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India: The Real Problem.

THE course of events in India since the rising of the Round Table Conference in December last may well seem to confirm the opinion of those who held that little practical good was effected in the second session of that body, which lasted throughout the autumn. This view of the result of the conference was perhaps unduly pessimistic. The unexpected adherence of the Princes brought the question of an all-India federation within the range of practical discussion ; and even though the differences of Hindu, Sikh, and Moslem were not resolved, and the position of the Outcastes remains unsecured, goodwill and mutual understanding were advanced by discussion. This has been admitted by delegates on their return to India. But most significant of all, perhaps, was the final phase in which the Prime Minister seized the opportunity to make the momentous declaration on behalf of the National Government, afterwards embodied in the White Paper, that Great Britain would press forward towards measures of constitutional reform in India even though the Round Table Conference had produced no concrete proposals to meet the difficulties which stand in the way.

However strong may be the body of opinion, whether in Great Britain or in India, which doubts the wisdom of the grant of self-government to the greatest of our dependencies, the day for argument has long gone by. It is for this reason that much of the discussion on the White Paper in the debates in the two Houses of Parliament, admirable as it may have been from the constitutional point of view, seemed to be fatally out of touch with the needs of the situation, when it pressed for delay before endorsing the principles of the Prime Minister's pronouncement. The firm declaration of Great Britain's determination to go forward and the practical measure of the appointment of Committees to explore the ways to a solution of outstanding difficulties conveyed a much-needed message to the peoples of India as a whole.

This message stands in no danger of the misconstruction of weakness to which eastern peoples are prone in viewing a concession. The firm handling of the situation at the first sign of disorder on the return of Mr. Gandhi to India and the action taken against the Indian Congress and kindred associations, as well as against the so-called 'Red-Shirts', opportunely accompanied as they were by a reaffirmation of the Government's intentions in the matter of constitutional reform, served to confirm the impression which it had evidently been the intention

of the Prime Minister to create. Granted a tactful and informed handling of the problems which must come under consideration in the near future, and the position of the Indian Congress should become untenable.

It must be borne in mind, in considering the situation as it stands to-day, that of late years in India a fundamental change has come about. This is due to the growth of what, for lack of a better term, may be called a 'national feeling', so far as such a thing can exist among so many diverse peoples. In dealing with the political problems of India we are no longer confronted, as was once the case, by the political agitator only, or even by one class alone, claiming on racial, social, or intellectual grounds a predominant share in the affairs of the State. The desire for change is spread over the whole area, almost without distinction of race, creed, or tongue. In parts, the rural population, which forms the largely preponderant majority of the peoples of India, crushed by economic conditions, often unable to earn even a bare subsistence owing to the fall in prices and the low value of silver, and crippled by debt and arrears of rent, would welcome alleviation of its troubles from almost any source. It has been persuaded that relief will come with political reform. The danger is that its only hope should be in the revolutionary nostrums of the political agitator and the suggested agrarian measures which the Indian Congress, aiming at usurping the functions of the Government, has formulated. This is the India, blindly seeking relief, to which Great Britain speaks. It is the India from which she has received loyal support in the past, and will once again if the present crisis brings forth anything like an adequate solution of social and economic difficulties. But it must be said that no solution will prove adequate which is not firmly based on intensive and scientific study of the racial and sociological factors which enter into the situation.

The difficulties with which we are confronted in India are to a great extent of our own making. It is true that they are not peculiar to India. They arise wherever an attempt is made to graft European political ideas and machinery on to the social concepts of the Oriental, as, for example, in China. The strength of our rule in India lay in the loyalty of the population, and particularly of the rural population, to the British *raj* as personified in the King-Emperor, just as the personal link with the emperor was the binding force in the Chinese empire. It is often stated—usually with some air of authority—that Orientals are best ruled by an alien race. The saying has some justification, but it requires qualification. Where it has held good, acquiescence in an alien rule and loyalty to the ruler have been proportionate to the extent to which this rule has accorded with the ideas of the subject race—in other words, so long as the ruler has left their institutions and beliefs untouched. Notwithstanding many mistakes, this has been the basis of what, on the whole, has been our successful rule in India. But we have allowed loyalties to be diverted by political agitation, so that now the people no longer accept an alien rule unquestioned, even in the native States. In Kashmir, for example, the Moslem population voices its discontent against the Hindu princes whose rule it has endured for generations.

The twentieth century reaps what the nineteenth century has sown. Although the study of the languages, literature, and history of India made great strides in the nineteenth century, relatively little attention was paid to the living institutions of the people, outside those spheres in which they came into contact—it might almost be said into conflict—with the laws and regulations laid down by a European administration fundamentally from a western point of view and only gradually and slowly modified to any degree of conformity with the outlook of the Oriental mind. Such knowledge of custom and belief as was acquired by officials in the course of their duties—of necessity, they found, as an essential condition of dealing faithfully with the people under their jurisdiction—was uncoded, often lost, on their retirement, because unrecorded. The theories of Max Müller and Sir Henry Maine's studies of Indian institutions gave an impetus to ethnographical observation among the people and the record of their customs and beliefs which bore fruit in the studies of Crooke, Risley, and other workers in the latter part of the nineteenth century and the early years of the twentieth. But it was long before it was realised that these studies had any bearing upon the problems of administration, except by a few such as the late Sir Richard Temple, who had attained that knowledge empirically. It is doubtful how far even to-day it is realised how vital is the bearing of anthropological studies, not merely on the ephemeral difficulties of administrative routine, but also in the solution of the graver problems of the future of the rank and file of the Indian peoples which will arise under the altered conditions of India when, in greater or less degree, it is responsible for its own government.

