and eight coloured plates (from Jardine's "Natural History"), illustrate the text; but in spite of all we still have the feeling that boys will fight shy of these leisurely and disjointed observations of the Vicar of Selborne.

*An Outline of Comparative Psychology.* By Prof. C. J. Warden. (Psyche Miniatures, General Series No. 20.) Pp. 147. (London: Kegan Paul and Co., Ltd., 1928.) 2s. 6d. net.

IN this work the author gives us a historical account of man's attitude towards the animal kingdom from the earliest ages. Cro-Magnon man appears to have been the first to take an intelligent interest in the animals round him. However, it is not until comparatively recent times that the science of comparative psychology can be said to have become established. Darwin may be looked on as the founder of modern comparative psychology. The author might well have devoted considerably more space to the experimental movement and told us more about the behaviourist school. The most important work of the Russian school under Pawlow dealing with conditioned reflexes is dismissed in a paltry five lines, but the Americans come in for pages of praise. Köhler's work on the mentality of apes might well have received mention if nothing more. Apparently the author is unaware of the results of the study of animal behaviour outside the United States.

*Birds at the Nest.* By Douglas Dewar. Pp. viii + 271. (London: John Lane, The Bodley Head, Ltd., 1928.) 7s. 6d. net.

THE title of this book scarcely conveys to the would-be reader what its contents really are. Briefly put, these may be said to be an attempt to prove that every action of the bird is controlled or carried out by instinct and that intelligence does not exist in the bird mind.

The author brings forward a vast mass of evidence to prove his theories, and at first would seem more or less to have succeeded in doing so. The second reading, however, leaves us with the impression that his reasoning is faulty, his deduc-

tions wrong, and his assumptions hasty. It is true that he shows—and shows really well—that birds during the breeding season are obsessed with three furores: first, that of producing their kind; second, that of hatching their eggs; and third, that of feeding the young. It is equally true that he proves in very many cases that birds are so completely controlled by these emotions that these entirely override intelligent action. To our mind, however, he fails to prove that instinct is the sole motive power in the actions of birds and that intelligence plays no part in them.

The book is one worth reading and is, perhaps, the best the very hard-working author has yet produced.

*Birds of the Ocean: a Handbook for Voyagers; containing Descriptions of all the Sea-Birds of the World, with Notes on their Habits and Guides to their Identification.* By W. B. Alexander. (Putnam's Nature Field Books.) Pp. xxiii + 428 + 88 plates. (New York and London: G. P. Putnam's Sons, Ltd., 1928.) 15s. net.

THE present volume contains an account of all those birds to be met with on sea voyages throughout the world, its aim being to make possible the identification of these birds by observation alone. On the whole, we may say that the object aimed at has been attained. The descriptions given are such as will enable most people to identify the vast majority of birds they happen to meet with, and Mr. Alexander's book is one which should find a place in the library of every sea-going vessel.

Each bird is dealt with briefly, the numerous diagrammatic illustrations given will be a real aid to identification, whilst some of the photographic illustrations are really beautiful. The get-up of the book is not worthy of its contents, the paper being poor and the letterpress to the plates often cut off by the faulty binding.

*Judgment and Reasoning in the Child.* By Prof. Jean Piaget, in collaboration with Mlles. E. Cartalis, S. Escher, A. Hanhart, L. Hannloser, O. Matthes, S. Perret, and M. Roud. Translated by Marjorie Warden. (International Library of Psychology, Philosophy and Scientific Method.) Pp. viii + 260. (London: Kegan Paul and Co., Ltd.; New York: Harcourt, Brace and Co., 1928.) 10s. 6d. net.

AN excellent book. Dr. Piaget gives a very detailed and comprehensive account of investigation into judgment and reasoning as shown by young children. The book forms a supplement to "Language and Thought of the Child." The logical and reasoning powers of children are not simply elementary forms of adult logic and reasoning; they are something different. The logic of the child is almost entirely ego-centric; it is more closely allied to the autistic or dereistic type of thinking, a conception which we owe to the psychoanalytic school. The child's powers of reasoning are very limited, and it is not until the age of 11-12 years that anything approaching sound formal reasoning appears.

Letters to the Editor.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

A New Type of Low Frequency Low Voltage Discharge in a Neon Lamp.

IN recent years a good deal of work has been done on the neon lamp as a means of producing oscillatory discharges of high frequencies. The arrangement for this purpose usually consists in placing a variable condenser in parallel with the two electrodes inside the lamp and connecting this in series with an adjustable resistance to a supply of D.C. voltage. The phenomenon of periodic 'flashing' owes its existence to the peculiar characteristics of the neon lamp, namely, to the fact of its having two 'critical' voltages. When the voltage across the condenser and the lamp in parallel approaches a value equal to that required to start a flash, a flash is visible. During the flash, the resistance of the gap falls and so does also the P.D. between the electrodes. The flash, however, does not disappear until the P.D. between the electrodes falls below the lower critical voltage. As soon as the flash ceases the condenser again begins to charge up to the upper critical value, and the process is automatically repeated. This explanation was given by Mecke and Lambrez (*Phys. Zeit.*, 27, 86; 1926). Using the above arrangement, periodic discharges of high frequencies have been obtained by a number of workers.

The experiments described in this note are of an entirely different nature, since they require no variable

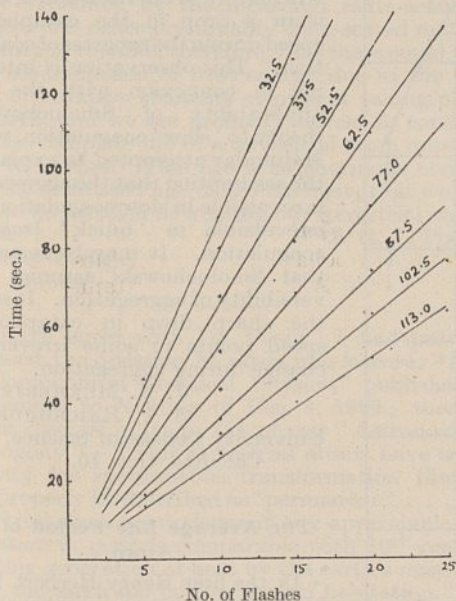


FIG. 1.—Curves showing the great regularity of the flashes. The period of flashing depends on the potential difference between the electrodes.

condenser and can be performed with sufficiently low voltages. Further, the discharges are very slow, and their period can be varied at will.

The arrangement consists in tapping the necessary P.D. from a potentiometer circuit connected to 230 v. D.C. The neon lamp was of the 'I' type with a small rod and a small plate for its electrodes. It

was observed that flashes of a regular period appeared at voltages below the upper critical value, when the outside of the bulb was earthed. The hand, which was at first seen to serve this purpose, was later on replaced by a surer mode of contact by immersing the bulb in conducting water and the water was connected to earth. Flashes made their appearance only when the earthing switch was on and not otherwise. The fair regularity of the periodic appearances of the flashes can be judged from the straight linear character of each of the lines in Fig. 1. Different voltages across

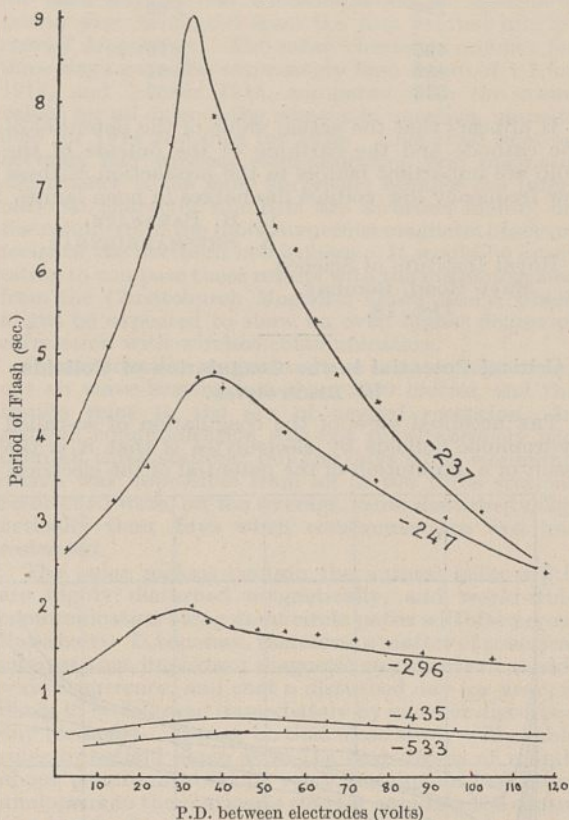


FIG. 2.—Graph showing the relationship between the applied potential difference and the period of flash for different values of the cathode potential.

the electrodes give different periods of flashing, but for a given voltage the period remains the same. The period of the flashes has a maximum value, but this value depends on the actual value of the negative potential on the cathode. There are no intermittent flashes when the plate is the cathode, and in fact the lamp refuses to light up until a certain high value of P.D. is reached.

Further experiments in this connexion were performed by employing an insulated high tension battery of 600 volts. Various negative potentials could thus be put on the rod-shaped electrode, keeping the outside of the lamp always earthed and the anode having throughout a negative potential of a numerically smaller denomination than that on the cathode. The results are shown in Fig. 2. The actual potential difference between the electrodes is marked on the abscissa and the period of flashing on the ordinate. The different curves are obtained by giving different negative voltages successively to the cathode (rod). For a P.D. of about 32 volts, each curve passes through a maximum, indicating that 32 volts is either a characteristic depending on the nature of the gas-filling or the geometrical disposition

of the electrodes. As the value of the negative potential increases, the P.D. across the electrodes remaining the same, the period of flashing diminishes. The following table will show this relationship. The maximum value of the period falls consistently with the increase in divergence of potential of the cathode from the earth.

Negative Potential of Rod (Volts).	Maximum Period of Flashing (Seconds).
237	9.04
247	4.78
296	2.03
435	0.70
483	0.61
533	0.57

It appears that the actual value of the potential of the cathode and the earthing of the outside of the bulb are important factors in the production of these low frequency low voltage discharges in neon lamps.

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K. SHESHADRIENGAR.

Royal Institute of Science,  
Mayo Road, Bombay,  
Oct. 18.

### Critical Potential in the Coagulation of Colloids by Electrolytes.

THE accepted view of the coagulation of so-called hydrophobe colloids by electrolytes is that it is the result of a diminution of the potential of the electrical

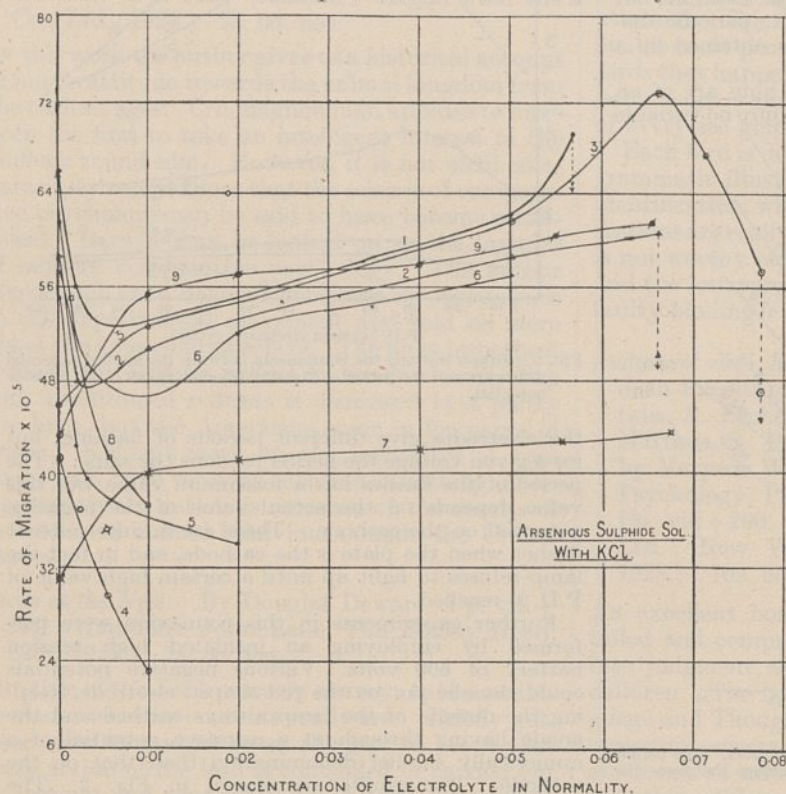


FIG. 1.

double layer. The potential is measured from the cataphoretic speed,  $u$ , by means of Helmholtz's equation,  $u = D \cdot V / 4\pi\eta$ , where  $D$  is the dielectric constant,  $V$  the potential of the double layer, and  $\eta$  the viscosity coefficient. In 1926, S. G. Choudhury made observations in this laboratory which threw

doubt on the above explanation of coagulation by electrolytes. Kruyt and Willigen (*Zeits. Phys. Chem.*, **130**, 170; 1927) have recently observed that in the coagulation of arsenious sulphide sol by potassium ferrocyanide, the cataphoretic speed is greater than that of the pure colloid up to the concentrations studied by them; their measurements, however, do not go up to the coagulating concentration. They attempt to get over the difficulty by assuming that the dielectric constant of the medium increases with the concentration of the electrolyte, so that though the cataphoretic speed is higher, the potential of the double layer is smaller than that of the pure sol. A number of observations show, however, that an impossibly large value of the dielectric constant must be assumed in order to reconcile the data with the above explanation. It also appears that the nature and even the manner of preparation of the colloid have a great influence on the cataphoretic speed at the coagulating concentration of the electrolyte. We reproduce our data in the accompanying curves (Fig. 1).

Curves 1, 2, and 3 have been obtained from different dilutions of the same sol, and curves 4, 8, 7, and 9 from Freundlich's and Kruyt's observations. It will be seen that there are, broadly speaking, two types of curves, one (4, 5, and 8) showing a regular diminution with increasing concentration of the electrolyte, while the other curves (1, 2, 3, 6) show a much more complicated behaviour. Both types of curves refer to arsenious sulphide sol, but the method of preparation is different in the two cases. These observations definitely contradict the assumption that coagulation takes

place at a critical potential, and consequently call for a theoretical treatment on an altogether different basis.

Attention may also be directed to a feature of curves 2 and 3, which show a drop in the cataphoretic speed during the progress of coagulation. This observation is interesting in connexion with the non-applicability of Smoluchowski's theory to 'slow' coagulation, which Majumdar attempted to explain on the assumption that the aggregation is reversible in slow coagulation but irreversible in 'quick' (*raschen*) coagulation. It may be remarked that Smoluchowski assumes irreversibility of aggregation. It seems the sharp drop in cataphoretic speed points to some irreversible change during aggregation.

J. N. MUKHERJEE.

S. P. RAJCHOUHURI.

University College of Science,  
Calcutta, Oct. 10.

### The Average Life Period of an Atom.

IN the first Henry Herbert Wills Memorial Lecture, published in *NATURE* of Nov. 3, Sir James Jeans has tentatively put forward the view that possibly no atom is eternal, but that they all spontaneously undergo transformations similar to that observed in the radioactive series. In fact, he goes rather further than this, for he suggests that even a hydrogen atom is finally itself converted entirely into radiation by the complete combination of the proton and electron composing it. It is to be observed that he assumes that this process

will not be affected by any temperature, or other external set of physical conditions, which can be possibly attained in the existing universe. If the process occurs at all accordingly, it should occur on the earth and hence be accessible to our direct experience.

As a matter of fact, the data quoted by Sir James Jeans himself *re* the observed energy flow from the earth's surface, enable us at once to place a minor limit to the average life of the existing terrestrial atoms. The heat flow from the earth's interior at present is about  $1.9 \times 10^6$  calorie per  $\text{cm}^2$  per sec., or  $2.6 \times 10^9$  ergs per  $\text{cm}^2$  per year. The total surface area of the earth =  $5.1 \times 10^{18}$   $\text{cm}^2$ , hence the total loss of energy of the earth per year is  $13.3 \times 10^{27}$  ergs, equivalent to a loss of mass of  $1.5 \times 10^7$  grams. Now the mass of the earth itself is  $6 \times 10^{27}$  grams, hence if the earth is cooling, the average life of a terrestrial atom must be at least  $4 \times 10^{20}$  years, or about  $10^8$  times the probable age of the existing universe.

It is to be observed that in the above calculation we have neglected the fact that a large portion of the energy loss is supplied by the known amount of radio-active elements present in the earth's crust. In fact, the surface materials are so rich that a layer about 13 km. thick would supply the whole loss, and it is only by assuming a rather arbitrary diminution of radio-activity with depth that we can ensure that the earth as a whole is cooling. If we accept Jeffreys' estimate that 87 per cent of the loss is due to the breakdown of the known radio-active elements, we can only attribute the remaining 13 per cent to the apparently stable elements, and this would lead to an average life for these elements of about  $5 \times 10^{21}$  years.

There is, of course, another possibility, that is, that the earth as a whole is not at present cooling, but that heat energy is steadily accumulating. This view is favoured by geological history, but the increase of energy production which it involves seems to be amply explained by the measured radio-activity of eclogites and other presumably deep-seated materials. It seems improbable, therefore, that there could be any large accumulation of heat energy due to the breakdown of ordinary elements at present taking place in the earth, and we are probably correct in concluding that the complete life of a terrestrial atom must be at least  $10^{21}$  years. This age is so enormous compared with the estimated age of the universe, that we would seem to be justified in treating our terrestrial atoms as eternal.

J. H. J. POOLE.

Trinity College,  
Dublin.

I QUITE agree with Dr. Poole. I had previously discussed the question he raises in a lecture, "Recent Developments of Cosmical Physics," published as a supplement to NATURE of Dec. 4, 1926; there is a similar discussion on p. 131 of my "Astronomy and Cosmogony": "Our terrestrial atoms have so little capacity for spontaneous transformation that they may properly be described as 'permanent.' . . . If the terrestrial elements underwent any appreciable transformation in periods comparable with  $10^{17}$  years, the resulting generation of heat by the earth's mass would make the earth too hot for human habitation."

J. H. JEANS.

#### Radio Communication and Magnetic Disturbances.

LOOKING through the wireless data of Sir Douglas Mawson's Australasian Antarctic Expedition which has come into my hands through the untimely death of Dr. Chree, I have found a copy of the *Australian Monthly Weather Report*, vol. 4, No. 9. This contains Mr. F. J. Henderson's analysis of the working of the

Macquarie Island station during 1914 and 1915 in the form of a statement of the dates on which the receipt of wireless signals was difficult or impossible, apparently excluding the days on which atmospheric were serious enough to cause the trouble. The stations with which Macquarie Island was generally in communication were Hobart, Wellington, and The Bluff.