Even had no other forces been at work, with

this failure to appreciate the significance of native institutions in view, it is not surprising that the development of the Indian has proceeded entirely on western lines, and that the only road open to him to progress in education, in the arts or sciences, in industry or commerce, and in political life has been directed solely towards European ideals. In consequence, advancement has been confined, broadly speaking, to the higher strata of the people, and that, too, of the urban classes. On the other hand, for the rural classes, who constitute the vast majority of the population, very little has been done by British rule to help them in any real progress towards a higher level of culture and an improved standard of life, which, it has been assumed, next to the preservation of law and order, it is the aim of good government of a people of backward culture to secure.

The more closely anthropologists study the conditions which arise when European ideas and culture come into contact with those of less highly civilised peoples, the more clearly it is appreciated that the harmful effect of the impact results from the break-up of the less advanced institutions and the emancipation of the peoples from their traditional controls. Native institutions need strengthening rather than weakening; while progress can most safely be promoted by a gradual modification of these institutions in directions which are in harmony with the temperament and genius of the people. The circumstances of India, combined with British policy, which, mainly, has been one of non-interference, on the whole have served to protect the rural population from this break-up of tradition; but there are signs of change. It is this rather than the agitation for constitutional reform that in the long run will call for every resource of skilful statesmanship.

It is dangerous to generalise in dealing with a country of so many races, creeds, and languages and so many variations in degree of culture as lie within the bounds of India. One generalisation may be made, however, with moderate assurance, and that is that the one stable political factor is the village-community. Whatever may be the type and the organisation of the village-community—and the variation is indeed wide—the social consciousness of its members finds expression, not as individuals, but as parts of a unitary organisation in which each individual has a recognised grading and a voice carrying more or less weight in the settlement of communal affairs. To a communistic mentality at home in this environment, the franchise, the supreme, and, indeed, the only expression of political individuality open to modern democracy, offers little that is comprehensible. Unless self-government in India is to become a pretence and an oligarchy in the hands of a section representing at most perhaps a tenth of the population, the problem of India lies in the development of the village-community and the mentality of its members on lines which will lead eventually to real self-government through the representation which at present lies outside their experience or even comprehension. This is a problem to which either the Committee on the Franchise or the Central Advisory Committee now set up might well direct their attention. But it may not be out of place to suggest that the skilled advice of those who have studied closely village-community organisation from the anthropological point of view should be sought. Modification of such institutions without full knowledge of their content or meaning in the life of the people has been shown by experience too often to bring disaster.

In Burma, by the reservation of the Shan States as a backward area, the reformed Government is to be relieved of the problem of its less advanced compatriots. In India it looks as if we shall pass over this problem to the governments which will succeed us. In any event, whether it should be found possible or not to develop the political sense of the people through their existing institutions, the portents are that an even greater understanding of them, such as comes from trained study on anthropological lines, will be required of the administrators of the future. This holds good in no less degree because those from whom such understanding will be demanded in days to come will be natives of India rather than Europeans. This is one of the reasons which weighs with those who think that the trend in the past has been towards the too thorough Europeanisation of the educated native of India. But to suggest that Indian education needs a new orientation towards the art, culture, history, and economics, as well as the natural history and geography of its own country and peoples, opens up a question upon which we must not dwell at this moment. For the present purpose it must suffice to point out that such a change in orientation is an inevitable and necessary condition of success in the self-government on which India is bent. Experience confirms the view of common sense that the high-class educated native of India is no more capable than the European of comprehending without close study India's infinite variety of language, race, and culture.

Back to the Land.

Rediscovering England. By Charlotte A. Simpson. Pp. 360. (London: Ernest Benn, Ltd., 1931.) 21*s.* net.

BACK we must and without delay. This book has an arresting value as a meritorious and attractive attempt to develop and encourage an interest in the countryside, now fast being buried in bungalows, tarmac, petrol pumps and pill signs; its matchless beauty by-passed out of existence everywhere, even in far Glencoe; the life-blood of its once majestic trees drained away to river and sea (seen in Greenwich Park and infested elm areas); incidentially, the phosphates are sent awash. A couple of thousand years hence, perhaps, England *will* be *re*discovered and disinterred, like Herculaneum, by its curious Mongolian possessors, who will write books, like Flinders Petrie's, in which they discuss the overwhelming evidence they have found of a once glorious civilisation becoming rapidly decadent, owing to the introduction of a debased religion, which had led to the entire neglect of the natural and the worship of brazened gods called machines. This, at the hands of a selfish, commercialised priesthood of engine-makers, working to enslave man and make him unnecessary, burying him in the pit and the town and binding him to rivers of water and of oil, instead of inspiring him to fall down upon and worship the soil from which alone he comes and can gain sustenance.