In order to obtain confirmation of certain results from the first rough analysis of the logs of communication between Macquarie Island and the Antarctic base station, the international magnetic character numbers for each day of bad communication at Macquarie Island were tabulated from the lists printed in *Terrestrial Magnetism*. The mean character number for these days gave the surprisingly high figure of 1.1 for 1914, and 1.0 for 1915, compared with the mean values for all days of the months in question, namely, 0.55 for 1914 and 0.64 for 1915. This close relation between bad wireless communication and magnetic disturbance is the more surprising because the international character numbers are awarded mainly on the results from the more numerous magnetic observations of the northern hemisphere. It would be interesting to compare these results with the magnetograms from the Christchurch Magnetic Observatory, which might be expected to show an even higher degree of correlation with wireless communication.

Communication appears to have been mainly carried out on wave-lengths less than 2000 metres, and the results refer to the era of crystal reception. In general, communication was not simultaneously bad from all three stations, but the days when communication was impossible from all of the three stations mentioned were, on the average, more disturbed magnetically than days when communication was less restricted.

The polar regions contain the auroral belts which are highly disturbed magnetically, and world-wide communication along great circle paths will often cross these belts. It becomes, therefore, a matter of practical interest that important magnetic storms are of world-wide occurrence, and that a disturbed day (or year) is likely to be followed immediately by another disturbed day (or year). It may be that close study will enable rules to be laid down as to the best means of round-about communication by relay stations on bad days, analogous to the mariner's rule for avoiding the centre of a hurricane.

It may be mentioned that the apparent relation between bad wireless communication from New Zealand and neighbouring parts to Macquarie Island, and magnetic disturbance defined by the international character number, is closer than the relation between this character number and exceptional aurora observed at Macquarie Island.

C. S. WRIGHT.

Research Department,  
Admiralty, S.W.1,  
Nov. 27.

#### The Raman Effect in X-ray Scattering.

THAT a quantum of radiation can be absorbed in part by an atomic system, and the remaining part scattered by it giving rise to a radiation of increased wave-length, has been demonstrated by recent work on the scattering of light in material media. In his address on "A New Radiation" (*Ind. Jour. Phys.*, vol. 2, p. 398, Mar. 31, 1928) Raman pointed out that precisely similar effects should also be observable in the case of X-ray scattering. In other words, in addition to the Compton type, we should also have other modified X-radiations scattered by the atom, in which the scattering electrons alter their positions

in the atom, but remain bound to it. The frequencies of the radiations scattered by the atom would be

$$\nu' = \nu - \frac{E_i - E_k}{h},$$

where  $\nu$  is the incident frequency,  $E_k$  is the energy of the initial level and  $E_i$  of the final level of the electron. When  $E_i$  is positive, it may have an arbitrary value, and, as has been shown by Wentzel and others, the scattered radiation is of the Compton type, in which the change of wave-length depends on the direction of observation. On the other hand, when  $E_i$  is negative, the electron remains bound to the atom, and we have a type of X-ray scattering completely analogous to that observed in the optical case. The frequency of the Raman type of X-ray scattering is independent of direction and is as sharply defined as that of the unmodified radiation.

Experiments to observe the new type of X-ray scattering here indicated have been in progress at Calcutta for some time. Meanwhile, results have been reported by Bergen Davis and Dana Mitchell (*Phys. Rev.*, vol. 32, p. 331; 1928) which may be regarded as a demonstration of its existence. Studying the scattered radiation from graphite excited by molybdenum  $K\alpha_1$ , they found three new lines the frequencies of which differed from that of the incident radiation by amounts corresponding to changes of energy level of the scattering electron by 279, 57, and 34 volts respectively. The first and the last may be identified with the transition of an electron from the  $K$  and  $L_1$  levels respectively, to a level of very loose binding to the carbon atom. The radiation corresponding to a change of energy of 57 volts may be identified with the case in which both the  $L_1$  electrons are shifted outwards. The latter supposition is not unreasonable in view of the well-known existence of double excitation in connexion with spark lines in the X-ray region of the spectrum. K. S. KRISHNAN.

210 Bowbazar Street,  
Calcutta, Oct. 25.

#### X-ray Studies on the Nitrides of Iron.

SINCE the two communications to NATURE of May 26 and Sept. 1, 1928, with the above title were written, I have done some more work on the nitrides with the highest nitrogen content attainable.

In the first communication it was mentioned that some of the lines in the photogram of a preparation with 11.3 per cent nitrogen (mean of three new analyses 11.23 per cent) were split, and the conclusion was drawn that this probably was due to the fact that the preparation consisted of two parts with different nitrogen content.

It has now been found that all preparations with maximum nitrogen content give exactly the same photograms, and it can be shown that these photograms are caused by a new phase  $\zeta$ . In this phase the iron atoms form an orthorhombic lattice with the elementary dimensions  $a = 2.758$  A.,  $b = 4.819$  A., and  $c = 4.419$  A. The co-ordinates 000,  $1/2$   $1/2$  0,  $1/2$   $1/6$   $1/2$ , and  $0$   $2/3$   $1/2$  reproduce the observed intensities very well. These positions are quite analogous to those in an orthohexagonal cell of close-packed atoms, and the dimensions of this orthorhombic cell are also very similar to the dimensions of the orthohexagonal cell of the  $\epsilon$ -phase at its highest limit of homogeneity, at about 11 per cent nitrogen. There exist consequently very close relations between the  $\epsilon$ - and the  $\zeta$ -phases, the nature of which still remains to be determined.

Owing to the evidently very limited homogeneity range of the  $\zeta$ -phase, and the fact that its composition practically coincides with the formula  $\text{Fe}_2\text{N}$ , it is most

probable that the  $\zeta$ -phase is the nitride  $\text{Fe}_2\text{N}$ . The nitrogen atoms, therefore, probably occupy definite places in the lattice, though nothing in the photograms indicates this. This can, however, be explained by the small atomic number of the nitrogen.

Three Fe-N phases therefore evidently exist in the concentration range now investigated. The first,  $\text{Fe}_4\text{N}$ , has the cubic structure described before (also independently found by R. Brill; see *Z. f. Krist.*, 68, 379; 1928). The second is the  $\epsilon$ -phase with a homogeneity range of about 8 to 11 per cent nitrogen and a hexagonal close-packed arrangement of the iron atoms. The third,  $\zeta$ , is probably  $\text{Fe}_2\text{N}$ . Its iron atoms are arranged in an orthorhombic lattice, very similar to a hexagonal close-packing. It has not been possible to determine the positions of the nitrogen atoms in the two last phases.

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#### Action and Reaction in Rotary Motion.

A BICYCLE wheel, loaded at the rim, is placed upon an axle about four feet in length. This axle passes vertically through a hole in the centre of a rotating stool and is fixed rigidly to the stationary pedestal of the stool. A man standing upon the rotating stool can now set himself in rotation in one direction by turning the bicycle wheel in the opposite direction. A more striking demonstration can be given when the axle of the bicycle wheel is not fixed to the pedestal but rests upon the rotary part of the stool. In this case the man stands upon the stool grasping the axle of the bicycle wheel and holding it vertically in his left hand. With his right hand he sets the wheel in rotation (clockwise), and he necessarily rotates with the stool in the opposite sense (anti-clockwise). By applying the palm of his hand to the rim of the bicycle wheel, the man can stop his own rotation and that of the wheel at the same time. If a second man standing upon the floor stops the rotation of the man on the stool, the latter can again start himself in rotation by taking energy from the bicycle wheel. In a complete analysis of these rotations, friction in the bearings of the rotating parts must be taken into account.

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#### Plant Growth in a Cheddar Cave.

GOUGH'S Cave at Cheddar, Somerset, is illuminated by electric light in those parts which are shown to the public. Within a radius of about six feet from almost every electric bulb (of the ordinary gas-filled type) the rock or clay is covered with a growth of green plants. At some points there is only a film of *Protococcales*; at others the growth is more luxuriant and consists of mosses, liverworts, fern prothalli, and ferns. At a point about a quarter of a mile from the entrance of the cave there is growing a plant of the Hart's Tongue Fern (*Scolopendrium vulgare*) about eighteen inches in height.

We are informed that this growth of plants has only been noticed in the cave since the former 60 candle-power lamps were replaced by 120 candle-power lamps about two years ago.

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Dec. 8.

## The South Africa Meeting of the British Association, 1929.

THOSE members of the British Association who attended the meeting in South Africa in 1905 and propose to attend the Capetown-Johannesburg meeting in 1929, will find that much change has taken place in the intervening years. Nowhere will the change be more striking than in the places where the meeting will be held. The sites of the University of Capetown and of the University of the Witwatersrand (Johannesburg) may not vie with that of the University of Glasgow, where the meeting was last held, but their sites are nevertheless magnificent, and the accommodation available is sufficient to provide meeting-rooms for all the sections. Both cities, Capetown and Johannesburg, have town halls of large seating capacity for the larger evening meetings which form such a prominent feature of the British Association meetings.

The officers of the Association and the secretariats of the Sections will be housed at both centres in proximity to the meeting places, and it is hoped that this convenience will contribute to the success of the meeting.

The ocean voyage from Southampton to Capetown is one of the finest that can be taken for the length of time occupied: it is accomplished by the mail steamers of the Union-Castle Mail Steamship Co. in sixteen and a half days, the only port of call on the way being Madeira. The intermediate steamers of the same line, and the steamers of other lines, take a few days longer on the voyage.

The mail steamer leaving Southampton on July 5 will arrive at Capetown on the morning of Monday, July 22, and the inaugural meeting will be held in the City Hall on the evening of that day. At this meeting the assembly will be welcomed by the Mayor of Capetown and will be addressed by the president of the South African Association for the Advancement of Science, his Honour Mr. J. H. Hofmeyr, Administrator of the Transvaal Province. The retiring president, Sir William Bragg, will induct the president, Sir Thomas Holland, who, it is hoped, will deliver a short formal address.

Sessions of the sections will be held on the mornings of July 23-26. During the week, opportunity will be given to visitors to see the beauties of the Cape Peninsula with its unrivalled marine and mountain drives.

The first party, in two special trains, will leave Capetown on the morning of July 28; the trains will pass through the magnificent mountain scenery of the Hex River in daylight and will reach Kimberley on the following morning. The day will be spent in the Diamond City, where the visitors will be the guests of the De Beers Consolidated Mines, Ltd. Leaving Kimberley in the evening, the party will arrive in Johannesburg on the morning of July 30. The second party will leave Capetown on the morning of July 29 and, following the same route and programme, will arrive in Johannesburg on the morning of July 31.

The Johannesburg session will begin on July 31 and will be continued until Aug. 3. The presidential address will be delivered on the evening of

July 31. During the week, visits to gold mines and to points of interest in the neighbourhood will be arranged.

It is proposed that some of the sectional presidential addresses shall be delivered at Capetown and that the remainder will be delivered during the second part of the session. Provisionally, it has been arranged that at Capetown the presidential addresses of Sections A (Mathematical and Physical Sciences), B (Chemistry), E (Geography), I (Physiology), J (Psychology), and L (Educational Science) will be delivered. The presidential addresses to be delivered at Johannesburg will be those of Sections D (Zoology), F (Economic Science and Statistics), G (Engineering), H (Anthropology), and K (Botany).

The fifteenth International Geological Congress is to be held in Pretoria on July 29-Aug. 7. Overseas members of the Congress will arrive in Capetown on July 15 and, after spending three days there, will proceed, by different routes and by easy stages, to Pretoria, which will be reached about July 28. Arrangements are being made for the second part of the session of Section C (Geology) to be held in Pretoria in association with the International Geological Congress; it is, however, definitely decided that the Section meetings are not to be merged in those of the International Congress, but that the two will take place simultaneously.

The Pan-African Agricultural and Veterinary Congress begins in Pretoria on Aug. 2, and it is intended that the second part of the session of Section M (Agriculture), at which the presidential address will be delivered, shall be held in Pretoria in conjunction with the Agricultural Congress. Pretoria can be reached from Johannesburg in about an hour either by road or by rail.

At the conclusion of the Johannesburg (and Pretoria) session, members may proceed direct to Capetown for the return voyage; leaving Johannesburg on the evening of Aug. 7, Southampton can be reached by mail steamer on Aug. 26. For those visitors who can afford the time, a wide choice of organised tours through South Africa and Rhodesia will be offered. The tours will permit visitors to see Rhodesia (Victoria Falls, Matopos, Zimbabwe Ruins), Eastern Transvaal (Sabi Game Reserve, White River Citrus Fields, Barberton Goldfields), Natal, Orange Free State, and Eastern Province (Cape). Arrangements will be made whereby members may embark at Lourenço Marques (Portuguese East Africa) or at Durban for the return voyage to Europe by the east coast of Africa route, or at Durban, Port Elizabeth, or Capetown for the return voyage by the west coast route.

As some of these tours will entail a considerable time being spent in the train, it may not be out of place to remark that, in spite of the narrow gauge of the South African railways, travelling is comfortable (apart from annoyance by dust), and the sleeping arrangements in the roomy coaches are satisfactory.

The meeting takes place during the South African winter. Capetown is in the climatic region of winter rains: for the period during which sessions will be held in Capetown the mean maximum temperature is 62° and the mean minimum is 48°, the average rainfall being about 2.5 inches per month. About ten hours by rail from Capetown the train will cross the line dividing the region of winter rains from that of summer rains. At

Kimberley, Johannesburg, and Pretoria lower temperatures will be experienced than at Capetown, but clear skies and brilliant sunshine normally prevail during the season at which the meetings are to be held.

Local arrangements for the meeting are in the hands of the South African Association for the Advancement of Science and every endeavour is being made to ensure the success of the meeting.

### Christmas Customs and their Origins.

OF the popular customs associated with Christmas, few have a Christian origin. The aim of the early Church was to distract its followers from the great festivals of the heathen, and consequently pagan elements were allowed to be incorporated as freely in the observance of Christmas as they were in the other major feasts of the Christian calendar. Here the pietistic sentiment of the Mediterranean peoples has tended to preserve the mystic element of paganism rather than the saturnalian. Hence the devotion to the Midnight Mass; and, as the cult of the Madonna enshrines the popular memory of the great pagan mother goddess, so the Cave of Zeus, of Adonis, and of Mithra survive in the cult of the Manger, in which both in the representations in the churches and in the popular shrines in the Italian streets, Mary, Joseph, and the animals kneel in adoration of the Child.<sup>1</sup> In Spain the Manger is set up even in private houses, where one or two rooms may be set aside for the purpose. In England the cult may be traced in the belief, once common in the west country, but not confined to that area, that at twelve o'clock on Christmas Eve the oxen kneel in their stalls. A connexion, with more than a flavour of paganism, may also be inferred in the divinatory custom of placing a cake on the head or horns of an ox in its stall on Christmas Eve, once practised in Herefordshire and other western counties and in the north, the prosperity of the coming year being foretold by the direction in which the cake fell or was shaken off. To the Manger cult may also be ascribed the 'vessel cup' of northern England, a box or framework, usually decorated with evergreens, containing a doll, or more often two dolls representing the Madonna and Child, which was carried from house to house by 'vessel cup' women or children. In the name 'vessel cup,' a corruption of 'wassail,' northern paganism combines with that of the south.

Among northern races, Christmas observances take on a different character from those of the Mediterranean area. Here Christmas coincided with the mid-winter feast of Yule, and popular custom, on the whole, has tended to emphasise the joyous nature rather than the solemnity of the observance. Harsher climatic conditions demanded a greater act of faith to believe in the return of the sun, and the rejoicing at the winter solstice when the sun god turned to his upward path was more

strongly marked to a corresponding degree. In England, in particular, the festival, it was noted by early travellers, was kept up with greater zeal than in any other country. Here Christmas is Yule, and Mediterranean conceptions, though not absent, have relatively little influence.

The feast of Yule, though associated with certain of the northern deities, was in its origin a mid-winter feast of sun worship, in which the characteristic features were rejoicing at the passing of the solstice, the sacrificial meal, and observances of a magical character to ensure the fertility of the coming year. Traces of all these survive in Christmas practice. There is also another aspect of the yule feast which has to be taken into account. It was a feast of the dead, and therefore a time of peril, when harm from their spirits must be averted. It was the time when the 'wild huntsman' rode with his hounds. Hence, even in Scotland, where the observance of Christmas is ignored, and at one time was made subject to penalty, divinatory and good luck practices were followed, similar to those of New Year. A dark man must be the first to enter the house in the morning, something should be brought into the house during the day, but nothing, especially fire, must be taken out or given away, and so forth. In Scandinavia everything in the house had to be left tidy and the tables laid for the Christmas meal before the family went to church, as the spirits of the dead came to inspect while they were away. Sometimes at the Christmas feast a special table was set aside for the spirits of the dead. Thus was prosperity ensured in the coming year.

In England a group of closely related customs connect Christmas with a feast of the dead. These are the yule log or yule clog, the yule candle, and the yule cake. The custom of the yule log was widespread—a huge block of wood was brought in with ceremony—sometimes it was provided by the overlord from the manorial woods—and was ceremonially lighted at a ritual hour on Christmas Eve and allowed to burn through the Christmas festivities. The sacred character of the fire is indicated by the injunction that the hands of the maid tending it must be clean; otherwise it will go out. A fragment of the log should be preserved for good luck and to light the next year's log, so that old and new might burn together. If the house of a neighbour caught fire, a piece thrown on the flames extinguished them. The yule candle was also lighted at a stated time on Christmas Eve. It should never be snuffed or put out, and no other

<sup>1</sup> A strong Nationalist movement is now endeavouring to revive the Manger and displace the imported Christmas Tree, which is also denounced by the clergy.



candle should be lighted from it. Yule candles were often presented to their customers by chandlers. Sometimes when a family feast formed part of the observance, the candle stood on the table and was lighted at the beginning of the meal. The table must bear everything that was needed, as no one was allowed to rise until the meal was finished. The yule cake may be compared with the Soul Cake of All Hallows and served a similar purpose. In poorer families it was made with flour obtained by 'Thomasing' or 'Gooding' (see Calendar, Dec. 21), and usually bore a number of crossing lines. Everyone who entered the house at Christmas must partake of the cake, which was first cut at a regular and specified hour. Usually it was eaten with cheese. The crumbs were buried in the ground with seeds, thus ensuring fertility. At one time it would appear that the Church made an income by selling cakes for the purpose, appropriately marked with a cross.

The ceremonial fire of the yule log, the lighted candle, the solemn meal, and the ceremonial eating of the cake, are all practices such as are associated with the cult of the dead and of spirits, and by their observance secure prosperity and fertility. Nor is it unreasonable to attribute to the same origin the snap-dragon—the dish of rasins in blazing spirit—and the ignited brandy poured around the Christmas pudding. Even the now apparently trivial belief that the number of different makes of mince pies tasted ensures an equal number of years of prosperity or life, links up with the same idea.

The sacrificial meal among the northern nations, without losing its character of a solemn feast of the gods or the dead, grew into the convivial banquet of the overlord, his peers, and his retainers, when unrestricted hospitality prevailed, and even those who were not members of the household might share the convivial meal. The ceremonial passing of the wassail bowl in the manner of a loving cup, still marked the solemn nature of the repast.

Of the dishes, the traditional boar's head, still served in Queen's College Hall at Oxford on Christmas Day, was carried with all ceremony to the table as the midwinter sacrifice to the Scandinavian deity, Freyya. It was served with an orange, lemon, or an apple in its mouth, and was decked with rosemary or evergreens. It was therefore a fertility offering. So also the other traditional dishes, mince pies—a mixture of meat and spices—frumenty, of which the principal ingredient was corn, and the ceremonial goose, were offerings of the fruits of the earth to ensure their continuance and increase. In England, after the discovery of America, the place of the goose was often, and now is commonly, taken by the turkey.

It is not improbable that human sacrifices took place at Yule. This may be concluded from the action of the mummers, whose house-to-house visits, with those of the waits and carol-singers, were a regular feature of Christmas celebrations. Miracle and mystery plays were substituted by the Church, but died out, while the mummers lasted down to the nineteenth century, when their place was filled by the still surviving waits. In addition

to the traditional dances, plays, such as the Cornish drama of St. George, were performed by the mummers. In these, one or both of the principal characters was killed and brought to life again—a symbol of the conflict of the seasons, the victory of light over darkness, or even, perhaps, of human sacrifice. The symbolism was even clearer in some of the sword dances of the north of England on Christmas Eve. Sometimes one of the performers carried straws in his mouth to represent the bristles of the hog to be sacrificed. In other dances one of the performers, either 'Bessy' or 'the Parson' interfered at the making of the 'knot' when the swords are interlaced into a geometrical figure, and was killed.

It is sometimes said that Christmas observances in England are derived from the Saturnalia, and to a limited degree and in respect of certain customs that may be. Such, for example, would be the election of a Lord of Misrule or an Abbot of Unreason, sometimes for the duration of the winter, or else at Christmas or at Twelfth Night, but this custom belonged rather to the Court and houses of the great nobles. In the popular observances the affinity is with Yule rather than with the Saturnalia, just as the Christmas games, bobbing for apples, scrambling for nuts, and hot cockles, hoodman blind, etc., were the traditional games of the earlier autumn and winter agricultural festivals, played on a more extensive scale.

As part of the Christmas feast, and as a magical vegetation charm, it was customary for the houses to be decorated with evergreens, especially holly, rosemary, laurel, bay, box, sometimes ivy, yew, and cypress. The last two, however, were not so common on account of their funerary uses. The early fathers discouraged the use of evergreens as a pagan custom, but it soon became a general practice in the Church. The mistletoe was used as a house decoration, but although Stukely mentions a solemn offering of mistletoe placed on the altar in York Cathedral at Christmas Eve, it does not generally appear to have been used in church decorations on account of its heathen associations. The custom of kissing under the mistletoe, when a berry should be taken from the bough by the man for each kiss obtained, may be a relic of the Saturnalia, but more probably of the licence of the older fertility festival. In the north of England, although the name mistletoe was used, on account of its scarcity the plant itself did not appear. The bough to which the name was given was usually box, on which had been fastened either oranges and apples, or sometimes hazel-nuts attached by the insertion of a box-leaf in a hole bored in one end of the nut. This rattled when the branch was shaken. In Lincolnshire eggs were fastened to the bough.

Sometimes, in the north of England, the name mistletoe was also applied not to a bough, but to a garland fashioned from flexible willow twigs to which sprigs of evergreen of one kind or another, little figures on elastic, apples and nuts and coloured tapers were attached. Sometimes a pole was erected and covered with evergreens, around which the

people danced. The garlands and the 'mistletoe' were in use so late as the middle of the last century.

The Christmas tree would appear to have been introduced into England from Germany at about the time of the Prince Consort, *i.e.* the middle of the last century. In Germany it was and continues to be an important institution. A description of the Christmas-tree ceremony there at the beginning of the last century says that it was a fir tree decorated with tapers and placed on a table. At its foot were presents which had been prepared for the various members of the family. It was placed in a room which was kept closed until a fixed hour, when the members of the household were admitted and the presents distributed. Even in Germany it does not appear to be an institution of any very great age. The earliest reference to it is in the seventeenth century, and it was only in the eighteenth century that it became general. From Germany it spread in the early nineteenth century to Scandinavia, where it became very popular, but it did not reach France, where it was introduced by German families, until the nineteenth century, after it had reached England.

The Christmas tree must be regarded as a development of the 'May tree' and as a vegetation charm to be related to the pole, the garland, and the 'mistletoe' customs of the north of England mentioned above, which the eggs—symbols of fertility—nuts and apples fastened to the bough, show to be of magical import. The connexion of the garlands and the pole covered with evergreens with the Mayday customs and the May tree is too obvious to need comment. The Christmas tree, therefore, although introduced late into England, as an emblem of fertility may be regarded as carrying on an earlier tradition.

In England it is customary for children to hang up one or both stockings on Christmas eve to receive the gifts of Father Christmas, of which apples, nuts, and oranges traditionally form part. On the Continent the place of the stocking is taken by one or both shoes. Father Christmas usually obtains access to the stockings or shoes by way of the chimney; and traditionally, though not invariably, the stockings are hung by the chimney-piece or the shoes placed on the hearth. This custom is a rite of the hearth analogous to the custom in German lore of placing shoes on the hearth to contain the payment or receive the gifts of the household elves who in favoured families performed the housework while the inmates slept.

The alternative name for Father Christmas of Santa Klaus points to the origin of the custom. It was the practice, as is recorded by Hospinian, to make gifts to the children on St. Nicholas Day in commemoration of certain acts of the saint. In Franconia boys fasted on the eve in order that the saint himself might come and fill their shoes with presents. In the performance of these good deeds he passed with his train from village to village throughout the night. The stocking appears in connexion with the saint's patronage of virgins. In various convents in France and Italy it was the

custom of the inmates to hang a silk stocking at the door of the abbess, each containing a piece of paper or parchment on which was written what the owner desired of the saint, and the next morning the stockings were found filled with sweetmeats and other gifts.

The practice was not confined to children. At the Courts of certain of the Italian princes, the custom of Zopata—the custom of the shoes—was observed, by which on St. Nicholas Day favoured individuals found their shoes filled with gifts when they came to dress. Sometimes the saint himself appears. In Holland on St. Nicholas Eve he comes to the houses and holds an inquiry into the conduct of the past year, and after a gentle reproof for misdeeds and praise for good, disappears, the shoes of the children being found full of appropriate gifts the next morning. In Germany a similar function is performed on Christmas Eve by *Knecht Rupert*, who is usually said to be accompanied by a white horse. In a house-to-house visitation, good conduct is rewarded by a present from Jesus Christ, and bad by a rod for the parents, to be used as the case requires.

Gifts at Christmas, however, are not confined to children, but are exchanged between adults. In so far as the evidence would point to their association with St. Nicholas, among northern peoples, excepting always Scotland, they have been transferred with the children's customs to Christmas. In southern Europe, more especially in France, the practice of making gifts now belongs to the New Year. In both cases the origin may thus be traced through St. Nicholas to the goodwill and rejoicing of the Saturnalia and mid-winter feast. In ultimate analysis, Christmas gifts and 'Christmas box' no doubt are one and the same; but in England they must be distinguished. They afford another example of the co-existence of a northern and a southern strain in Christmas observance. The custom of making gifts, usually of money, to those who may be in a socially inferior position, is of long standing.

The name 'Christmas box' is said to be derived from the custom of placing pence in a box for the Christmas masses for the poor; but its origin is even more remote. A whole group of customs point in this direction. By 'Gooding' and 'Thomasing,' provision was made for the Christmas ceremonial meal of the poorer members of the community. Mummers, waits, and carol singers were regaled with ale and food and received money gifts from the houses at which they called. Not only did the overlord sometimes provide the yule log, but those who were not members of his immediate household were at liberty to attend at least part of the Christmas meal or celebrations. Tradesmen contributed the yule candle or part of the articles necessary for the Christmas meal of their customers as 'Christmas boxes,' a custom which survived until recent years, though now perhaps only as the gift of an almanac or calendar. It would be a mistake to regard these as simply the manifestations of Christmas goodwill. The Christmas box was not always a

charity; often it was a fee. For in the house-to-house visitation of mummers, waits, and others, at other seasonal festivals as well as at Christmas, the gifts of money and kind made the donor free of the benefits accruing from the ceremony—good luck, fertility, and the like. The ‘Christmas box,’ in

fact, was an expression of the originally communal character of the festival and a reaffirmation of the one-time solidarity of the social group when the well-being of the whole depended upon the due participation of every member in the prescribed ritual.

### The ‘Old-Fashioned Christmas.’

By Dr. C. E. P. BROOKS.

WHEN the rain of Dec. 25, 1927, turned to heavy snow, the remark was probably made in thousands of homes in Great Britain that this was Christmas weather of the real old-fashioned sort. It is equally probable that any meteorologist present stated with conviction that the ‘old-fashioned Christmas is a myth. Prof. W. J. Humphreys, of the U.S. Weather Bureau, is particularly severe on the similar belief current in America, assuring us that statistics prove it to have been “just the same as the new”; and nine out of ten meteorologists agree with his dictum. It is, however, quite possible to make out a plausible case in defence of the popular opinion.

Meteorological statistics show that recent winters in Great Britain have been abnormally warm. Comparable records are available for more than a century and a half in both London and Edinburgh, and show several interesting features. In London, after a well-marked maximum about 1780, there followed a pronounced minimum about 1815. The average temperature of the three winter months of 1814–15 was 32° F., this being the coldest winter of the whole series, but 1816 was little warmer. Temperature remained generally low until about 1848, after which a second series of warm winters occurred, with its crest in 1870. A second period of cold winters centred about 1890; from 1886 to 1895 inclusive, only one winter exceeded 40° F., while both 1890–91 and 1894–95 were exceptionally cold. During the present century the winters have become steadily warmer, and the average of the past ten years, 41.4° F., is the highest since records began. In Edinburgh the rise of winter temperature during the twentieth century has been even more marked than in London.

A similar result follows from a table included by Sir Richard Gregory in his paper on “British Climate in Historic Time” (*Geographical Teacher*, 1924), relating to the number of days of skating in Regent’s Park, which totalled 236 during the ten winters from 1885 to 1895, compared with only 43 in the nine following winters. After 1904 the records unfortunately ceased, but one knows from personal experience that there has been little skating in London in the past twenty-five years.

An attempt has been made to discover whether there was any corresponding decrease in the number of days with snow, but the figures are difficult to collect, and such as were obtained were inconclusive. A tendency, generally in evidence, for the number to *increase* with the passage of time must be attributed to greater care in observing, rather than to a true increase. A specimen study

of the eight days centred round Christmas showed for the twelve years 1870 to 1881 in London exactly the same average as for the 30 years 1886 to 1915; while in Aberdeen the twelve years were decidedly less snowy than the general average. On the other hand, a count of the very snowy and of the almost snowless winters in the British Isles, as described in Mr. L. C. W. Bonacina’s paper on “Snowfall in the British Isles” in “British Rain-fall” for 1927, gave for the 25 years 1875–76 to 1899–1900, 12 very snowy and 6 almost snowless winters; while the subsequent 25 years gave 7 very snowy and 9 almost snowless, an apparent decrease in snowfall which accords better with the change of temperature.

Although, on the whole, the popular belief thus seems to be justified by statistics, there are several considerations which suggest that the ‘old-fashioned winter’ was not the winter of a generation ago. The variations quoted above, with the possible exception of the cold spell round 1815, were comparatively small fluctuations, scarcely large enough to impress themselves on slow-moving tradition. Moreover, the belief occasionally crops up in the written records of an earlier day. Mr. Bonacina points out, in the article referred to, that two observers described the snowfalls of December 1878 as resembling those of a former generation, and Dr. Glasspoole quoted in the *Meteorological Magazine* for April 1927 a reference, written in 1853, to “one of the old-fashioned winters, snow and frost.” No doubt there are still earlier references, but I do not think that Pepys uses the term anywhere in his diary, as would have been likely had the belief been current in his day.

There seems to have been a real change of climate about 1750. Before that date there was a prolonged period, approaching a century, of abnormally dry weather in England. At the same time, weather in Norway was stormy and snowy; this and other facts suggest that our droughts were of the ‘anticyclonic’ type, which would be accompanied by generally cold weather in winter. This was the time of the great ‘frost fairs’ on the Thames, notably 1683–84, 1715–16, and 1739–40, events which were likely to impress the memory of Londoners in a way which mere weather could not do, and which were kept in mind by the numerous ‘relics,’ such as engravings and ballads from printing presses set up on the frozen river. If the ‘old-fashioned winter’ ever had a real existence, no series of years is more likely to have given birth to the tradition.

An alternative possibility remains to be considered; namely, that the belief results from

inaccurate mental processes. Three theories may be mentioned. The first is that the change of the calendar was responsible. In 1752 eleven days were added to the date, so that in 1751 Christmas Day fell on Jan. 5, new style, that is, almost exactly at the coldest time of the year. The long record at Greenwich shows, however, that the difference between the mean temperatures of the end of December and of the beginning of January is inappreciable. Moreover, the 'old-fashioned Christmas' is practically interchangeable with the 'old-fashioned winter.' Secondly, Mr. M. T. Spence, in the *Meteorological Magazine* for January 1927, points out that long spells of cold weather occur less frequently than long spells of mild weather in winter, so that by the time a cold spell arrives, the preceding one has passed into the hazy 'good old days.' His figures, however, refer only to spells which are statistically cold or mild, and the popular idea of the weather is often at variance

with the statistical. A more plausible theory is that the belief is upheld by the memories of immigrants into London from the colder and more snowy north. A difficulty is that the belief is not confined to London, but is deeply rooted in many rural districts where the amount of immigration is very small.

None of these ingenious theories satisfies, but after all, is such ingenuity necessary? A change in our sense of proportion as we grow older would seem sufficient, for a few frolics in the snow when we were young would colour all our memories of winter. The change may not be in the weather, but in ourselves.

I would suggest, therefore, that the belief in the 'old-fashioned Christmas' may have originated in a series of severe winters in the late seventeenth and early eighteenth centuries, but that since then its vitality has been purely subjective, so that it now refers not to any definite period of time, but to the childhood of the speaker.

### The Broadcasting of Seismological Reports.

FROM the records of a single well-equipped observatory the position of the epicentre of a large earthquake at a great distance can normally be determined with considerable accuracy. Closer estimates can be made, however, when the records from several stations are available, and especially when the stations are well distributed over the world. A system of exchange of seismological information by cable was inaugurated several years ago by the British Association. By the use of information received from stations in India, Australia, and America, Prof. H. H. Turner, chairman of the British Association Seismological Committee, has been able to determine the details which he has communicated regularly to the Press.

For the circulation of meteorological data, the submarine cable has been almost superseded by wireless telegraphy, and it is a natural development to use the latter medium for inter-communication of seismological information. The first step was taken by France. Since 1921 the readings of seismographs at Strasbourg have been broadcast regularly from the Eiffel Tower. The information is added to synoptic weather messages by the French Meteorological Office. The seismological code was given an international standing by publication in the report of the Rome meeting (1922) of the Seismological Section of the International Geodetic and Geophysical Union. The code is used by the Egyptian Meteorological Service for reports from Helwan. Since the beginning of 1927, seismological reports from Kew Observatory have been broadcast by the Air Ministry with the midday synoptic weather report which is sent out from Kidbrooke at 14 h. 0 m. G.M.T. Arrangements have been made by the Air Ministry for the transmission to London of seismological reports from Bombay. These reports also are broadcast from Kidbrooke.

In America, co-operation amongst the various bodies interested in seismology is well organised.

Information is collected from the United States and Canada by the United States Coast and Geodetic Survey, by the Jesuit Seismological Association, and by Science Service, the well-known news agency. At the request of the Meteorological Office, London, it has now been arranged that from Jan. 1, 1929, seismological reports will be transmitted regularly from Arlington with the meteorological synoptic message which is sent out at 4 h. 0 m. G.M.T. This service is made possible by the co-operation of the United States Coast and Geodetic Survey, the United States Weather Bureau, and the United States Navy. The meteorological message from America is re-broadcast from the Eiffel Tower at 6 h. 20 m. G.M.T., and the seismological information will be included in the re-issue. The international or Strasbourg code will be used for this service. Details regarding the code, wave-lengths, etc., will be supplied by the Superintendent, Kew Observatory, Richmond, Surrey, on request.

The data will refer to two stations which will be selected on each occasion by the Coast and Geodetic Survey. The stations will be chosen from those for which the phases of the earthquake are well determined. Stations not too far from the epicentre and pairs giving a good angle of intersection will be selected.

The list of possible stations includes not only nine in the United States (Berkeley, Chicago, Cincinnati, Fordham, Georgetown, Harvard, St. Louis, Sitka, and Tucson), but also two in Canada (Ottawa and Victoria), one in the West Indies (San Juan), and four in or beyond the Pacific (Apia, Honolulu, Manila, and Wellington).

The new service will be much appreciated by European seismologists. The elasticity of the system by which the most valuable data are selected for transmission is noteworthy. In some cases trustworthy estimates of the positions of the epicentres of earthquakes will be available at once instead of after a delay of several weeks.

## Obituary.

DR. J. McA. HENDERSON.