England has not yet even been discovered by the schools nor any proper desire to know it implanted in their pupils. Since cycling came in, boys and girls have learnt to read maps and cleverly use them in rushing about—to no other end. The 'muddied oaf' on cricket or football field knows clay only as dirt: in days gone by I have tested hundreds of them from public schools and found scarce one who had learnt more than that you slip upon it.

> For in the Market-place, one Dusk of Day,
> I watch'd the Potter thumping his wet clay;
> And with its all obliterated Tongue
> It murmur'd—"Gently, Brother, gently, pray!"

We thump it with plough and upon potter's wheel without thought. Now "its all obliterated Tongue" must be tended and healed, made vocal to us all. That we should only take interest in it when flung into ever-receding space in nebula and star is preposterous. As geologists cannot get us gold enough, they might well take up such lesser things and seek to make their value more plain.

Who cares to know the make-up of 'Our Realm of Albion'—how many can give an intelligent interpretation of the phrase and locate Albion-stuff?

In the school of to-morrow, when education is thought of as a preparation for life, not for an examination, maybe an arrangement will be made with the local Office of Works for the supply, at arranged intervals, of a few cartloads of road making or building material, together with gravel, sand and clay. These will be dumped in the playground and thoroughly studied. The various hard rocks will be supplied in big pieces needing to be broken to gauge: children will have an opportunity to learn what stone-breaking involves and what the feel of stones is. Clay, loam and sand will be dug over and handled. Frequent visits will be paid to local exposures. Bricks will be made. Limestone will be burnt to lime, this slaked, made into mortar and a wall built. Various rocks will also be studied in the school workshop, not in the superficial way that is now customary but measured and weighed so far as is necessary to establish their individual characters. Sections will be cut and examined under the microscope; stones will be polished and worn. The classroom will be used mainly for discussions and in writing considered accounts of the work, in amplification of notes taken while it is in progress. In this way, English will be taught by the Squeers method: after all the only sane method. Unless instruction of this order be given in the near future, no God will be found to save us.

We have less to consider what is in Miss Simpson's book than the vision it calls up of the vasty deep of ignorance before us, of what might be and what should be in the now empty pates of those who scorch—or even hike—through our highways and byways. Hiking is sure good for the muscles and lungs—what of the soul? We wonder what the average talk of the hiker is—the proportion of 'eyes' to 'no eyes'.

The authoress—it is a mistake to speak of a woman writer as 'author', the words are not synonymous—is lecturer in geography at Warrington Training College, Liverpool. Her book is welcome evidence that the teaching of the subject is at last coming into enlightened hands and tinged with geology. Although geology is the one and only possible foundation of a true geography, the subject is scarcely if ever mentioned in most schools. Where taught, it is taught apart and mostly at the desk. Years ago, visiting a noted school, which

professed to teach geology and gave the subject its room, injudiciously inquiring what sections in the district—one rich in outstanding examples—had been visited, I discovered that it was only a four-wall subject. I have never 'acquired merit' in my own estimation so much as when I was able to couple geology with geography upon the first plans for the recently erected extension of the science buildings at Christ's Hospital School. The two names now appear together upon several class-room doors. Has such happening ever been before? Still, I doubt if I shall live to see the children swarming about my heaps o' stones in the yard and the teacher with the *nous* and enthusiasm to conduct the worship; I say children, because such work must be begun in the preparatory school and ever afterwards continued.

A true geography is now coming upon us, through the enlightened enterprise of the railway companies and also through the publication of often most admirable large scale reproductions of photographs in the press, especially the *Times*, which is setting a great example. One of the first, if not the first, of the magnificent half-page pictures published in that journal, was that of the southern end of the Jaws of Borrowdale, which I had sent to them at the time when we were trying to prevent the desecration of the valley by the soulless engineer on behalf of the road-hog, unfortunately, without effect. The memorial 'mutton-back' we desired to save from further injury is figured by Miss Simpson, as it was before the snout was wickedly blasted away.

The pictures we now get in the press are some consolation. Yet they are apt to be misleading, though good in form, owing to the vagaries of the modern over-corrected photographic plate, which now has a nasty trick of rendering yellow and red in white. This distortion was specially noticeable in the striking picture of the Sidmouth coast published in the *Times* of Oct. 24. Perfect in outline and as a panorama, the entire stretch of coast appeared white as if it were chalk. Actually, only the far-distant corner, Bere Head, is Chalk rock; the rest is a deep red, capped by yellow Greensand and a final, scarcely perceptible thin layer of chalk east of Sidmouth. The Southern Railway displays a magnificent poster of South Devon, giving the true appearance of the red rocks; in another, the junction of the chalk with the New Red beds is strikingly shown.

The photographer of coast scenery to-day needs to have the geologist's eye and must choose light, plate and screen with considered care. An invaluable series of posters is now being produced by the railway artists, showing that they are most accurate observers not only of form but also of geological character as shown by colour. At the recent Faraday Exhibition, at the Albert Hall, as one illustration of the use now being made of colours derived from Faraday's benzene as printing inks, at 'The Sign of the Hexagon', a particularly fine series of posters was arranged along 36 feet of the screen at the back of the stand, showing how geology may now be studied *from the railway platform*: colour chemistry, too, if you will.