NEWS has been received by cable of the death of John McAskill Henderson, at Nairobi, in Kenya Colony, East Africa, where he was carrying out research on deficiency diseases on the African native. Dr. Henderson was a graduate of the University of Edinburgh, where in addition to having a distinguished academic career he was president of both the Students' Representative Council and the Students' Union.

In 1923 Dr. Henderson joined the staff of the Physiology Department of the Rowett Research Institute in Aberdeen. His chief work in Aberdeen was in connexion with the effects of ultra-violet irradiation on mineral metabolism in animals. The results of his investigation on this aspect of nutrition made a permanent contribution to our knowledge of the subject.

In 1926, Dr. Henderson was sent to East Africa with a group of other workers from the Rowett Institute to carry out an investigation on deficiency diseases in farm animals and African natives. The reports on this work which have been sent home show that he has opened up a field of investigation of exceptional interest. The data accumulated seem to throw new light on some of the problems of disease in the African native. This investigation, which was carried out in co-operation with Dr. Gilks, Principal Medical Officer of Kenya, and his staff, was done under the general supervision of a sub-committee of the Civil Research Committee, consisting of Major Walter Elliot, M.P., Sir Frederick Gowland Hopkins, Sir Walter Fletcher, Prof. E. P. Cathcart, Dr. A. T. Stanton of the Colonial Office, and the Director of the Rowett Institute. All the data collected by the late Dr. Henderson and his colleagues are available, but the lack of Dr. Henderson's help in their interpretation will be a serious loss to the investigation.

Dr. Henderson was a man of wide culture, who was much beloved by his colleagues. Although only thirty-three years of age he had already done brilliant research work, and had undoubtedly a most distinguished future as a physiologist. His death is an irreparable loss not only to the Institute to which he belonged, but also to the wider field of scientific research in which he was engaged.

J. B. O.

DR. MAX MARGOSCHES, professor of chemical technology at the German Technische Hochschule in Brünn, died on Sept. 27, after an operation, in his fifty-second year. We are indebted to the *Chemiker-Zeitung* for the following details of his life and work. Born at Jassy, in Rumania, Margosches studied at the Technische Hochschule in Vienna and, after graduation there, was appointed assistant to Prof. Donath at the Technische Hochschule in Brünn. In 1906 he became lecturer on the chemical technology of mineral oils, fats, and asphalts. He was appointed extra-ordinary professor in 1913, and in 1918 he succeeded to the chair of chemical technology. In

conjunction with Donath he carried out numerous investigations on coal, asphalt, and tar. Margosches' success in this field led to his appointment by the Austrian Ministry of Commerce as a delegate to the International Petroleum Congress, where he prepared a comprehensive report on the subject of asphalts, and he was elected a member of the International Petroleum Commission. In 1907 he began the publication of a comprehensive work on chemical analysis, which has had a wide circulation among analysts. The researches of Margosches and his pupils in the field of chemical technology, and particularly of oils and fats, led to the publication of a large number of scientific papers, many of which dealt with iodometric methods of analysis and the applicability of Kjeldahl's method of estimating nitrogen to the analysis of nitro-groups in organic compounds.

MR. DOUGLAS J. P. BERRIDGE, who died on Nov. 11 after an operation in London, spent nearly the whole of his life as senior science master at Malvern College. The eldest son of Mr. Thomas Berridge, solicitor, of Leicester, he went up to Wadham College, Oxford, and took honours in natural science in 1892. He was for a short time a master at Dulwich, before his appointment to Malvern in 1893. At that time science was almost unknown as a school subject, and Berridge was one of the pioneers of science teaching. The proposal to found a Science Masters' Association originated in 1900, when a letter was sent out from Eton to the science masters in 57 schools. The result was the Association of Public School Science Masters, which later became the Science Masters' Association. Berridge was one of the original members, and in 1907 was appointed secretary, holding the post for the maximum period of four years. He served for several years as secretary of the Section of Educational Science of the British Association, and also as recorder of the Section. To the end of his life, and in spite of serious ill-health, Berridge remained an indefatigable worker, always wanting to undertake more than his fair share of common duties in school or in committees. Enthusiastic and often inspiring as a teacher, he included F. W. Aston among his pupils. As a house-master at Malvern he quickly won the devotion of his boys, many generations of whom will remember his example with affection. Increasing ill-health finally compelled his retirement in April 1927.

WE regret to announce the following deaths:

Mr. James Edwards, curator and secretary to the late Mr. H. J. Elwes, with whom he was associated in the preparation of several monographs on the lesser known butterflies, and himself an authority on British beetles and Homoptera, on Oct. 13, aged seventy-two years.

Dr. Frank C. Wagner, president of the Rose Polytechnic Institute since 1923, known for his work on dynamo design and engine testing, on Nov. 21, aged sixty-four years.

## News and Views.

THE continued illness, and consequent physical weakness, of his Majesty the King fill the minds of his devoted people with anxiety and their hearts with deep sympathy for all the members of the royal family. During the past month the thoughts of millions of citizens at home and overseas have been turned towards the bed of sickness at Buckingham Palace, and every bulletin recording the King's condition has been eagerly awaited. It is not surprising that the very trying time through which his Majesty has been passing should have led to weakness and almost to exhaustion, but by using every resource at the disposal of modern medical science, the royal physicians have been able to maintain his strength sufficiently to justify the hope that the troublesome malady and its effects will be completely overcome, though progress towards perfect health may be slow. What we are anxiously watching is veritably a fight against disease with weapons provided by the best existing knowledge of bacteriology, radiology and electro-therapy, aseptic surgery and neurology. We cannot entertain any other thought than that through these applications of science and medical skill his Majesty will be preserved for many years yet to receive the homage of his faithful people.

SIR WILLIAM BOYD DAWKINS, distinguished in the departments of geology, archaeology, and anthropology, celebrates the ninetieth anniversary of his birth on Wednesday next, having been born on Dec. 26, 1838. We offer very hearty congratulations, in which we are sure all scientific workers will join, to this veteran of the old-time 'joyous band' of geologists. Sir William was elected a fellow of the Royal Society sixty-one years ago; his fellowship of the Geological Society is, however, of longer period—sixty-seven years, though that is exceeded in the case of Mr. Ernest Noel, who has been on the roll actually seventy-nine years, and whose age is ninety-seven. Son of a clergyman, Sir William Boyd Dawkins was born at Buttington Vicarage, near Welshpool, Montgomeryshire. Educated at Rossall, he graduated at Jesus College, Oxford, of which college he is an honorary fellow. Evincing a strong bent for geology, he obtained a post on the Geological Survey of Great Britain in 1862, remaining until 1869, when he became curator of the Manchester (Owens College) Museum, his connexion in this capacity covering a long series of years; it would be difficult indeed fully to appraise the consequent high value of his services. He is still personally concerned in the development of the institution. Sir William took up in 1874, and long held, the chair of geology and palæontology in Owens College (afterwards Victoria University). An original member (1882) of the scientific committee discussing the Channel Tunnel project, Sir William was entrusted with the geological survey of the English and French coasts. Stimulated by the researches of Prestwich, he engaged in considerations referring to the existence of coal deposits in Kent. Thirty-eight years back, in a communication to *NATURE* of Mar. 6, 1890, entitled, "The Discovery of Coal near Dover,"

the story of the enterprise was recited in illustration of the progress of a scientific idea passing through various phases. The south-eastern coalfield is now "clearly defined, and ranks among the assets of the nation" (Dawkins, 1918).

A LONG and varied list of papers recorded in the Royal Society's "Catalogue of Scientific Papers" stands to the credit of Sir William Boyd Dawkins. Chief in importance may be mentioned his series of monographs on "The British Pleistocene Mammalia," issued by the Palæontographical Society (1866-87). Wild animals, he remarks, are of equal interest to the geologist, the archaeologist, and the historian; for they afford to the first a means of classifying the deposits with which he has to deal, while in archaeology and history they bear a direct relation to the numbers and civilisation of the human dwellers in the same region. Besides the foregoing, his published works include two fascinating books, "Cave-Hunting" (1874) and "Early Man in Britain" (1880). The former treated of the formation of caves and of the light thrown by their contents on the sojourn of man in Europe, and on the changes in climate and geography. Of similar significance was his co-operation in the exploration of the hyæna den of Wookey Hole, near Wells. Sir William is Hon. D.Sc. (Oxon), and he has received from the Geological Society the Lyell and Prestwich medals. He was president of Section C (Geology) at the British Association's meeting at Bath in 1888.

THE centenary of the death of William Hyde Wollaston—a contemporary of Davy and Dalton—falls on Dec. 22. Wollaston was born in 1766 at East Dereham, Norfolk, the birthplace also of George Borrow. Although endowed with the cautious judgment of a true natural philosopher, and the manipulative skill of a wizard, he yet just missed that lofty eminence in the world of science which some of his associates attained. His interests lay mainly in the infinitely little; in a microcosm of his own making. After being educated at Charterhouse and Cambridge, Wollaston set up in practice as a doctor at Bury St. Edmunds. However, on account of his shyness and sympathy with physical suffering, he realised his unfitness for a medical practitioner. Luckily he came into a comfortable fortune, and was able to abandon medicine and devote his talents to applied science, when still as a young man he was trying to establish himself as a physician in the metropolis. In 1793 he was elected a fellow of the Royal Society—his father at one time was on its council—and throughout the rest of his life he worthily upheld the honour of that distinguished body, as a constant contributor to its publications, as a secretary, and in 1820 as interim president; he having been elected to succeed Sir Joseph Banks, but knowing Davy's ambition, he vacated the chair a few months later.

WOLLASTON'S remarkable acuteness of vision was often a topic of conversation among his intimate friends. On horseback he could detect small plants that others

could only see when dismantled and close to the hedgerows. He discovered several dark lines in the solar spectrum with his naked eyes. This attentiveness to minute things is exemplified in the construction of his well-known gossamer threads of platinum wire, and in the making of a voltaic cell in a tailor's thimble, powerful enough to raise those fine strands to incandescence. Sometimes at house parties he surreptitiously tested the range of audibility of the guests by blowing a shrill pocket whistle. His discovery of the rare metals palladium and rhodium was a direct result of superfine chemical analysis of the discarded remnants of platina residues. So extensive and generally so infallible was his knowledge of scientific matters that he was familiarly called the 'Pope.' To many of his inventions and discoveries Wollaston gave a practical and marketable form, and his periscopic spectacles, camera lucida, and reflecting goniometer found a ready sale; while his rediscovery of the art of cutting diamonds and of rendering platinum malleable greatly increased his income. He bequeathed funds and presents to the Royal Society, the Royal Astronomical Society, and the Geological Society, the Wollaston medal of which is named after him.

ON the same day that Wollaston died, Robert Blair, the first professor of practical astronomy in the University of Edinburgh, passed away at Westloch, Berwickshire, having held his post since 1785. Blair had been a naval surgeon, and was present at the action of April 12, 1782, when Rodney beat the Comte de Grasse in the West Indies, and he attended Capt. Lord Robert Manners, who was mortally wounded. The noble family to which Manners belonged, in gratitude to Blair, solicited the Crown to found a chair for him, and thus Blair became a professor at Edinburgh. The post, however, was a sinecure, with a salary of £120. The writer Doran, some years ago, said: "If Blair was not a practical astronomer he was an experimental philosopher of great repute, and his experiments and observations on the refrangibility of light excited considerable interest in his own day, and may be read with profit even now, when philosophers and experiments have equally increased." Unfortunately, few details are known of Blair's life.

At a recent meeting of the Council of the National Museum of Wales, a letter was received from H.M. Treasury intimating that the Government is prepared to make grants from the National Exchequer, amounting to £50,000, towards the cost of erecting the second section of the National Museum of Wales. This section will include the East Gallery and the lecture theatre, and will provide six additional exhibition rooms. The total cost of this further building is estimated to be £150,000. Of this sum about £50,000 is in hand, and the Treasury grant is made on the condition that the further £50,000 required will be raised locally. The Government has been induced to make this special grant with the view of affording relief to the exceptional amount of unemployment prevalent in the South Wales area, and on the understanding that the contracts will be so placed as to

employ South Wales labour, directly or indirectly, to the utmost possible extent. In spite of the acute depression in the South Wales area, it is expected that the sum required will be subscribed in a short time and so enable the offer of the Government to be redeemed. Plans, specifications, and bills of quantities for part of the work being already prepared, the Council is in a position to accept tenders for part of the contemplated building at once, and it is hoped that work will begin early in the New Year. The completion of the new wing will take about three years, but when it is erected Wales will have in its National Museum one of the finest and most up-to-date museum buildings in the world.

IN engineering industry there are unfortunately some who have initiated inventions which have proved of great commercial value, and yet have reaped little or nothing from their invention. A few take this in a philosophic spirit and are not embittered by seeing others being honoured for having taken some slight part in the development of their ideas. Occasionally we find one who takes a pride in his obscurity. He knows that he deserves well of his fellow-men. He is not blind to his own merits, and he resents being patronised by governments, societies, or individuals who know little of his work. Outsiders regard him as a hermit, or possibly a misanthrope. Luckily, however, he generally has a few friends whose appreciation he values. Such a one was Oliver Heaviside, whose life history as a pioneer has been well written by Mr. Rollo Appleyard in *Electrical Communication* for October. His invention of the distortionless circuit in telephony and the great commercial developments to which this gave rise are now well known. Many of his discoveries, however, are not so well known, the reason being partly due to a stubborn clinging to his own methods and symbols, which puts difficulties in the way of everyone who has not studied his writings closely. Some of his friends—Heinrich Hertz, for example—were well aware of this. We notice that in a letter written to him by Hertz from Bonn in 1890, he is told that it is a false pride which prevents him from explaining to others more fully how his results are arrived at. It is ancient wisdom "that the many will expect you to come to them and not come up to you, be your merits ever so great." Thus it was not for lack of good worldly advice that Heaviside preferred to travel by the difficult path he chose.

At a general meeting of the Society for the Preservation of the Fauna of the Empire which was held in the lecture hall of the Zoological Society, Regent's Park, on Dec. 10, Dr. J. M. Derscheid, of the International Informatory Office for the Protection of Nature, Brussels, introduced the late Mr. Carl Akeley's film taken in the Kivu Parc National Albert, Belgian Congo, which has never been exhibited in public. This film shows interesting scenes in the life of the mountain gorilla, and a wonderful presentment of the live volcanoes and lava lakes of the Kivu area. The Belgian Ambassador, H. E. Baron de Cartier de Marchienne, afterwards gave an address on the Kivu

national park, and expressed the hope that the British administration of the adjoining area of Uganda would declare the gorilla country on its side of the border also a sanctuary for the animals. Mr. J. Smit, High Commissioner for the Union of South Africa, described what is being done in respect of declaring game reserves and national parks in South Africa. Many farmers there are now sparing baboons, for they do so much good by destroying harmful insects among the crops, that they much more than make up thereby for the grain that they consume themselves. The meeting passed a resolution that "the Society has heard with concern and regret that an English party has left for Africa on an aeroplane alleged to be equipped for the pursuit of wild animals from the air."

THE twenty-fifth anniversary of the first controlled flight in a power-driven aeroplane, made at Kitty Hawk, North Carolina, on Dec. 17, 1903, by the Wright brothers, was celebrated at a dinner held at the Science Museum, South Kensington, on Monday last. The dinner was held under the auspices of the Royal Aeronautical Society and, most appropriately, in the gallery of the Museum where the original Wright machine hangs. Mr. Griffith Brewer, who was the first Englishman to fly with the Wright brothers and has been closely associated with them, gave a short address on their work, in the course of which he said that the Wrights, having considered fully the work of their predecessors in attempts at human flight, decided that the main problem was equilibrium rather than the application of power to wings. They built a glider, which was balanced by changing the angle of the wing tips. A long series of measurements of the lift and drag of the machine were made, in the light of which other gliders were built and tested, a wind tunnel having been constructed meanwhile in order to examine the effects of wind pressure on surfaces at various angles. Finally, the first power-driven machine was designed and built, even to the engine and propellers, and successful flight was accomplished on Dec. 17, 1903. Four flights were made before a gust of wind tipped the machine over and wrecked it, but it has recently been restored by Mr. Orville Wright, and now hangs in the Science Museum. The anniversary was celebrated at Kitty Hawk in the presence of Mr. Orville Wright and representatives of the U.S. Government and various aeronautical organisations, by the unveiling of a granite boulder bearing a memorial tablet.

As honorary president of the Edinburgh University Forestry Society, Col. F. R. S. Balfour, of Dawyck, delivered his presidential address to the Society at the University on Dec. 7. His subject was "The Trees of the North Pacific Coast of America," illustrated by a fine series of slides from photographs taken by himself. Col. Balfour pointed out that the arborescent species on the west and east of the main Continental Divide of the Rockies differ entirely; owing to a similarity of climate many of the conifers on the west do well in Great Britain, whereas the reverse is the case with the many fine hardwoods—

oaks, hickories, maples, etc.—growing to the east. Many slides were shown depicting, in their natural surroundings, exotics now well known in Great Britain, such as Douglas, hemlock, several silver firs, spruces, sequoias, and pines. Col. Balfour recalled the fact that the first knowledge in Europe of these species was due to Archibald Menzies, who was doctor on board of Vancouver's ship the *Discovery* and collected species in 1792. Thirty years later David Douglas was sent out by the Royal Horticultural Society and was the first to send home seed of Pacific coast conifers.

In speaking to the toast of "Forestry" at the Edinburgh University Forestry Society's annual dinner on Dec. 7, Prof. E. P. Stebbing dealt with the possibilities which the Benmore estate in Argyllshire, presented by Mr. Harry Younger to Government in 1925, offers as a practical training centre and research station for forestry educational centres in Great Britain. Including two neighbouring estates purchased by the Forestry Commission, the area extends to some 8000 acres, with a number of plantations of different types, forest nurseries, an arboretum, and a mansion-house capable of providing quarters and other facilities for visiting students. It is also intended to have a botanical garden at the centre, which is receiving consideration from the professors of botany of Edinburgh and Glasgow. After pointing out that many Continental European forestry schools have areas of woods attached to them for educational and research purposes, Prof. Stebbing said that it might be possible for the appropriate Government department and the heads of university schools interested to work together to develop the possibilities of Benmore. In speaking to later toasts, both Prof. Wright Smith and Dr. J. D. Sutherland, of the Forestry Commission, referred to Benmore. Prof. Wright Smith said they could not have fallen upon a happier spot in the Western Highlands, and the prospects are peculiarly attractive. There are many problems, and it is early yet to say on what lines they will develop. Dr. Sutherland said that it is the wish of the Forestry Commission that Benmore shall be made use of in every possible way for forestry and botany, and he is satisfied that those responsible will call in and be guided by those who can tender valuable advice.

THE second International Conference on Bituminous Coal began at Pittsburgh on Nov. 17. Dr. T. S. Baker, in opening it, visualised a time when the pipe for liquid and gaseous fuel and the cable for power, all obtained from coal, would displace the coal truck. He urged the endowment of research to develop coal, the "most useful raw material with which man is endowed." Many nations were represented and some interesting announcements were made. Thus Dr. C. Krauch described the results obtained by the I.G. on the hydrogenation of solid fuel. Germany has become independent of many imported raw materials—fuel oils, lubricants, fats—edible and otherwise. Thus at Leuna the annual output of synthetic motor spirit will by the end of 1929 have reached 250,000 tons. Hydrogenation has proved to be a means of



desulphurising mineral oil, and by arrangement with the Standard Oil Co., this is to be introduced into American refinery practice. At some future date such a process might be of decisive importance in refining oil from English shales rich in sulphur. Dr. Krauch advances a new theory that petroleum results from the hydrogenation of vegetable remains.

M. G. CLAUDE gave an account at the Second International Conference on Bituminous Coal of his proposals for generating power by utilising the difference of temperatures found at the surface and the sea bottom. He has constructed a model installation to show how water vapour at the surface can be expanded through a turbine and then condensed to a vacuum at the low temperature of the sea floor. Such an invention would seem to lack urgency until the world's coal resources near depletion. A. T. Stuart of Toronto returned to the advocacy of production of hydrogen and oxygen by the electrolysis of water, by off-peak current of hydro-electric stations. The hydrogen could be made available for chemical synthesis and the oxygen for other purposes, among others for the gasification of fuel. He visualises a condition where the oxygen might be had almost cost free. This suggestion is interesting, because the use of oxygen in gas-making has been repeatedly considered, but the price of oxygen has hitherto been a stumbling-block.

THE Laboratory of the Division of Animal Nutrition, the first building to be completed by the Commonwealth Council for Scientific and Industrial Research, was officially opened in the grounds of the University of Adelaide, by the Prime Minister of Australia, on Oct. 22. In this laboratory there will be carried out, under the direction of Prof. T. Brailsford Robertson, all the fundamental biochemical work upon which he proposes to base his studies of nutrition of stock, and particularly of sheep. The cost of the laboratory is approximately £14,000, and it is of two stories. On the ground floor there are a general office, recording and computing department, drawing office, dark room, centrifuge room, office and laboratory of the Chief of the Division, three laboratories for chemists, and caretaker's and store rooms. The first floor is divided into two similar portions, each containing an office for a technician and preparation room, an animal room (for mice on one side and rats on the other), kitchen, sterilising and washing rooms, and food bins. In addition to the work going on in this building, field work on sheep is in progress at the Waite Institute and also at four field stations which have been established, one some 200 miles north of Port Augusta (South Australia), another near Beaufort (Victoria), a third at Moree (New South Wales), and quite recently a fourth at Springsure (Central Queensland).

AMERICAN scientific institutions have the knack of making their annual reports interesting to a wide field of readers. This is mainly because they are engaged in a variety of exploration work and do not hesitate to describe in vivid language the adventures of their explorers in their collecting grounds, instead of simply

cataloguing the trophies of the trip. The *Year Book of the Academy of Natural Sciences in Philadelphia* for 1927 keeps up the tradition. Wharton Huber describes his observations on the habits of the birds in the Bear River region of the Great Salt Lake, where he made good use of the 'alkali poisoning' which has destroyed thousands of ducks there, by collecting from the dead and dying complete plumage series of six species of ducks which breed in the area. Clement B. Newbold clearly enjoyed his experiences in hunting Stone's sheep and the mountain goat of British Columbia for two museum life-groups. It is interesting to note that the progress of the exhibits in the museum is entirely due to the generosity of members and friends of the institution, since most of the endowment funds are restricted to the maintenance of the building, the scientific staff and the research work being conducted by them. The accounts reveal that these special donations amounted to more than £3000; the total expenditure for the year was about £18,000. Four hundred and four new members were elected during the year.

THE 'Before Easter' lectures at the Royal Institution will commence on Tuesday, Jan. 15, at 5.15 P.M., when Dr. F. A. Freeth begins a course of two lectures on critical phenomena in saturated solutions. On Tuesday, Jan. 29, Prof. J. S. Huxley delivers the first of six lectures on evolution and the problem of species; on the following Tuesdays there will be two lectures by Dr. S. W. Kemp on Antarctic whaling investigations. On Thursdays there are to be two lectures by Major Gordon Home on Roman London; three by Sir William Bragg on the early history of X-rays; and two by Prof. A. O. Rankine on physics in relation to oil finding. The Saturday afternoon lectures include four by Sir Ernest Rutherford on molecular motions in rarefied gases. The Friday evening meetings will commence on Jan. 18, when Sir William Bragg will deliver a discourse on further progress in crystal analysis. Succeeding discourses will probably be delivered by Prof. A. C. Seward, Prof. J. L. Myres, Mr. C. E. R. Sherrington, Dr. E. K. Rideal, Dr. F. A. Bather, Sir Robert Robertson, Prof. T. F. Tout, Prof. V. M. Goldschmidt, and Sir Ernest Rutherford.

PROF. G. KENIGS, professor of physical and experimental mechanics at the Sorbonne, Paris, has been elected an associate of the Royal Academy of Belgium.

PROF. EDMUND B. WILSON, of Columbia University, New York, has been awarded the Daniel Giraud Elliott medal of the U.S. National Academy of Sciences, for the "most meritorious work in zoology or palæontology" for the third edition of his "The Cell in Development and Heredity."

THE council of the Royal Anthropological Institute has awarded Rivers' Memorial Medals for 1928 to Mr. Sidney H. Ray and Mr. E. Torday. These medals are given for work in anthropology in the field of outstanding merit. The award to Mr. Ray is in recognition of his research in the linguistics of Papua and Melanesia, a subject on which his knowledge is

certainly unique. Mr. Ray was a member of the Cambridge Anthropological Expedition to the Torres Straits in 1899, of which Dr. A. C. Haddon was the leader. Mr. E. Torday receives the medal in recognition of his work in the Belgian Congo, where he conducted an expedition which collected a mass of information relating to the social organisation and religious beliefs of the tribes and brought back a remarkable collection of ethnographical objects, some of which revolutionised previous ideas of the capabilities of the African as an artist.

RECENT appointments to scientific and technical departments made by the Secretary of State for the Colonies include three assistant conservators of forests: Mr. R. V. H. Porter to Nigeria, Mr. A. K. Gibbon to Tanganyika Territory, and Mr. F. S. Walker to the Federated Malay States. Mr. C. B. Taylor has been appointed a superintendent, Agricultural Department, Nigeria, and Mr. R. H. Cowan, produce inspector in the same Department. Mr. R. M. Maynard has been appointed district agricultural officer, Tanganyika Territory. Among recent transfers and promotions notified are the following: Mr. H. A. Tempany (director of agriculture, Mauritius) to be director of agriculture in Malaya; Mr. H. B. Waters (deputy assistant director of agriculture, Nigeria) to be deputy director of agriculture, Gold Coast; Mr. G. N. A. Hall (veterinary pathologist, Uganda) to be veterinary pathologist, Nigeria. Mr. W. Allan has been appointed assistant research officer, Northern Rhodesia.

### Our Astronomical Column.

CHARACTER FIGURES OF SOLAR PHENOMENA.—The first number of a *Bulletin for Character Figures of Solar Phenomena* has just been issued from Zurich under the auspices of the International Astronomical Union. It was resolved at the Leyden meeting of the I.A.U. to publish a quarterly bulletin of solar data, so that investigators might, with as little delay as possible, be provided with daily index figures of solar activity, much in the same way that the De Bilt figures furnish magnetic data.

The first bulletin, covering the period January-March 1928, contains for each day, whenever possible (1) the relative spot numbers for the whole disc and for a central zone between the meridians  $30^\circ$  east and west of the sun's central meridian; (2) a measure of the intensity of the sun's ultra-violet radiation; (3) character figures expressing the area and intensity of calcium flocculi in the central zone of the disc; (4) and (5) similar character figures for bright  $H\alpha$  flocculi and dark  $H\alpha$  flocculi respectively. There are a number of contributing observatories, and the bulletin is compiled by Prof. W. Brunner, of the Federal Observatory, Zurich. Those engaged in tracing solar-terrestrial relationships will have a useful source of current solar data provided quarterly by these bulletins.

MATHEMATICAL TABLES.—The *Handbook of the British Astronomical Association for 1929* contains a list of tables by Dr. L. J. Comrie, chief assistant at the *Nautical Almanac* Office, together with notes and comments on the special features of each. He is such an expert in the use of tables that his experience is of great value. He himself, in conjunction with Prof. Milne-Thomson, is bringing out a volume of 4-figure tables which will be more extensive than any existing

CATALOGUE No. 510 of Messrs. Francis Edwards, Ltd., 83 High Street, Marylebone, W.1, is of bibliographic interest, being devoted to early newspapers, magazines, periodicals, and journals of learned societies. A few of the items relate to scientific publications.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A principal of York Technical Institute—The Secretary, Education Offices, York (Dec. 29). Two junior research assistants in the High-Pressure Gas Research Laboratories of the Department of Chemical Technology of the Imperial College of Science and Technology—The Registrar, Imperial College of Science and Technology, South Kensington, S.W.7 (Dec. 30). A junior lecturer in metallurgy in the University of the Witwatersrand, Johannesburg—The Secretary, Office of the High Commissioner for the Union of South Africa, South Africa House, Trafalgar Square, W.C.2 (Jan. 15). A principal of the School of Science, Technology, Commerce, etc., of the Bournemouth Municipal College—The Director of Education, Town Hall, Bournemouth (Jan. 19). A secretary of the North-Western Polytechnic—The Clerk to the Governors, North-Western Polytechnic, 3 Temple Gardens, E.C.4. A junior assistant under the Directorate of Radiological Research, Research Department, Woolwich—The Chief Superintendent, Research Department, Woolwich, S.E.18. A temporary librarian at the Leicester College of Technology—The Registrar, Colleges of Art and Technology, Leicester.

4-figure tables and will include hyperbolic and inverse trigonometrical functions.

The increasing use of calculating machines has once more brought natural functions into importance; Brandenburg, Gifford, and Hayashi have all brought out tables of this kind; the last two extend to 8 decimals. The increase of accuracy in some fields of astronomy makes this degree of accuracy advisable. Bauschinger and Peters brought out logarithm tables to 8 decimals several years ago; Dr. Comrie informs us that Peters has also prepared an 8-figure table of sum-and-difference logarithms, but this is held up for want of means of publication. The publication of the present list may be useful in such respects as this by helping to put prospective purchasers in touch with the publishers.

CAPE CATALOGUE OF 4569 STARS.—This catalogue is based on observations made with the reversible transit circle at the Cape between 1918 and 1925. Observations of the sun, Mercury, and Venus indicate a correction of about  $-0.05$  sec. to Newcomb's equinox. Similar corrections have been found at other observatories; it is not applied in this catalogue, which is still based on Newcomb's value. The stars in this catalogue are all contained in Boss's preliminary general catalogue. They show a close agreement with Eichelberger's fundamental catalogue; this is to be expected owing to the high weight given by Eichelberger to the Cape observations; many of those in the present catalogue had been used by him. The correction found to Boss's declinations between  $10^\circ$  and  $30^\circ$  north decl. is  $0.44''$ , in fair agreement with  $0.51''$  given by the recent Greenwich Altazimuth catalogue.

## Research Items.

**ELECTRICAL REPRODUCTION OF SPEECH.**—The production of sound pictures has made it necessary for research engineers to study very closely the fundamental principles of speech, hearing, and music. In the United States there is now a Society of Motion Picture Engineers, and some of the papers read before it are reproduced in the *Bell Laboratories Record* for November. Such problems as sound recording, wax recording, recording with the light valve, speed control, sound projector systems, and the fundamental principles of speech, hearing, and music are discussed in an able and interesting way. Studies on the wave forms of speech sounds have shown that the pitch of a man's voice is of the order of 128 cycles per second, whilst that of a woman is of the order of 256 cycles. In both cases overtones occur. Woman's speech is more difficult to interpret than man's. This may be partly due to the fact that it does not disturb the membrane of hearing in so many places. The more difficult consonant sounds in woman's speech are not only fainter, but also require a higher frequency range for interpretation. When by electrical methods frequencies below 100, 200, . . . 1000 cycles are progressively eliminated from speech, its character changes in a marked way. 'Timbre' or 'tone colour' best describes the characteristic lost. For the correct interpretation of speech sounds, frequencies below 300 cycles do not appear to be necessary. When frequencies above 8000, 7000, . . . 3000 cycles are progressively eliminated, the character of the speech again changes markedly. The characteristic lost may be described as sibilance. It refers to the hissing or frictional character of speech. The impairment produced by eliminating higher frequencies is generally greater in the case of female voices. Timbre seems to be more important in music than in speech. In order to distinguish the tones of various instruments, the fundamental and the first three or four overtones are essential.

**FISHES FROM THE PHILIPPINES.**—In the *Philippine Journal of Science*, May 1928, Mr. Albert W. Herre and Mr. Heraclio R. Montalban describe twenty-two species of Goatfishes (The Goatfishes, or Mullidæ, of the Philippines). This family includes upwards of forty species belonging to five closely related genera, three of which, *Upeneoides*, *Upeneus*, and *Mulloidis* occur in the Philippines. They are shore or reef-dwelling fishes found in all warm seas and living on the sea bottom, where they feel and test everything with their two long barbels as they search for food, which consists of small crustacea and fishes. All are coloured in the most gorgeous way with characteristic patterns of various spots and stripes and are some of the most striking and beautiful fishes in existence. Many of them are valuable food fishes, reaching to a size of 300 or 400 millimetres. The paper is well illustrated by one uncoloured and five coloured plates. In the same journal for June, one of the authors (Mr. Herre) deals with the Belonidæ (the Philippine Gars or Needlefishes). Like the British Garfish, the body is more or less green, the flesh and bones being green also. One species of *Ablennes* and eight of *Tylosurus* are described in detail. They live near the surface and are exceedingly voracious and carnivorous, but prey only on small fishes (chiefly atherines, anchovies, and pilchards), the gullet being very narrow. The larger gars are valuable food fishes, and may reach a length of more than one and a half metres. Also in the June number, Mr. Abelardo Valanguela discusses the composition and nutritive value of Philippine food fishes. Approximately one-tenth of all

the known fishes are found in Philippine waters, most of which are edible. From the investigation of forty species of fresh fishes, the author finds an average protein content of 20.15 per cent, while smoked or dried fish (six species) has as much as 44.92 per cent. Fresh fish has an average fuel value of 99.02 calories; smoked or dried, 237 calories per 100 grams. Some of the commoner shell-fishes were also analysed.

**INSECTS OF SAMOA.**—Since last referred to in our columns, six further fascicles of "Insects of Samoa," in course of publication by the British Museum (Natural History), have appeared. In Part 6, Fasc. 2, dealing with the Nematoceros flies, Mr. F. W. Edwards mentions that only eleven species were known prior to 1926, and with the material now available the list is raised to one hundred. He concludes that the Samoan fauna of these insects is purely of Austro-Malayan origin. Regarding the Thysanoptera (Part 7, Fasc. 2), Mr. R. S. Bagnall notes that with one exception the species either form leaf-galls on *Ficus* or are inquilines thereof, and all the species are described as new. The Geometrid moths studied in Part 3, Fasc. 3 by Mr. L. B. Prout bring up the known Samoan species of that family to thirty: they are included in eighteen genera, none of which is endemic or even restricted in its range. In Part 7, Fasc. 3, dealing with the Neuroptera, Mr. P. Esben-Petersen adds twelve species to the Samoan fauna which belong to the three families Chrysopidæ, Hemerobiidæ, and Myrmeleonidæ. He remarks that, as a whole, these insects indicate close relationship with the Austro-Malayan fauna. The Apterygota are dealt with in the same fascicle: they present no startling novelties, and Dr. G. H. Carpenter finds only eight species, of which two Thysanura and one Collembolan are new. Other reports deal with Hemiptera, Anoplura, Mallophaga, Trichoptera, Plecoptera, Siphonoptera, Orthoptera, and Dermaptera, and are written by leading specialists in the groups concerned.

**ENGLISH-GROWN PYRETHRUM.**—In the *Annals of Applied Biology*, vol. 15, No. 3, August 1928, Messrs. J. C. F. Fryer, F. Tattersfield, and C. T. Gingham contribute the first part of an interesting paper on English-grown pyrethrum as an insecticide. The use of certain species of this plant for insecticidal purposes has been known for some time, and the authors' object has been to determine whether pyrethrum grown under English conditions retains its killing powers. The species *Chrysanthemum cinerariæfolium* was grown from Swiss and Japanese seed, and the flowers from plants grown in six different English localities showed practically the same toxicity from the insecticidal point of view. Artificial drying of the flowers had no significant effect on their properties, although prolonged exposure of pyrethrum to wet conditions led to some loss of toxicity; but contrary to the usual opinion, if stored in a reasonable manner, they remained without deterioration for long periods. The data given in this paper show that pyrethrum can be successfully grown in England and harvested without loss of toxicity under our climatic conditions.

**STOCK DISEASES CAUSED BY TOXIC PLANTS.**—The importance of plants which are toxic when eaten by his flocks and herds has long been recognised by the stock-owner, and in Great Britain the yew and rhododendron are well known to be poisonous to cattle and sheep. In the Kimberley District of Western Australia a disease of the horse ('walk about disease') has been determined by Mr. Murnane and Prof. Ewart to be

due to slow poisoning by saponin derived by the ingestion of the leaves of a local plant, *Atalaya hemiglauca* (whitewood), a tall shrub or small tree with pinnate leaves belonging to the Sapindaceæ. 'Winton' disease of horses in New Zealand has been shown to be due to the ingestion of ragwort, *Senecio jacobæa*, which is likewise rich in saponin (*Bull.* No. 36, Council for Scientific and Industrial Research, Australia).