No school should be without these posters; it would be to the advantage of the railways to put themselves in communication with the schools, so as to provide these regularly with appropriate issues. The Empire Marketing Board might join in the game. Foreign posters might be included: though often flamboyant and misleading in colour, these are faithful in form and very attractive. If children saw posters at school, the question 'where to go in the holidays' might often be answered with intelligence—not so frequently from the Lido point of view, perhaps, though some companies seem to favour the display of muscular femininity rather than of scenic beauty.

Consider the effect of using the railway posters systematically. We have quantities of sand everywhere upon our island shores, upon which spade and pail are most deftly used by multitudinous young urchins during the holidays: the children are patently full of an inquisitive intelligence, yet when they go to school they take no further interest in the material which we are told forms at least 60 per cent of the crust of our earth. I have suggested above a way of continuing the spade drill; the pail should also not be forgotten. Picture the joy many youngsters would have in helping to boil down pailfuls of sea water and extracting the salts systematically. The discovery that there are so many different things in sea water is itself a revelation. Suppose the study of sand and sea were thus quietly continued at school, young people might go to the seaside not only with minds but with minds really prepared to find "sermons in stones"—an art that has made little popular progress since melancholy Jacques advocated its practice: notwithstanding the money lavished upon our schools and the attention nominally given to Shakespeare.

The mental vacuity of the average seasider is delightfully pictured in "A Fortnight in September" by R. C. Sherriff, though reflection falls upon the literary interpreter in putting no high lights into

his picture. Surely there are thrills to be got out of the rocks. Are the word purveyors, the Aldous Huxleys, ever to wander in realms of merely euphonious expression? Will they not learn something of Nature outside man and lead him to see that he may sometimes adventure with profit away from himself. Have their forefathers lived to so little purpose that they have no care for real culture? The broad culture that I heard Huxley advocate, full fifty years ago at Birmingham, is no more come upon us to-day than it was then—the literary mind seems to be ascientific, in the Huxley sense: it lives only in the lilt of words: so, the sooner we decide to depose it from our schools the better: down to Nature, back to the land, we must in some way go. We must learn to lime our souls as well as our soils: "Lime!" I hear the young Huxley say, "What is lime?"—as if it were a carminative! He inherits no interest in it.

Miss Simpson would make geo-topography—not geology—the key-note to the development of the countryside. Unfortunately, she flings only scraps of geology at her readers. Most will have no fundamental earth-knowledge. It is this fundamental training that is so necessary and so lacking to-day. Rocks must have been hammered off and handled: sections visited and photographed: the nature and worth of fossils and of stratigraphical relations, the character of soil, realised. There must be clear elementary understanding of the chemical nature of sedimentary and igneous rocks. It is pleasant enough to speculate why this village is on the hilltop, that in the valley below: this, however, leads nowhere.

Our business to-day is to understand the ground upon which we live, sufficiently to use it to the general good; we need to extend our view to the Empire, if we are to avoid making endless mistakes. Some day Australia must awaken to the importance of the study and see how much of the land is not habitable.

Far too much is attempted. The book is one to be read with interest and profit but not as a guide to methodical study: in fact, as in all our attempts at didactic, scientific writing, the intellectual process is in no way made clear that we aim at developing by observational and experimental study. The illustrations are exceptionally good and sometimes really beautiful—that of the Stroud valley from Burleigh, for example. It is a pity the authoress does not give us more of her own work—the example at p. 151, "A Cotswold Barn", is definitely a work of art.

The book is also full of literary charm—though this side is a little overdone. Still, to have brought "Defoe's Tour through Great Britain" to the fore is no slight service. Strange to say, Charles Kingsley's "Lectures on Town Geology" nowhere finds mention: it is the one book into which method enters; the book of scientific essays in which it appears should be studied by every teacher of geography. The use made of the pictures is sometimes far from what it might be, if not misleading. On p. 189, for example, a photograph is reproduced of Grange, Cumberland, showing the bridge over the Derwent at the foot of Borrowdale: it is one of the best of its kind I have ever seen. The reference (to glaciated country) is as follows:—

"The most casual visitor and lover of scenery will notice the boulders of different shapes and sizes scattered over the hillsides, obviously brought from a distance and dropped there by some means which no longer exists. Also many rocks partly embedded in grass or bracken have their surfaces rounded and smoothed as if by something of the nature of sandpaper passing over them. One of these is shown in Fig. 32, between the village and the bridge."

Grange is conspicuously free from scattered boulders. The rock referred to, just behind the bridge, at the far end adjoining the cottage, is noted among geologists. It is part of the general rock mass, not an embedded rock: glaciated over the whole of its surface, down to its base below water in the shallow stream, it is clear evidence that the rocky river bed has remained unworn and unaltered in level since the Ice Age, whenever that may have been. Unique in its way, it should be scheduled as a national monument, so that it may be protected against any and all future disturbance.

In adding, in a pocket, a copy of the Geological Survey map, beyond question the most wonderful map in existence, Miss Simpson has done notable service.