**TIMBER INVESTIGATIONS.**—The investigation work into the properties and strength of home-grown and imported timber being carried out by the Forest Products Research Laboratory at Princes Risborough has been already alluded to in NATURE. In what was designated as *Forest Products Research Project I.*, the mechanical and physical properties of timber, based on experiments with small clear specimens, was dealt with. A second pamphlet on the results attained with tests on British home-grown ash, Douglas fir, European larch, Corsican pine, and Scots pine has recently been issued under the title *Project I.: Progress Report I.* ("Tests on some Home-grown Timbers in their green condition," by C. J. Chaplin, London: H.M.S.O.). It may be suggested that a simplification of the titles of these reports would perhaps result in their being more widely read; or at any rate more readily obtained in a library or elsewhere. For example, the average member of the public, unless he had the two publications before him, would not readily appreciate the fact that the first, termed *Project I.*, and the one under review entitled *Project I.: Progress Report I.* were two different pamphlets. In connexion with the experimental work being undertaken on the above-mentioned timbers, it is stated that the object in carrying out the tests is not primarily to determine the strength of timber as used for commercial purposes (which is dealt with under another series of investigations) but to determine the strength of timber, selected free from all defects. The value of this research work, it is contended, "lies in the fact that it is necessary to select timber free from defects, termed clear timber in *Project I.*, so as to obtain data on the species that will be strictly comparable with similar data of another species." Of the five specimens dealt with, the wood of the ash came from Coleford, Gloucester; the Douglas from Taymount, Scotland; the European larch from the Forest of Dean, Gloucester; the Corsican pine from Wells, Norfolk; and the Scots pine from Bedgebury, Kent. The localities chosen for the larch and Scots pine appear to be curious. It might have been confidently expected that the latter at least would have come from Scotland, and the former from a locality where larch has been grown over a far more extensive area than has been the case in the Forest of Dean. Mr. Chaplin's work has been carried out with considerable care and the results attained are of interest.

**NATURE RESERVES IN NEW ZEALAND.**—The policy of making State-owned reservations for the protection of scenic features and the preservation of flora and fauna is steadily pursued in New Zealand. Since 1904, nearly half a million acres have been acquired for these purposes at a comparatively small expense to the State. The number of reserves is now 806, including about eleven thousand acres added during the last year. These recent additions are described in the Scenery Preservation Report of the New Zealand Department of Lands and Survey for the year 1927-28. Many of the reserves are small, and some of these are of no value for cultivation. Others are not easy of access at present, but will be appreciated as settlement increases. The supervision of most of the reserves is delegated to local authorities or speci-

ally constituted local boards. In some of the reserves there are specially appointed caretakers. The report concludes with an account of the present state of the fauna and flora of Kapiti Island, at the western end of Cook Strait.

**EXTERMINATION OF BRACKEN.**—Many acres of grassland are rendered useless for grazing in Great Britain by the growth of bracken, which largely prevents the growth of the grasses as a result of the dense shade thrown by its fronds, whilst their dense stiff foliage excludes the sheep. At the same time, the extermination of this plant, although its normal habitat may be the deeper soils of the natural woodland, presents many practical difficulties. Dr. W. G. Smith gives the results of some recent experiments upon the farm of the Edinburgh and East of Scotland College of Agriculture in the *Trans. and Proc. Royal Botanical Soc. of Edinburgh*, 30, 3-12, 1928. Cutting has proved most effective if carried out when the fronds had grown up for about seven or eight weeks. They have then taken a maximum amount of food from the underground rhizomes and not yet commenced to replenish these supplies as the result of their own photosynthetic activity. Sheep have also been induced to graze down the young fronds by dressing the ground with crushed rock salt. A hopeful preliminary experiment is also described where the young fronds were destroyed by a dressing of potassium chlorate.

**FOSSIL BACTERIA.**—In 1922, Prof. Hans Schneiderhöhn (*N. Jahrb. f. Mineral., Beil.-Bd.* 47, pp. 1-38) announced the discovery of sulphur bacteria in the Permian copper-shales of Mansfeld in Saxony. Mr. Sven V. Bergh now publishes in *Geologiska Foreningens i Stockholm Förhandlingar* (50, pp. 413-418) photographs of polished sections of Ordovician alum-shales from Kinnekulle, Sweden, seen by reflected light. They show small, somewhat rounded, fragments of bituminous substance, closely surrounded by minute grains of pyrites. These grains also occur in roughly spherical aggregates. In the opinion of Mr. Bergh, Prof. Schneiderhöhn, and some unnamed bacteriologists, these are fossilised sulphur bacteria.

**PALÆOZOIC BRACHIOPODS.**—In a memoir on *Plectambonites* and some allied genera (*Mem. Geol. Survey Gt. Britain, Palæont.*, vol. 1, pt. 6, pp. 367-527, plates 21-25; 1928) Prof. O. T. Jones describes in great detail the morphology, classification, affinities, and distribution of some late Ordovician and Silurian Brachiopods, many of which have hitherto been referred to the genus *Plectambonites* which was founded on Ordovician species. The limitations of that genus are discussed, and it is shown that the forms of later age should be separated from it. Three new genera are established, *Leptelloidea*, *Sowerbyella*, *Chonetoides*, and many new species are described. *Plectambonites* is reminiscent of *Billingsella*, and it is probable that both genera are descended from a common ancestor. The memoir concludes with two tables, one showing the correlation of the divisions of the strata from the Llandeilo to the Ludlow in Great Britain, the other giving the geological ranges and localities of the species described.

**THE ETIGO (JAPAN) EARTHQUAKE OF OCT. 27, 1927.**—Though not of great strength (intensity 9, Rossi-Forel scale), this earthquake showed some features of considerable interest. According to T. Matuzawa (*Earthq. Res. Inst. Bull.*, vol. 5, 1928, pp. 29-34), it occurred at 1h. 53m. 35s. G.M.T. The devastated region was very small, so that the position of the epicentre could be determined precisely, as in lat. 37° 27'

N., long. 138° 46' E., that is, close to the north coast of Japan, a short distance to the west of Nagaoka. At the request of Prof. A. Imamura (*Tokyo Imp. Acad. Proc.*, vol. 4, 1928, pp. 56-59), the precise levelling over about 170 miles of the Etigo province had been carried out about three months before the earthquake. It was repeated over the central area soon afterwards, when it was found that over a distance of 2½ miles, including the epicentre, there had been an upheaval of 2.1 cm. or about four-fifths of an inch. This change may be taken as wholly due to the earthquake, the first result of the kind quite free from error due to secular variations of land-level. Mr. Matuzawa has also examined the records from 23 stations in Japan (*Earthq. Res. Inst. Bull.*, vol. 5, 1928, pp. 1-28), and finds that the velocity of the earth-wave in the upper or granitic layer was 4.99 km. per sec., and in the layer below 6.4 km. per sec. The depth of the focus cannot be estimated with accuracy, but it was apparently about 12 miles.

**A NEW TRANSIT INSTRUMENT.**—Prof. C. V. Boys has designed a new type of transit instrument which embodies the principle of the diploscope in a solid prism (*Proc. Roy. Soc., A*, 121, Nov. 1). Two stellar images are obtained from the latter, one formed by two internal reflections, and the other by direct reflection from the face of emergence of the internal rays. The two images are thrown on to a moving cinema film by a long focus object glass mounted in the tubular support of the prism, and the beats of a standard clock are also recorded on the film as discontinuities in the stellar trails, produced by the controlled rocking of a plate of glass in the path of the light. Two coincidences are registered, the first with the star about 1' to the east of the meridian, and the second with the star to the same extent past the meridian. Prof. Boys has given exact details for the construction and mounting of the instrument—one of the prism's supports is a bar passing through a hole drilled in the glass—and points out that many of the troubles encountered with instruments now in use do not arise. The mechanical requirements of an absolute character are reduced to a minimum, and the crucial point would appear to be whether or not a prism of the necessary perfection for work of this type can be manufactured; a two to one ratio of the angles, and freedom from pyramidal error should each be to within 1' of perfection.

**ATTENUATION OF WIRELESS WAVES OVER LONDON.**—An interesting paper by R. H. Barfield and G. H. Munro on the attenuation of wireless waves over towns was read to the Wireless Section of the Institution of Electrical Engineers on Dec. 5. The work carried out was part of the programme of the Radio Research Board. To obtain measurements a motor van was employed with a frame coil fitted on the top as a receiving aerial. The strengths of the received signals were indicated by the deflection of a microammeter in the anode circuit of the detecting valve of an amplifier. When occasion offered, a few experiments were made on the effects of trees and wires. In most cases their proximity resulted in a reduction in the signal strength and also in a flattening of the minimum of the curve obtained by rotating the aerial coil. In one case, beneath a set of telephone wires, the minimum exceeded fifty per cent of the strength of the maximum. An interesting new radio contour map of 2 LO (London) made in March 1927 was given. The earlier map (1926) was constructed mainly by taking observations in seven radial directions at equal angular intervals round the transmitter and interpolating for the intermediate spaces. Blind directions therefore may have remained undetected.

Alterations made in the transmitting aerial also made it advisable to construct a new map. Over the greater part of the area the changes are slight. The chief point of difference is the appearance in the later survey of two distinct 'crevasses' in the contour lines in the directions west-south-west and east-north-east from the transmitting station. These are almost certainly produced by the directional properties of the 2 LO aerial, and correspond to the minima in a polar curve obtained by the authors and ascribed to mast shadow. These 'blind' directions were probably present during the earlier survey and were undetected owing to the method of observation adopted.

**WIRED WIRELESS TELEPHONY.**—In view of the increasing demands continually being made on the overcrowded ether, researches are being made for further channels for broadcasting which will not congest the ether further. So far back as 1900, Duddell realised that his whistling arc not only solved the problem of wireless telephony, but might also be utilised to transmit music, produced by a band playing in an electric lighting station, into the houses of all connected to the station, the electric currents producing the vibrations being carried by the lighting mains. This was an early illustration of 'wired wireless.' In the *Wireless World* for Nov. 14 and 21 the underlying principles of this system, sometimes called wireless wave telephony, are explained. The high frequency oscillations developed by some suitable type of high frequency generator are used. They are modulated by the currents produced in a microphone by speech or music. The resulting modulated oscillations, instead of being radiated into space from an aerial as in radio telegraphy, are introduced into a land line circuit along which they are transmitted as electro-magnetic waves. A recently suggested application of wired wireless is the broadcasting of programme matter over existing wire networks without interfering with the main services for which the wires are intended. Although at present there are few commercial applications of the method, the Western Electric Co. of America has worked out in detail and patented (Brit. Pat. 192,359), a complete wired wireless system utilising the ordinary telephone wires. Several broadcasting programmes can be superimposed on a telephone system without interfering with its ordinary use by subscribers. Electric filters are essential for this method. As a rule these are complicated and expensive. If, however, a power or lighting system like the British 'grid' were employed, these filters would be unnecessary.

**THE ATOMIC WEIGHT OF BORON.**—Briscoe, Robinson, and Stephenson (1926) concluded that the atomic weight of boron depended on its source. Their determinations involved the densities of beads of fused boric oxide and the different densities observed could not be explained by temperature changes. The *Journal of the Chemical Society* for October contains a paper by A. Cousen and W. E. S. Turner, in which these results are criticised on the grounds that the fused beads were not free from strain. The density of fused boric oxide is now found to be about 1.844, while Briscoe, Robinson, and Stephenson found it to be 1.795. Cousen and Turner show that this difference is probably due to the careful annealing of their beads, which were also prepared at a higher temperature (1400°). In view of the difficulty with which the last traces of water are eliminated from boric acid, this may further contribute to the discrepancy. It appears that the densities of boric oxide glass cannot be relied upon as evidence that the atomic weight of boron varies according to the source of the mineral containing it.

## Cancer Research.

IN the twenty-sixth annual report of the Imperial Cancer Research Fund, the Director, Dr. J. A. Murray, reviews certain aspects of the cancer problem with special reference to the contributions made by members of the scientific staff of the Fund. He points out that although cancer is at its inception a local disease, a factor of general susceptibility or resistance also plays a part in the development of, or failure to develop, a tumour. The response to a local irritation, if it occurs, is the appearance of a growth at the site stimulated; early removal will result in complete cure, even though the growth may be of a typically malignant character. Such cure is observed not only in mice painted with tar, but also in human beings, provided the operation is carried out at the earliest stages of the development of the tumour. But tarpainting only produces a neoplasm after different intervals in different mice: some fail to develop one even after a year's painting. If the growths are removed from a number of mice in which they have appeared soon after the commencement of the course of tarpainting, it is found that these animals are distinctly more resistant to a second course of tarring. A similar resistance to a subsequent course of tarring is also observed in mice which have suffered from a spontaneous mammary cancer, after the successful removal of the latter. This last experiment proves that the increased resistance is not due to a change in the cells of the skin alone, but to a general constitutional factor.

The existence of this factor of susceptibility or resistance in man is disclosed by two different sets of observations: first, multiple malignant new growths in a single individual are extremely rare; secondly, the incidence of tumours in males and females in different countries strongly suggests that a certain number of the population are susceptible to the disease, but that the actual site at which it will appear depends on factors of race and environment. In England, Holland, Japan, and Switzerland the incidence of cancer is about the same in men and women, and varies from 1.0 to 1.2 per 1000 living. In the male, however, the majority of the tumours observed are found in some part of the digestive tract: in the female the incidence here is lower, but is very much heavier in the specific sex organs, especially the uterus and breast; 20-40 per cent of all cases of cancer in women occur in these organs. Thus, so to speak, the heavier incidence in the specific female organs is compensated by a lower incidence in the digestive tract. At the same time the incidence in breast and uterus varies in different countries: cancer of the breast is commonest in Englishwomen, rare in

Japanese, and only half as common in Dutch women; cancer of the uterus is very prevalent in Japanese, but only half as common in Dutch as in English women. The lower incidence of cancer of the specific organs in Dutch women is, however, accompanied by an increased incidence in the digestive tract, so that the total mortality is about the same as in English women. These observations strongly suggest that the incidence of cancer is determined by general factors of susceptibility, but the actual organ in which it appears by local factors varying according to the environment in its widest sense.

Dr. Murray states that his colleagues have been unable to demonstrate any connexion between malignant growths and dietetic deficiencies. Old rats, or rats kept on diets deficient in vitamins A or B, frequently develop papillomata and warts of the epithelial lining of the fore-stomach, but no malignant tumour has ever been observed. He considers, in fact, that there is no trustworthy evidence, experimental, statistical, or clinical, of a causal correlation between cancer and the absence, or presence, or excess of any particular dietetic constituent, in spite of statements to the contrary frequently made.

During the year Prof. Heidenhain stated that he had been able to transmit cancer from man to animals, by injecting a large number of mice with human cancerous material. After a considerable interval a certain number of these mice developed tumours; however, the incidence of these growths was similar to that of spontaneous neoplasms in the stock of mice maintained by the Imperial Fund, so that Heidenhain's growths must be considered to be spontaneous new developments, and not as originating directly from the human material injected.

The glycolysis produced by cancer cells in the presence of oxygen does not appear to be a specific phenomenon: virus infections resulting in cellular overgrowth also show glycolysis, whilst those in which this overgrowth is absent fail to show this characteristic. It appears, therefore, that an aerobic glycolysis is not restricted to cancer, but occurs also in other types of pathological cellular overgrowth. The majority of normal tissues only show this phenomenon in the absence of oxygen.

Exposure to low oxygen pressures results in delayed growth and extensive necrosis of tumour cells, but even prolonged exposure fails to arrest the growth completely, and regression has never been observed. As a possible treatment of cancer this method is therefore without therapeutic value by itself (although it might be useful as a supplement to other methods of treatment).

## Report of the Forestry Commission.

IN their eighth annual report, the Forestry Commissioners give a record of the work accomplished in Britain during the year ending Sept. 30, 1927. The planting programme, which has formed the chief of their activities, was continued. On the subject of finance, the report shows that out of the total of £3½ millions sanctioned in 1919 for a ten years' programme to be paid before Mar. 31, 1929, £3,014,400 had been allotted up to Sept. 30, 1927, leaving £485,600 still to be provided. The Treasury had since intimated that this balance would be made available for the financial year 1928-29, which, with a balance of £136,000 estimated to be in hand on April 1, 1928, gives a sum of £621,600 for the possible expenditure during 1928-29.

The land acquisitions amounted to 36,039 acres

during the year, of which 30,755 acres were classified as plantable. The total land acquired between 1920 and 1927 amounted to 391,511 acres, of which 244,838 acres were classified at the time of acquisition as plantable; 155,208 acres of this latter land are leased and 109,630 acres have been purchased. Of the plantable area, 140,756 acres (57 per cent) are situated in England and Wales and 104,082 acres (43 per cent) in Scotland. In spite of the smaller amount of planting land in the latter, the total acreage, leased and purchased, acquired in Scotland amounts to 233,667 acres as against 157,844 acres in England and Wales. It is at least open to doubt whether the Commissioners are acting wisely in thus saddling themselves with so large an area of unplanted land in the early years of their existence.

As is well known, the main idea governing the Commissioners' work so far has been the acquisition of land and the formation thereon of coniferous plantations, the original programme being to plant 150,000 acres in the ten-year period. For reasons detailed in previous reports, there was a check in the work. The area planted during the year under review amounted to 21,963 acres of conifers. It is estimated that 135,000 acres will have been afforested with conifers by the end of the ten years, of which 90,156 acres had been planted by the end of the eighth year, with, in addition, 4130 acres of broad-leaved species (hard woods); or a total of 94,289 acres. The report adds that a total area of approximately 117,300 acres had been completed by May 1928. It was proposed in the original programme that assistance should be given, by way of grants, to local authorities and private owners to afforest areas under their control, an area of 110,000 acres being prescribed for the ten years. About 62,000 acres have been more or less dealt with, and it is hoped to achieve a total acreage of 75,000 by the end of the ten years. The work on the provision of forest worker's holdings has proceeded. The systematic formation of these holdings was commenced in the summer of 1924. Up to September 1927, 357 holdings had been completed (171 in the year under review), and 219 were in process of formation.

The cost of planting still remains very high. The report says that the outlay per acre on labour and material on the area planted between 1919 and 1927 was as follows: England and Wales, £8:9:9; Scotland, £9:10:3; Great Britain, £8:16:4. These figures include the cost of preparation of the ground, drainage, fencing, plants, planting, replacement of failures, and weeding. It is noticeable that during 1927 the expenditure on replacing failures (beating up) was something over 25 per cent of the cost of original planting, a decrease on 1926, when it was nearly 50 per cent; the figure is, however, excessive, and few private owners could undertake afforestation if they had to face so high a proportion of failures.

The Commissioners have scarcely faced the question of undertaking a part of their work by direct sowing, of which few adequate experiments have yet been made; and yet it would appear that it is in this direction that the true solution of the afforestation question is to be sought. With high planting charges and nurseries costing as much as half the total expenditure entailed on the cultural operations (£351,046 as compared with £675,889 for the eight years), it is difficult to foresee how an adequate area of forests will be obtainable with the amount of money which the tax payer is likely to be able to devote to this forestry work, necessary as it is to the future welfare of Great Britain.

### Moray Firth Fisheries.

THE Fishery Board for Scotland has recently issued two important papers dealing with commercial fishing in the Moray Firth. The first is a review of the cod-net fishing,<sup>1</sup> and the second is an account of the Danish seine-net fishery.<sup>2</sup> Prepared by so able an authority as Dr. Alexander Bowman, these two papers contain much interesting and valuable practical information. Read together, they demonstrate very clearly the great extent to which the prosecution of both cod-net fishing and Danish seine-netting has been influenced by the prevailing economic conditions of the great Scottish herring fisheries.

Between herring seasons, other work must be found for the steamers and motor craft, which need to be kept in almost constant commission to meet expenses; they cannot be laid up with the same facility as the older sail boats. Thus cod-net fishing, begun in the Moray Firth in the year 1906, attracted little attention until two or three years later, when the fact had become more generally realised that remunerative results were being obtained at a time of year when there is a general lull in herring fishing. Even then, one disastrous season in 1911 so weakened the confidence of the crews of the steamers that, in the following year, fewer steamers were fitted out for the fishery, although cod entered the area in considerable numbers. Moreover, the fact that their subsequent return to the fishery has been slow, seems

to suggest that, as yet, confidence in the method has not been fully regained.

The method of fishing by means of the Danish seine was first introduced into Scottish waters in the autumn of 1921. In that year, during the coal strike, a large number of Danish motor boats using the seine landed good catches at English ports, and even after bunkers again became available to trawlers, these small vessels proved able to compete successfully in the market. The Danish net was therefore rapidly adopted, at first by English vessels and almost immediately thereafter by a number of Scottish steam-drifters and motor boats. The vessels normally employed in the Scottish drift-net fishery being especially suitable for the use of the light Danish seine and easily convertible at comparatively small expense, both steam and motor drifters from Moray Firth were rapidly equipped with the new gear, and fishing was soon being carried on energetically in local waters. The adoption of the method was accelerated by the acute depression prevailing in the herring-fishing industry at the time. The intensity of fishing which characterised the early operations was, however, not maintained, and, in 1923, the total number of landings fell short of that of the previous year, but in the following years there was no sign of further decline. With the large number of power vessels adopting the Danish seine, it became a question of some interest whether or not the new method would supplant the older one of cod-net fishing. The innovation is of too recent a date, however, to permit a definite answer to be given at present.

### Liverpool Observatory and Tidal Institute.

AN agreement has just been made between the Mersey Docks and Harbour Board and the University of Liverpool for the administration as a single institution of the Board's Observatory at Bidston and the Tidal Institute of the University. The combined institution is to bear the name of "The Liverpool Observatory and Tidal Institute" and will

be governed by a joint committee of the Dock Board and the University.

The Liverpool Observatory was founded in 1845, and since 1867 it has been situated on Bidston Hill, near Birkenhead. The work carried on has always been intimately associated with the activities of the port, much attention being given to time-measurement

<sup>1</sup> "Review of the Cod-net Fishing in the Moray Firth." *Fisheries, Scotland, Sci. Invest.*, No. 1; 1928.

<sup>2</sup> "Danish Seine-net Fishing in the Moray Firth." *Fisheries, Scotland, Sci. Invest.*, II; 1928.

and distribution, together with the testing of chronometers and navigational instruments. Though in the past the director has always been primarily an astronomer, changing conditions have made the Observatory mainly a meteorological station with a regularly working seismograph.

The Tidal Institute was founded so recently as 1919, and its work has often been referred to in our columns.

Five years ago an agreement was made between the Dock Board and the University whereby both these institutions were placed under the government of a joint committee of the Board and University, and a large measure of co-operation has resulted. For example, the tidal predicting machine has been housed in the Observatory building, so that the major part of the work of constructing tide-tables has been done at Bidston. The new arrangement, which comes into force on Jan. 1, goes much further than this and completes the association of these two types of scientific activity. The work in meteorology and seismology hitherto carried out at the Observatory will be continued, the testing of chronometers and instruments will be undertaken, and the time-gun at Birkenhead will be fired as heretofore.

The last director of the Observatory, Mr. W. E. Plummer, died a few months ago. The new combined institution will have for director Prof. J. Proudman of the University of Liverpool, and for associate director Dr. A. T. Doodson, who will reside at the Observatory. The total scientific staff will consist of five men and three women.

### Properties of Electrons.<sup>1</sup>

**C. G. DARWIN.**—(1) On the magnetic moment of the electron. Starting from the wave equations for an electron and the associated electric density and current, it is shown how the electromagnetic fields of a moving electron can be attributed partly to the convection of electricity and partly to an intrinsic magnetisation. A geometrical construction shows the relation between the wave constants and the magnetisation. The formulæ, first worked out for slow motion, are easily generalised by relativity for high speeds, and in this case there are electric as well as magnetic moments, and various invariant properties are given.

A comparison is made between an electron wave and a light wave, and the resemblance may be loosely expressed by saying that a light-quantum is an electron without charge or mass.

(2) On the diffraction of the magnetic electron. The problem is solved of the diffraction of an electron wave by a line-grating exerting periodic electric or magnetic forces; this represents the essential features of diffraction by a crystal. The incident wave is supposed to be magnetised in a definite direction, and it is shown that, when the grating exerts only electric forces, the effect is to rotate the direction of magnetisation through a definite angle about an axis perpendicular to the incident and diffracted rays, and no polarisation can be produced by the diffraction. For some magnetic forces a similar rotation occurs, but in general the simultaneous action of electric and magnetic forces may produce a partial polarisation, though the case is too remote from experiment to be worth treating in detail.

**G. TEMPLE.**—The scattering power of a bare nucleus according to wave mechanics. A direct proof is given of Mott's result (*Proc. R. S.*, vol. 118, p. 542) on the scattering of an infinite plane wave by a bare nucleus. The accurate expression for the incident and scattered waves is obtained, together with the complete asymptotic expansion, leading to a rigorous proof of Rutherford's formula for the scattering power. The same problem is briefly considered on the basis of the relativistic wave equation, and the necessary modification of Rutherford's formula is obtained to the usual approximation, neglecting the terms involving the square of the electrostatic potential.

J. E. LENNARD-JONES AND H. J. WOODS.—The distribution of electrons in a metal. The distribution of electrons in a two-dimensional metal is worked out by statistical methods on the assumption that the assembly of electrons is 'degenerate' in the sense of Fermi and Dirac.

### University and Educational Intelligence.

**BIRMINGHAM.**—Dr. Leonard G. Parsons, physician to the General Hospital and senior physician to the Children's Hospital, has been appointed professor of infant hygiene and diseases of children.

The Council has approved an expenditure of about £300 for the preparation of a laboratory to be used specially for tissue culture in connexion with the Department of Physiology.

From October 1929 there is to be a considerable reduction of fees for engineering students.

The degree of D.Sc. has been conferred on R. H. Hopkins for contributions to biochemistry.

**CAMBRIDGE.**—Prof. Eddington, Mr. Landon, Mr. R. H. Fowler, and Mr. Rideal have been appointed members of the council of the school of physical sciences, and Sir F. G. Hopkins, Prof. T. B. Wood, and Mr. C. F. Cooper have been appointed members of the council of the school of biological sciences.

**EDINBURGH.**—At a graduation ceremony on Dec. 14, the degree of D.Sc. was conferred upon Sunder Lal Hora (Assistant Superintendent, Zoological Survey of India) for his thesis on "Ecology, Bionomics, and Evolution of the Torrential Fauna, with Special Reference to the Organs of Attachment"; and on Richard Maclean, for his thesis on "Strengthening of Certain Important Bridges of Main Line of Bombay, Baroda, and Central India Railway."

**LIVERPOOL.**—At the meeting of the Council of the University on Dec. 11, Prof. J. H. Dible, professor of pathology and bacteriology, Welsh National School of Medicine, Cardiff, was appointed to the George Holt chair of pathology.

At the same meeting Prof. Warrington Yorke, who has held the Walter Myers chair of parasitology in the University since 1914, was appointed to the Alfred Jones chair of tropical medicine as from Jan. 1, 1929.

**MANCHESTER.**—The council has accepted the resignation of Dr. Stuart Thomson, senior lecturer in zoology; Dr. Stuart Thomson has been a member of the staff of the Zoological Department since 1910.

The Council has elected the following to honorary research fellowships in physics: Dr. A. G. Bradley, Dr. Szabo V. Naray, Dr. Felix Machatschki, Mr. J. West, and Dr. W. H. Zachariassen. The following have been awarded elected research studentships: Mr. Harold Walkden (in botany), Dr. Werner Albrecht (in physics).

The Phonetic Institute of the University of Vienna has assigned tables for foreigners who wish to study their own speech by the graphic method. Four tables are now used for Czechisch, Hungarian, Yiddish, and Hindustani. Two others are available. Applications may be made to the Director, Prof. E. W. Scripture, Strudelhofgasse 4, Vienna.

<sup>1</sup> Abstracts of papers read before the Royal Society on Nov. 1.



## Calendar of Customs and Festivals.

## December 22.

ST. DECLAN.—The festival of St. Declan at Ardmore was at one time one of the most frequented and at the same time one of the most conspicuously pagan of the popular religious observances in Ireland. The holy stone of St. Declan in Ardmore Bay stood on a number of irregular stones like pillars, and could only be reached at low tide. The worshippers, who numbered thousands, passed under it three times, crawling on bare knees. Each time they emerged they struck their backs three times against the rock while they repeated Aves. They also circuted the round tower and the house in the graveyard in which the saint was buried, and kissed the stone cross.

## December 24.

CHRISTMAS EVE.—Carol Singing.—The custom of carol singing is one of considerable antiquity in the Church, sometimes in early days the office being performed by the bishop. Judging from some of the children's songs which have survived, a song of greeting or chant in addition to the cry of 'Yule' may, in northern England or Scotland, have formed part of the midwinter ritual, and there is a tradition that the Druids sang some form of chant at the cutting of the mistletoe. The boar's head was often introduced in the dining hall to the singing of a carol. In Rome it was once the custom of the shepherds of the Campagna to come in to play their pipes before the shrines of the Madonna. In England the waits were often composed of the church band or choir, and their religious character emphasised by remaining in church until twelve o'clock before going on their rounds.

## December 25.

CHRISTMAS DAY.—In the Julian Calendar the day of the winter solstice, and in the sun cult, *i.e.* *Dies Natalis invicti solis* or *solis novi*, when both in Egypt and in Syria feasts were held and a ritual observed in which the birth of the sun was hailed with the cry, "The virgin has brought forth! The light is waxing!" The identification of the god Mithra with the sun, and the spread of his worship throughout the Roman Empire, extended still further the recognition of this day as of supreme religious import. Outside the Mediterranean area the pagan festival of midwinter extended over a period of some days, as is shown by the extent to which the twelve days between Christmas and Epiphany are observed as a holiday and a time of portent; while judging from the variations in date in similar and analogous customs in different localities, it is probable that no very precise but only an approximate uniformity prevailed in the date of observance. Yet as Roman and Mithraic influence extended, there would probably be a tendency to give an increasing importance to the exact day in relation to the midwinter festival. It is difficult, however, to discriminate between pre- and post-Christian influences, and the effect of the Mithraic cult among the general population may well have been exaggerated.

There can, however, be no doubt that in the lands in which Christianity first took root, Dec. 25 was a date of great importance in pagan rites, and largely influenced the ultimate choice of that date for the celebration of the Nativity of Our Lord, although the exact date of his birth was uncertain, being placed by some authorities in April and by others in November. The festival of Christmas was not observed in the early Church, and it was not until the fourth century that it became general, and even then with some differences. By the East it was celebrated on Jan. 6 at the feast of the Epiphany, and by the West

on Dec. 25. The latter date was made universal by Pope Liberius in the year 353-4. When once the feast had been established, increasing attention was paid to it, and its especially sacred character emphasised by Christian writers in order to distract attention from the pagan observances, which bore so close a resemblance to those of Christmas that both pagan and Christian accused each other of borrowing.

## December 26.

ST. STEPHEN'S DAY.—In Germany "Der Grosse Pferdstag," a day associated with the cult of the horse, St. Stephen having been made the patron of horses. According to Hospinian, it was the custom on this day to gallop horses until they were in a sweat and then to bleed them to protect them from any disorders in the coming year. As a set practice this was said to have been introduced into Britain by the Danes. Among the Finns a piece of silver was thrown into the troughs out of which the horses drank on this day. Although it is pointed out in references to this custom that it was convenient at this season owing to the horses being at rest, a magical import is suggested by the belief that it will keep them from harm throughout the year. It may also be viewed in relation to the custom of 'Hodening' in the Isle of Thanet and at Ramsgate, where on Christmas Eve or Christmas Day a head of a dead horse was carried around on a pole by a carol-singing party. The bearer was concealed by the horse cloth, and a string was attached to the lower jaw to make the teeth snap. The hobby-horse was usually a conspicuous figure in the Christmas mumming performances.

Hence St. Stephen's Day was also associated with the chase, and was regarded as a day like Nov. 5 and St. Andrew's Day on which the game laws did not apply. A special 'Boxing Day' meet is still usual.

HUNTING THE WREN.—Although in most European countries the wren is greatly revered, and it is considered unlucky to kill it or disturb its nest, in Britain, Ireland, and France it was hunted and killed at Christmas time—on Christmas Eve, Christmas Day, and St. Stephen's Day. Its body was hung on a pole with wings outspread, and it was then carried from house to house. Sometimes those who made a gift of money received a feather for good luck. In the Isle of Man the body was buried solemnly in the churchyard at the end of the day. In the south of France the procession was headed by a 'king of the wren,' the first who had struck down a bird. The custom may be compared with those of primitive peoples in which a sacred animal is killed periodically and carried in procession, as, for example, the bear among the Gilyaks of Siberia.

## December 28.

CHILDREMAS, HOLY INNOCENTS.—A day which is reputed unlucky for all purposes, whether marriage, paring one's nails, wearing a new suit, or beginning to do anything, the explanation being that it was the day on which the massacre of the Innocents by Herod took place. The ceremony of the boy bishop sometimes took place on this day as well as that of St. Nicholas, or his jurisdiction might last until this date. In order that the day might remain fresh in memory, children were whipped on this day—a method which may be compared with that of bumping a boy's head on a stone in beating the bounds. In France it was the privilege of the young people who rose early to turn over and smack the late risers as they lay in bed. In Wales on St. Stephen's Day any one was privileged to beat another on the legs, even until the blood ran. The custom may be compared with the practice of whipping boys in Spartan religious ritual.

## Societies and Academies.

LONDON.

Physical Society, Nov. 9.—J. B. Seth, Chetan Anand, and Gian Chand: The effect of moist air on the resistance of pencil lines. The resistance of a pencil line increases when it is kept in a moist atmosphere. This change may, in certain circumstances, be utilised to measure humidity.—L. F. Richardson, V. Stanyon, and other students of Westminster Training College. An absolute current-balance having a simple approximate theory. A simple form of current-balance has been constructed which measures currents with a probable error of about 1 part in 1000. The coils are single layers, so that they can in the future be made as precise helices. The authors had to aim at cheapness rather than at perfection, and so irregularities of shape leave the current uncertain by 5 parts in 1000. A second approximation, depending on a simple deduction from Laplace's equation, corrects the elementary theory by 1.4 parts in 1000 of current.—E. V. Appleton: Notes on wireless methods of investigating the electrical structure of the upper atmosphere (I.). Various direct wireless methods of measuring the 'effective' height of the atmospheric ionised layer are discussed and compared. For a layer of horizontal stratification, and under conditions for which the influence of the earth's magnetic field may be neglected, the effective height is greater than the maximum height reached by the atmospheric ray.

Geological Society, Nov. 21.—Frederick William Shotton: The geology of the country around Kenilworth (Warwickshire). This paper completes the mapping of the so-called 'Permian' rocks at the southern termination of the Warwickshire coalfield. The strata are conformable with the carboniferous deposits on the north, and must therefore be regarded as belonging to that system. The total thickness of post-Keele carboniferous beds is estimated at about 3500 feet, with the top of the sequence overlapped unconformably by Keuper sandstone. Various subdivisions are made, the most important being a well-developed conglomerate (Gibbet Hill Conglomerate) above the Tile Hill Marl Group, and two breccia-bands at Kenilworth. The superficial deposits of the area have been mapped for the first time. They are divisible into an eastern and a western type.—Stanley Smith and Sidney Hugh Reynolds: The carboniferous section at Cattybrook, near Bristol. About 5 miles north of Bristol the carboniferous limestone rim of the Bristol coalfield is traversed by the South Wales branch of the Great Western Railway, by means of the Patchway Tunnel. In the railway-cuttings west of that tunnel, and in the adjacent brickworks, the rocks represented are the uppermost part of the carboniferous limestone ( $D_2$  and probably  $D_1$ ) and the coal measures. Red, coarsely oolitic, and current-bedded limestones, which often pass rapidly into grits, are the most characteristic rocks. The limestones contain much iron. At the western end of the main cutting the  $D_1$  beds and coal measures are brought into contact by the Cattybrook Fault, and on both sides of this for some 200 yards the rocks show an astonishing amount of disturbance. East of the fault the  $D_1$  beds are traversed by a powerful line of thrust. West of the fault the ironstone-bands in the coal measures may be crumpled up, or torn apart so as to resemble a series of isolated nodules.