Whatever the shortcomings, the book is to be commended as a whole-hearted attempt to further the study of a neglected and undeveloped subject. In making an appeal to headmasters, thirty years ago, I quoted words used by Matthew Arnold:—

"The want of the idea of Science, of systematic knowledge is . . . the capital want of English education and of English life."

He would say this to-day, if with us. We have still to follow the advice he gave in 1886 in saying—"the ideal of a general liberal training is to carry us to a knowledge of ourselves and the world. . . ."

This is geography *in excelsis*—in its every mood and tense, a subject as yet unrecognised in the

schools. Our architects to-day have so little æsthetic feeling, they are so rigid in their outlook, that in the buildings they erect, talk is becoming a mere clatter of noise: modern building involves rejection of the brick and of the human hand and is soulless in its lack of softness; even the mortar is a hard synthetic cement. In like manner, the 'science' of the schools is mere clatter of noise. Having done so much to paint our globe red, it is time that we took up the serious study of at least the reddened areas: if we do not, we may easily lose both them and ourselves.

HENRY E. ARMSTRONG.

The Constitution of the Human Body.

The Physical Basis of Personality. By Prof. Charles R. Stockard. Pp. 320. (London: George Allen and Unwin, Ltd., 1931.) 12*s.* 6*d.* net.

ALTHOUGH Dr. Charles Stockard, professor of human anatomy in Cornell University, has given the title "The Physical Basis of Personality" to the book under review, it is in reality an important contribution to our knowledge of the physiological and developmental processes concerned in the shaping of the human body. Under the action of these processes human types are moulded, and new races and species are ultimately produced. The author explores the machinery of evolution from a new angle. His primary purpose is to explain, not the resemblances which link one man to another, but the differences which distinguish every individual born into the world from all other births—past, present, and future. It is an explanation of the 'uniqueness' of every birth and of the manner by which every human being comes by his or her 'individuality', 'personality', or 'constitution' that is Prof. Stockard's quest.

Prof. Stockard's search carries him first to the 'physical basis of heredity'—the chromosomes of the fertilised egg. He reads into the human egg what has been learned from the egg of the fruit fly —*Drosophila*. Personality, he holds, is determined as soon as the chromosomal constituents of the male and female elements have become assorted in the fertilised ovum. He then turns to experimental embryology to discover how the qualities inherent in the chromosomes of the fertilised egg become manifest or are 'expressed' during the earlier stages of development. He comes to the conclusion that although the basis of personality is already present in the egg, yet the expression of all the potentialities depends on 'environment', particularly on the 'internal environment', which in the case of the embryo is the fluid by which its cells are bathed and nourished. Prof. Spemann's researches have thrown a flood of light on the nature of the internal environment. The tissue fluids of the embryo are charged with substances which act as 'organisers'. From fertilisation to death in old age the internal environment is ever changing; hence 'personality' is never fixed; it alters in every decade from childhood to adolescence and from adolescence to serene old age. Prof. Stockard concludes that the personality of every man and woman is determined by the interplay between their chromosomal potentialities and the environment which these potentialities meet with when seeking for expression. External environment is effective only when it can alter the internal environment and constitution of the individual.

The best parts of this book are based on investigations carried out by the author himself. Prof. Stockard was bred in the orthodox school of reconstructional embryology and continued in the straight anatomical path until 1907, when he had his first lapse into experimental embryology. By hatching eggs of the minnow in sea-water, to which he had added a certain percentage of a magnesium salt, he produced one-eyed and other monstrous forms. He was thus made to realise the importance of internal environment. After a brief interlude spent on the study of regenerating tissues, he again resumed his inquiries into the influence of internal environment. Alcohol was the agent he selected for experimental study. He subjected guinea-pigs, generation after generation, to an over-dosage of alcohol, to ascertain whether or not their germplasm was thus damaged. Although in the earlier generations there was a high mortality of the young within the uterus, the ultimate result of the experiment was the production of guinea-pigs as sound as the original breed. He then resumed his studies in experimental embryology, amplifying and exemplifying Wilhelm Roux's conception of the 'struggle for expression' which goes on between the developing parts of an embryo.

Then, in 1921, Prof. Stockard struck into another field of inquiry, and obtained results which form a large part of his present book. He became interested in the tissue fluids—the 'internal environment'—not of the embryo and fœtus, but of the growing child and matured adult. Starling's demonstration that growth-controlling substances —hormones—circulate in the tissue fluids, and the belief, acted on by medical men, that growth

disorders of the human body are brought about by a break-down in the normal interplay of the glands of internal secretion, led Prof. Stockard to seek for means of putting these beliefs to the test of experiment. The breeds of domesticated dogs seemed to offer ideal opportunities for his purpose. Dog fanciers, quite unconsciously, have exploited the growth-controlling or hormonic systems of the body to produce the various known breeds. Prof. Stockard regards the Irish wolfhound as the plain (non-acromegalic) form of canine giant; the blood-hound and St. Bernard show the features met with in human acromegalic giants; the mastiff has the qualities of simple acromegaly; toy breeds are canine counterparts of human dwarf-midgets. The British bull-dog, the dachshund, and the griffin reproduce the various forms of achondroplasia met with in all races of mankind. To exploit this new field Prof. Stockard found it necessary to add to his anatomical department a farm for experimental morphology.