Society of Public Analysts, Dec. 5.—A. Scott Dodd: The occurrence and determination of boron compounds in vegetable products. The amount of boron compounds (expressed as boric acid) found in dried raisins

and currants ranged from 110 to 260 parts per million, and in miscellaneous dried fruits from 40 parts per million in prunes to 300 parts per million in apricots and peaches. In fresh fruits the quantities varied from 31 to 62 parts per million, corresponding to 280 to 550 parts per million on the dry substance.—John Evans and A. O. Jones: Chemical tests for drunkenness: the determination of small quantities of alcohol in urine. The urine is evaporated in a current of air, and the mixture of air and alcohol vapour led into a strongly acid standard solution of potassium dichromate. The alcohol is oxidised to acetic acid, and the unreduced dichromate is determined by adding potassium iodide and titrating the liberated iodine with standard thiosulphate solution.—C. A. Adams and J. R. Nicholls: The analysis of mixtures containing acetone, ethyl alcohol, and isopropyl alcohol. Tables have been made of the specific gravities and refractometer readings of aqueous mixtures of acetone and the lower alcohols; these tables can be used for calculating the proportion of three of these ingredients, provided that one of the three can be determined by an independent method.

Linnean Society, Dec. 13.—S. L. Hora: Evolution, divergent and convergent. Variations in organisms are the result of divergence. Convergence implies resemblances which result from independent functional adaptation to similar ends. Animals living under different conditions sometimes exhibit similar modifications; but these are responses to similar factors in the environments. Attention is also directed to the communal convergence, with special reference to the body-form, of insects inhabiting torrents. Organisms living in the same environment and in response to the same element in the habitat are sometimes differently modified. Environment is the supreme master of most of the changes in animal organisation, and organic evolution is an index of the varied conditions under which life exists.

DUBLIN.

Royal Irish Academy, Nov. 30.—J. Algar and P. J. Hanlon: Dichalkones derived from diacetoresorcinol. The dichalkones described are obtained by the condensation of furfuraldehyde and of *p*-dimethylaminobenzaldehyde with diacetoresorcinol. Furfuraldehyde in the presence of boiling alcoholic sodium hydroxide yields golden-yellow plates of difurfurylidenediacetoresorcinol (M.P. 226°-227° C.). Diacetoresorcinol condenses with *p*-dimethylaminobenzaldehyde in absolute alcoholic solution, in the presence of a small amount of piperidine, to form *a*-di-*p*-dimethylaminobenzylidenediacetoresorcinol—bright-red prisms, M.P. 240°-241° C. When 80 per cent alcohol is employed as solvent, an isomeric  $\beta$ -compound is obtained—orange-red plates, M.P. 262°-263° C. Attempts to convert the dichalkones into diflavone or dicoumaranone derivatives were unsuccessful.—J. Algar and Nora M. MacDonnell: The condensation of aldehydes with nitro-diacetoresorcinol. Nitrodiaacetoresorcinol (M.P. 235.5° C.) is formed when diacetoresorcinol is treated at a low temperature with a slight excess of nitric acid in the presence of sulphuric acid. The nitro compound, when reduced by ferrous hydroxide, gives a small yield of aminodiaacetoresorcinol (pale-yellow prisms, M.P. 185° C.). It condenses in the normal way with benzaldehyde and furfuraldehyde to form dichalkones; with piperonal the condensation proceeds in a somewhat unusual way, with the production of orange-red prisms (M.P. 262° C.). This substance does not give any of the usual reactions of dichalkones and would appear to be nitro-di-3'-4'-methylenedioxy-diflavanone.

## EDINBURGH.

Royal Society, Dec. 3.—T. A. Stephenson: A contribution to Actinian morphology: the genera *Phellia* and *Sagartia*. In 1858, P. H. Gosse collected from a "rock called Proudfoot, at the entrance to Wick Bay in Caithness" (Gosse, 1860) the original specimens of *Phellia gausapata* Gosse. The author visited this rock in 1926 and collected thirteen examples of the species. The type-species of the genus *Phellia* was *P. mucrocineta*, but this has proved to be a form of *Sagartia troglodytes*, so *P. gausapata* now becomes the type-species. The genus *Phellia* is defined.—Miss S. M. Manton: On some points in the anatomy and habits of the Lophogastrid Crustacea. The Lophogastrida are the most primitive living Malacostraca. They show a simpler filter feeding mechanism than that of any other known form in that in *Gnathophausia* a maxillary filtering mechanism exists alone. Further primitive characters are seen in the form of the mandible and in the segmentation of the abdomen. The mandibles show a simpler condition than yet recognised in any Peracaridan. A seventh abdominal segment is present in the abdomen as in the embryo of *Hemimysis*, but here it is incompletely fused to the sixth segment even in the adult. With the exception of *Nebalia* these are the only living forms with the seventh segment incompletely fused to the sixth. *Lophogaster typicus*, unlike *Gnathophausia*, is a specialised form which feeds on large food on the bottom. It has lost its filtering mechanism, and the structural changes involved resemble those of the members of the more specialised groups of the higher Peracarida which have given up filter feeding.—H. G. Cannon and Miss S. M. Manton: On the feeding mechanism of the Syncarid Crustacea. The Syncarid Crustacea, *Paranaspides* and *Anaspides*, both possess two distinct feeding mechanisms, one filtratory, by which minute suspended food particles are filtered from a food current, and the other raptatory, by which large food masses are seized by the mouth parts. In this respect they resemble *Hemimysis*, and it is suggested that the modern Malacostraca evolved from a form possessing these two mechanisms. The mouth parts of *Koonunga* show no evidence of a filtratory mechanism. The filter plate of the maxilla is represented by a group of stout spines. *Koonunga* is entirely a raptatory feeder.—B. P. Weisner and F. A. E. Crew: The preparation of *p* factors: their physiological action upon the immature, mature, and senile gonad. There are two phases of ovarian activity—the first (during which ovulation occurs and oestrin is produced) is caused by a factor,  $p_1$ ; the second (during which oestrin and also betahormone is produced, so that pregnancy or pseudo-pregnancy occurs) is induced by another factor,  $p_2$ .  $p_2$  is also produced in the (human) placenta. Extracts of  $p_2$  from placenta prolong the second phase, induce the formation of active corpora lutea, etc. When administered to animals, the ovaries of which do not contain active lutein cells or corpora lutea which still can be activated, the extracts cause oestrus until sufficient lutein tissue has been formed. They have a very intensive reactivating influence upon the senile male gonad. There has also been observed a favourable influence upon the general state of the animals. These extracts are protein-free and non-toxic and can be given to human beings. (See NATURE, Mar. 31, p. 498.)

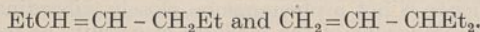
## PARIS.

Academy of Sciences, Nov. 12.—A. Lacroix: The constitution of the lavas of the island of Mehetia (Society Archipelago). Complete chemical analyses of six specimens, ranging in composition from an

ankaratic limburgite to a Labrador basalt.—J. Costantin: Appearance of argonanes on the field eryngo (*Eryngium maritimum*) in the laboratory.—Charles Richet, Mlle. Eudoxie Bachrach, and H. Cardot: The adaptation of marine animals to living out of water. The experiments were carried out with crustaceans and with fish (*Gobius*), each being taken out of the water for gradually increasing periods. The crustaceans acquired the power of remaining out of water a certain time without injury. The three species of *Gobius* also acquired an increased resistance to exposure to air.—A. Bigot: The existence of medusæ in the Bajocian of Bessin.—Blas Cabrera y Felipe was elected *Correspondant* for the Section of Physics in succession to the late S. Arrhenius.—C. Lurquin: A fundamental inequality of probability.—F. Eggenberger and G. Pólya: The interpretation of certain curves of frequency.—Bertrand Gambier: The intrinsic equation of a surface.—Jacques Chokhate: The best approximation of measurable and limited functions with the aid of polynomials or limited trigonometrical series.—K. Kunagi: An infinite number of dimensions lower than that of the space of Hilbert.—Eugène Slutsky: Continued contingent functions, integrable and capable of differentiation in the stochastic sense.—Raphaël Salem: A general property of Fourier coefficients of functions capable of summation.—Alex. Froda: The zeros of integral functions.—Armand de Gramont and Georges Mabboux: The soundness of spherical levels with bubble.—F. Bourion and Mlle. O. Hun: The magnetism of hydrated zirconia. The magnetic susceptibility was proved to be a linear function of the proportion of water present. Hence, from the magnetic point of view, hydrated zirconia behaves as a mixture of water with a feebly paramagnetic hypothetical zirconium oxide,  $ZrO_2$ .—R. de Malleman: The expression of the refractive power.—A. Travers and Malaprade: The existence of a new kind of fluoborates. Additional evidence is given of the existence of a new form of fluoboric acid, characterised by the fact that its potassium salt is soluble.—Dumanois and Mondain-Monval: Remarks on the oxidation of hydrocarbons. An account of the study of the oxidation by air, under pressure, of pentane at temperatures between 0° C. and 300° C., both with and without lead tetra-ethyl.—Frérejacque: The configuration of the trivalent nitrogen atom. The physical properties of a series of substituted amides derived from a new camphor sulphonic acid are given: the conclusion is drawn that there is no experimental reason to suppose that the three valencies of nitrogen are not in the same plane.—J. Cuvillier: The Nummulites in the Eocene in the neighbourhood of Cairo.—J. Thoulet: The cycle of the oceanic limestone.—Pierre Dangeard: Iodine volatilisation and its characters in the northern algæ. The evolution of iodine, first proved for French algæ, has also been proved for plants growing in the Arctic regions, and hence is not a phenomenon closely subordinated to the conditions of the medium of growth, as might have been expected.—Pierre Lesage: The comparative growth at Rothamsted of plants cultivated at Rennes, which have originated from seeds ripened at very different latitudes. A single generation of life at the Midi, Algiers, or at Marseilles is not sufficient to determine precocity in the north, at Rennes or at Rothamsted.—V. Hasenfratz: A principle extracted from *Sphacelae parviflora*. From the micro-analysis and characters of the small quantity of material isolated (0.7 gram) it is concluded that the substance is identical with ledol, or Ledum camphor, extracted by Grassmann in 1831 from *Ledum palustre*.—Lucien Daniel: The influence of grafting

on the reproductive correlations.—P. Lasareff: The action of alcohol on the adaptation of the eye in the course of peripheral vision.—A. V. Léontowitch: The microstructure of the nervous system (of its neurones) as a basis for the theories of conductivity and stimulation in the nervous system.—Ludovic and Pierre Blaizot: *Treponema podovis*, the pathogenic agent in the foot disease (*piétin*) of sheep. A new spirochæte has been isolated which is regarded as the true cause of the disease. Treatment of infected animals with atoxyl and with novoarsenobenzol proved that the best results were obtained with the latter substance, although in grave cases a relapse occurred after 10–15 days. It is probable that a prolonged arsenical treatment will be necessary for a complete cure.

Nov. 19.—Jean Perrin: The determination of the rôle of light in thermal chemical reactions.—Charles Moureu, Charles Dufraisse, and Marius Badoche: Autoxidation and antioxygen action. The catalytic action of arsenic and its compounds. A summary of the results obtained with twenty-two substances containing arsenic. In general, organic compounds of arsenic containing oxygen are much less active as catalysts than inorganic arsenic compounds.—A. Blondel: Remarks on the theory of oscillographs and recording apparatus.—André Rousset: The primitive of the second species.—J. Priwaloff: A general property of analytical functions.—Josef Micoláš Mohr: The determination of the apex by means of *G*-type stars.—N. Stoyko: The approximate calculation of the influence of the short period terms in the determination of time by the meridian telescope.—René Planiol: A very slightly damped pendulum. Some results obtained with a torsion pendulum (quartz fibre suspension) placed in a high vacuum.—Marcel Chopin: Control of a new method of measurement of the temperature of gases.—N. Bogoliouboff and N. Kryloff: The mathematical theory of oscillographs.—Pierre Daure: The secondary radiations observed in the molecular diffusion of light (Raman effect). A study of the effect produced with the halogen derivatives of phosphorus, arsenic, antimony, bismuth, carbon, silicon, and tin. The Raman spectra of all these elements consist of four chief lines, the characteristic frequencies of which decrease regularly with the atomic weight, but no simple law has been found to express this.—Ponte and Y. Rocard: The possible rôle of diffusion by electrons in the propagation of short waves.—Jacques Risler and Foveau de Courmelles: The action of light rays on potassium chloride. The action of potassium chloride on a photographic plate is increased if the salt has been previously exposed to light. The effect is most marked when the activation has been caused by exposure to ultra-violet light.—Charles Prévost: The action of  $\beta$ -ethylallyl bromide on ethylmagnesium bromide. Two isomeric hydrocarbons are produced in this reaction,



—Stanislas Landa: The slow combustion of triacontane. Normal triacontane,  $\text{C}_{30}\text{H}_{62}$ , slowly oxidised with air, gave fatty acids, including butyric and valeric, and a mixture of aldehydes. Neither ketones nor alcohols could be detected among the oxidation products.—Raymond Delaby and Pierre Dubois: The formation of allyl alcohol. The pyrolysis of the formins of glycerol.—Raymond Furon: The fossil delta of the Sahelian Niger.—E. Guyénot and A. Naville: The chromatic reduction in *Drosophila melanogaster* and the theory of crossing over.—D. Bach: The conditions of action of asparaginase from *Aspergillus niger*.—Albert Leulier, Léon Velluz, and Henri Griffon: The

distribution of potassium in the animal organism. There are distinct differences in the amounts of potassium present in the different forms of muscular tissue.—A. Boquet: The adsorption of cobra poison and of the diphtheria toxin by carbon. Finely divided carbon (norit) renders cobra poison innocuous; diphtheria toxin is also rapidly adsorbed by carbon and its toxic power removed.

## Official Publications Received.

### BRITISH.

The Scientific Proceedings of the Royal Dublin Society. Vol. 19, N.S., Nos. 9-13. 9: A Synthesis of 5:7:2':4'-Tetrahydroxyflavone and of 7:2':4':6'-Tetrahydroxyflavone, by Dr. Nicholas Michael Cullinane, Dr. Joseph Algar and Dr. Hugh Ryan; 10: The Estimation of Diphenylamine and Diphenylnitrosamine in the Presence of their Derivatives, by Dr. H. Ryan, Dr. J. Keane and J. Dunne; 11: The Action of Aromatic Amines on Nitric Esters, by Dr. Hugh Ryan and Michael T. Casey; 12: The Commercial Utilisation of Java Citronella Oil, by Dr. Brendan O'Donoghue, James Drum and Dr. Hugh Ryan; 13: The Action of Alcoholic Hydrochloric Acid on Methylphenyltetrahydropyrone, by Dr. Hugh Ryan and Dr. J. J. Lennon. Pp. 77-124. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 4s.

Proceedings of the Royal Society of Edinburgh. Vol. 48, Part 3, No. 15: The Invariant Theory of the Quaternary Quadratic Complex. 2: The Complete System. By Prof. H. W. Turnbull and Dr. J. Williamson. Pp. 180-190. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 1s.

Transactions and Proceedings of the New Zealand Institute. Vol. 59, Part 2, June. Pp. iv+213-428+plates 34-67. (Wellington, N.Z.) 10s.

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1154 (Ae. 319): Wind Tunnel Experiments on a Model Autogyro at small Angles of Incidence. By C. N. H. Lock and H. C. H. Townend. Pp. 61+20 plates. (London: H.M. Stationery Office.) 2s. 6d. net.

The Royal Technical College, Glasgow. Annual Report on the One Hundred and Thirty-second Session adopted at the Annual Meeting of Governors held on the 16th October 1928. Pp. 71. (Glasgow.)

Memoirs and Proceedings of the Manchester Literary and Philosophical Society, 1927-28. Vol. 72. Pp. 219+ii. (Manchester.) 12s.

### FOREIGN.

Japanese Journal of Botany: Transactions and Abstracts. Vol. 4, No. 2. Pp. iv+113-217+31-54+plates 16-22. (Tokyo: National Research Council of Japan.)

Records of Oceanographic Work in Japan. Compiled by the Committee on Pacific Oceanography of the National Research Council of Japan. Vol. 1, No. 2, October. Pp. ii+57-94+plates 16-23. (Tokyo: National Research Council of Japan.)

Verhandlungen der ozeanographischen Konferenz veranstaltet von der Gesellschaft für Erdkunde zu Berlin anlässlich ihrer Hundertjahrfeier 24-26 Mai 1928. Mit Unterstützung der Notgemeinschaft und im Auftrage des Vorstandes. Herausgegeben von A. Defant. (Ergänzungsheft 3 zur Zeitschrift der Gesellschaft für Erdkunde zu Berlin.) Pp. xiv+157. (Berlin: Gesellschaft für Erdkunde.)

Smithsonian Institution: United States National Museum. Contributions from the United States National Herbarium. Vol. 26, Part 3: Costa Rican Mosses collected by Paul C. Standley in 1924-26. By Edwin B. Bartram. Pp. vi+61-114+vii-x. (Washington, D.C.: Government Printing Office.) 20 cents.

Proceedings of the United States National Museum. Vol. 74, Art. 2: Three new Species of Two-winged Flies of the Family Bombyliidae from India. By J. M. Aldrich. (No. 2747.) Pp. 3. Vol. 74, Art. 17: New Fresh-water and Marine Bivalve Shells from Brazil and Uruguay. By William B. Marshall. (No. 2762.) Pp. 7+4 plates. (Washington, D.C.: Government Printing Office.)

University of Illinois Engineering Experiment Station. Bulletin No. 183: Tests of the Fatigue Strength of Steam Turbine Blade Shapes. A Report of an Investigation conducted by the Engineering Experiment Station in co-operation with the Allis-Chalmers Manufacturing Co. By Prof. Herbert F. Moore, Stuart W. Lyon and Norville J. Aleman. Pp. 38+2 plates. 25 cents. Bulletin No. 184: The Measurement of Air Quantities and Energy Losses in Mine Entries, Part 3. By Alfred C. Callen and Cloyde M. Smith. Pp. 61. 35 cents. (Urbana, Ill.)

## Diary of Societies.

### FRIDAY, DECEMBER 21.

EMPIRE SOCIETY (at Hotel Victoria), at 3.—P. Edmonds: Burma and the Burmese.

JUNIOR INSTITUTION OF ENGINEERS (Informal Meeting), at 7.—C. H. Hudson: Oils for Cutting and Quenching Purposes.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION (at Royal Society of Arts), at 7.30.—J. E. Tapper: Hire and Hire Purchase in Electrical Development Schemes.

### THURSDAY, DECEMBER 27.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—A. Wood: Sound Waves and their Uses (I.): Waves.

### SATURDAY, DECEMBER 29.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—A. Wood: Sound Waves and their Uses (II.): Signalling in Air and Water.