It is not necessary to review the results which Prof. Stockard has obtained at his farm. Two matters, however, are too important to be passed over. He has found that there are exceptions to Dollo's law of the irreversibility of evolution. He has succeeded in bringing back, to the feet of guinea-pigs and dogs, digits which were supposed to have disappeared for good. The 'genes' responsible for the missing digits must still be latent in the germinal chromosomes. He finds, further, that growth control involves two factors—a local factor inherent in the organ or part, and a circulating factor, a hormone. Further, however much the internal environment may be changed, the inherited influences, conveyed through the germinal chromosomes, are dominant in determining the form of growth. In this connexion, however, it must be remembered that the 'organisers' of the embryonic body and the hormones of the growing child are also the results of influences which are transmitted through the chromosomes of the fertilised ovum.

There is one important contribution added to our knowledge of evolution since Prof. Stockard wrote this book, which will certainly lead him to modify one of his statements. He accepts the conclusion reached by Sir Francis Galton, namely, that "all families and stocks have a strong tendency to return to the mean of human ability, mediocrity". If this were really true, it is difficult to conceive how the evolution of a new type or of a new species would ever have taken place. Prof. Karl Pearson has proved (*Annals of Eugenics*, 1930, vol. 4, p. 1) that in an isolated community, of any kind of living things, the tendency is not to return to mediocrity, but for the qualities with which the community was originally endowed to become ever more intensified. Prof. Stockard's own experiments seem to support the law of Pearson rather than that of Galton.

Prof. Stockard is a human anatomist of a new kind. He seeks to unravel the problems of morphology by an appeal, not to the dead, but to the living body. His "Physical Basis of Personality" must be recognised as one of the most important contributions which has been made in recent years to our knowledge of the biological processes concerned in the evolution of humanity.

A. KEITH.

The Metallic State.

The Metallic State: Electrical Properties and Theories. By Dr. W. Hume-Rothery. Pp. xx + 372. (Oxford: Clarendon Press; London: Oxford University Press, 1931.) 25*s*. net.

IT becomes increasingly difficult to-day to work contentedly at any one corner of knowledge, unrecking of the repercussions between the different branches of science; moreover there exist borderline regions, the successful cultivation of which demands an intimate acquaintance with the facts and theories of two or three branches of science. At the same time it is not easy to take a catholic view—the enormous mass of accumulated facts, increasing in a manner which reminds one of the expanding universe, drives us, in despair of ever coping with them, back to the position of the specialist, cultivating our corner, perhaps not so contentedly, as we muse upon the inter-relations which we are perforce ignoring.

Metallurgy, and the relevant parts of physics and chemistry, exhibit very markedly the confusions and difficulties which arise from this lack of collaboration. As Dr. Hume-Rothery points out, the practical metallurgist, interested in the properties of metals of commercial importance, has amassed a large amount of information which is not, however, seen against a background of general principles, and in particular has not been correlated with the regularities of the periodic table. The physicist, who has made most precise measurements of the thermal, electrical and elastic properties of metals, has not merely ignored the periodic table, but, "out of touch with scientific metallurgy", has carried out "much experimental work of the highest quality . . . on specimens

which any scientific metallurgist would have condemned as unsuitable ".

All the more grateful should we be to him who, possessing the necessary qualities of detailed knowledge and philosophic breadth of view, essays this task of correlation and carries it to a successful conclusion, as Dr. Hume-Rothery has certainly done. He is at once encyclopædic and eclectic; encyclopædic, inasmuch as, even where little information is available in the book, he provides us with 'pointers' which serve to show where that information may be gained; eclectic, in that he chooses for detailed description certain parts which presumably are most to his personal taste, as they are obviously written *con amore*. It must be confessed that he has, for the most part, chosen well and wisely.

The book is divided into two sections—the first section dealing with the experimental facts, the second with the various theories that have, from time to time, been propounded to correlate these facts. Detailed discussion of experimental technique very properly finds no place in Dr. Hume-Rothery's scheme; none the less, as we have just remarked, he gives ample references for those who wish to study experimental methods. The first section, which occupies rather less than half the book, contains chapters dealing with the electrical conductivities of pure metals, primary metallic solid solutions, secondary solid solutions and intermetallic compounds. The facts dealing with the effect on resistance of temperature, pressure, and of stress and deformation are very fully and clearly stated, and space is found for a fairly detailed account of galvano- and thermo-magnetic effects. The thermal conductivities of pure metals and of alloys are next discussed, and the effects of temperature, pressure and deformation are described. Chapters on thermo-electric properties, emission phenomena and contact electricity complete this section.

It will be seen that Dr. Hume-Rothery has omitted all consideration of the facts connected with specific heats. The omission is deliberate, inasmuch as "these are dealt with in most books on Physical Chemistry". But similar remarks may be made concerning most of the sections with which Dr. Hume-Rothery has dealt. After all, it is the angle of outlook that matters, and we trust that, in the next edition of his book, the author will reverse this decision, and will give us a résumé of specific heat results as clear as those dealing with the properties just mentioned.

It is pleasant to note that, in a book which carries us to the confines of existing knowledge on the subject, Dr. Hume-Rothery, with the instinct of a teacher, is not afraid to begin at the beginning. Thus his chapter on thermo-electric properties begins with an admirably simple discussion of the fundamental phenomena, which may be read with profit by the general student. Concerning this discussion, attention may be directed to one point which is commonly overlooked in the elementary thermodynamic treatment of the matter. The thermo-electric electromotive force *E is a property of the whole circuit.* If now we attempt to establish the equations of the circuit by assuming that the cold junction is kept at a constant temperature T_0, and that the hot junction, originally at T, is raised to $T+\delta T$, the differential coefficient $\delta E/\delta T$ is certainly not a property of the whole circuit. The point is subtle, and neglect of it has given rise to considerable confusion. The whole matter was very fully discussed by Prof. A. W. Porter in his presidential address to Section A at the Glasgow meeting of the British Association.

In the second portion of the volume Dr. Hume-Rothery has been faced with a task of more than ordinary difficulty. Here again he has resolved it by beginning at the beginning, a method which, although it involves a certain amount of repetition and of discussion of discarded theories, is more likely to beguile the reader up the steep slopes, "with learning put lightly, like powder in jam", than is the opposed process, not uncommon nowadays, of plunging him "directly into the strange conceptions which are resulting from the new quantum mechanics".

In this section, then, the first chapter deals with Drude's simple free electron-gas theory, the second with the older complex gas electron theories. Chap. iii. gives a brief conspectus of certain 'intermediate' theories, including Thomson's di-pole theory, and the theories of Wien and Grüneisen, of Bridgman and of Hall. Chap. iv. is concerned with Lindemann's electron-lattice theory, and Chap. v. with the Sommerfeld theory. The concluding chapter contains, *inter alia*, an admirable section on the periodic classification, and in an appendix is given what is, in effect, a translation of Bloch's paper of 1929, in which the motion of the free conductivity electrons is supposed to be a motion in a periodic field of force of period that of the atomic lattice.

Dr. Hume-Rothery has given us a thoughtful and well-ordered survey of a more than ordinarily difficult region. His book may be unreservedly commended.

ALLAN FERGUSON.

Short Reviews.

Air Ministry: Meteorological Office. British Rainfall, 1930: the Seventieth Annual Volume of the British Rainfall Organization. Report on the Distribution of Rain in Space and Time over the British Isles during the Year 1930 as recorded by over 5000 Observers in Great Britain and Ireland. (M.O. 335.) Issued by the Authority of the Meteorological Committee. Pp. xix+292. (London: H.M. Stationery Office, 1931.) 15*s.* net.

THIS volume contains maps, tables, and descriptive matter in the usual form, together with special articles on the exposure and shielding of rain-gauges at Penrith and Hythe, on measurements of wind velocity at the level of a rain-gauge, on the Jardi rate-of-rainfall recorder, and on cloudbursts on Stainmore in Westmorland.

For the British Isles as a whole, the rainfall of 1930 was 115 per cent of the average, the year being the eighth wet one in succession, though over a small part, including the Thames Valley, it was drier than usual. There are two outstanding events to note. One was the sustained torrential rainstorm on July 20–23, when 11·97 inches was recorded at Castleton, near Whitby, in Yorkshire, resulting in great damage to bridges in the valleys of the Esk and Leven. In regard to this storm, the geographical reader will not be pleased to see the country behind Whitby repeatedly referred to as the Wolds instead of the Moors. The Wolds, terminating in Flamborough Head, are the most northerly extension of the English Chalk system, and are separated by the Vale of Pickering from the very different country formed of the Jurassic rocks to which the North Yorkshire Moors belong.

The other event was the cloudburst in Westmorland on June 18. On this day, when violent thunderstorms were fairly widespread, there broke over Stainmore Forest, at the southern extremity of the Cross Fell range, one of those formidable storms of the 'cloudburst' type which, as records show, are relatively common on the high fells of northern England. Peat was removed from several acres of moorland, leaving deep scars on the hillside, the debris causing quantities of fish to be suffocated lower down in the River Eden. Mr. F. Hudleston, who describes the occurrence, says that the moors appeared to lie under a sheet of water and that something in the nature of a water-spout, from the sudden collapse of a heavily charged cloud, must have developed over Knipe Moor, where the holes were dug out.

L. C. W. B.

Die tierischen Schädlinge des Ackerbaues. Von Sofie Rostrup und Prof. Dr. Mathias Thomsen. Nach der vierten dänischen Auflage ins Deutsche übertragen und für die deutschen Verhältnisse bearbeitet von Dr. H. Bremer und Dr. R. Langenbuch. Pp. xi+367. (Berlin: Paul Parey, 1931.) 18 gold marks.

THIS well-produced book, dealing with the animal pests of agricultural crops, forms a thoroughly reliable and up-to-date manual on the subject. It is a German translation of the fourth Danish edition of the same authors' "Vort Landbrugs Skadedyr" (1928), with certain additions and amplifications in order to adapt it to German needs. The number of illustrations has also been increased. Although specially written for continental readers, this book will be found to include very few pests that are not concerned with some form of crop injury in Britain. It is, therefore, a volume which can be consulted with profit by workers and students in Great Britain. The bulk of the letterpress is, naturally, devoted to destructive insects, and other arthropods, but there are also chapters dealing with Nematoda, Chætopoda, and Mollusca.

The method adopted is to treat of the individual pests by the orders or groups to which they belong. Each species is briefly but concisely described, its biology is discussed, and standard control measures explained. These accounts are clearly written in a terse style and most of the species dealt with are very well illustrated, with figures portraying the characteristic injuries they inflict. At the end of the book there is a tabular summary of the different pests arranged upon a crop basis. As a kind of appendix there is a short, but useful catalogue of modern literature classified under the names of the pests concerned. All concerned in the production of this volume are to be congratulated upon its general excellence.

A. D. I.

The Official Year-Book of the Scientific and Learned Societies of Great Britain and Ireland: a Record of the Work done in Science, Literature and Art during the Session 1930–1931 by numerous Societies and Government Institutions. Compiled from Official Sources. Forty-eighth Annual Issue. Pp. vii+171. (London: Charles Griffin and Co., Ltd., 1931.) 10*s.* net.

THIS valuable annual consists of a classified collection of the names and addresses of learned societies, with information as to officers, conditions of membership, meetings, publications, etc., and particulars of scientific institutions controlled by Government in the British Isles. Where publications are of the nature of reports on specific subjects or special lectures, the titles are in many cases given. Brief accounts of the history and work of certain institutions are also included. The information printed is provided by officials of the bodies concerned.

In the course of the forty-seven years of its existence, the "Year-Book" has grown, and last year the publishers announced that they proposed to economise by omitting lists of papers read before societies. This has been done in the present issue, and in consequence the subtitle should have been revised. That the change has made a substantial difference is evidenced by the fact that the volume is less than half the size of last year's issue and that the price is also substantially less. We believe that the volume in its new and abbreviated form will be welcomed, with few regrets for the omissions, and we are grateful to the publishers for retaining the characteristic and substantial binding.

Field Anthropology in Central Australia.

THE continued opening up of the central regions of the Australian continent is rapidly diminishing the opportunities for carrying out research on living Australian aborigines under their natural conditions.

The Board for Anthropological Research of the University of Adelaide has, for a number of years,

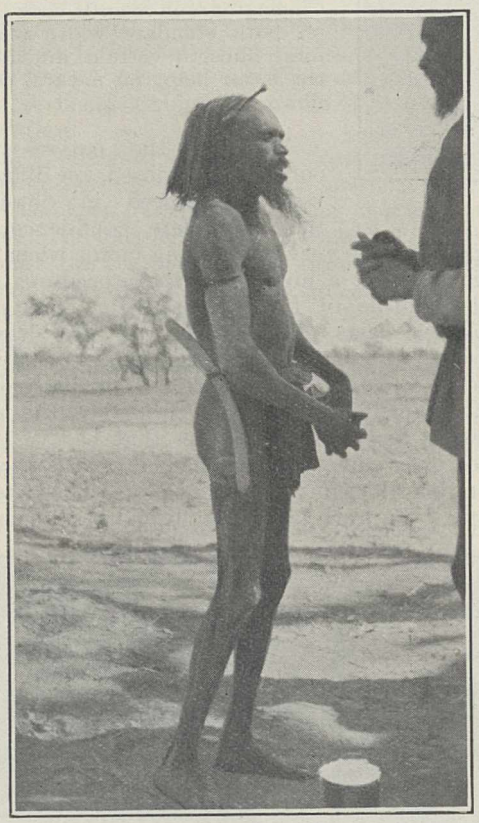


FIG. 1.—A typical bush native. Note the scars on his thigh, and the hairstring around his head, arm, and waist.

organised annual expeditions to obtain information on various aspects of aboriginal life, but concentrating more particularly on physical and physiological anthropology. The expenses of these investigations have been met, for the greater part, by funds generously placed at the disposal of the Australian National Research Council by the Rockefeller Foundation for such purposes.

The time available for this work is limited to the University vacations, falling in the more temperate seasons of the year, and it has been found that, for short periods, the most efficient and economical method of securing the desired information is by means of team work. By this method, the personnel consists of men experienced in the proposed sections of work, each worker concentrating intensively on his own special province of research. By standardisation of the work and methods of observation a considerable mass of data is recorded in a relatively short time.

There was an expedition in August 1931 to Cockatoo Creek, situated about 185 miles northwest of Alice Springs in Central Australia. As in several previous and similar expeditions, the South Australian Museum co-operated with the University, and its representatives directed their attention to work in which they were specifically interested.

The party journeyed from the rail terminus at Alice Springs, about a thousand miles north of Adelaide, by motor transport, consisting of two motor trucks and two cars, and a further two hundred miles over the mulga plains and dry, sandy watercourses typical of such regions.

A field camp was established at Cockatoo Creek, nearly forty miles west of the areas as yet occupied by Europeans. At this site approximately one hundred and fifty natives were collected. They mainly represented the Ilpirra, Anmatjera, and Ngalia tribes. With very few exceptions, practically all these natives examined are still living their customary nomadic existence, and are entirely de-

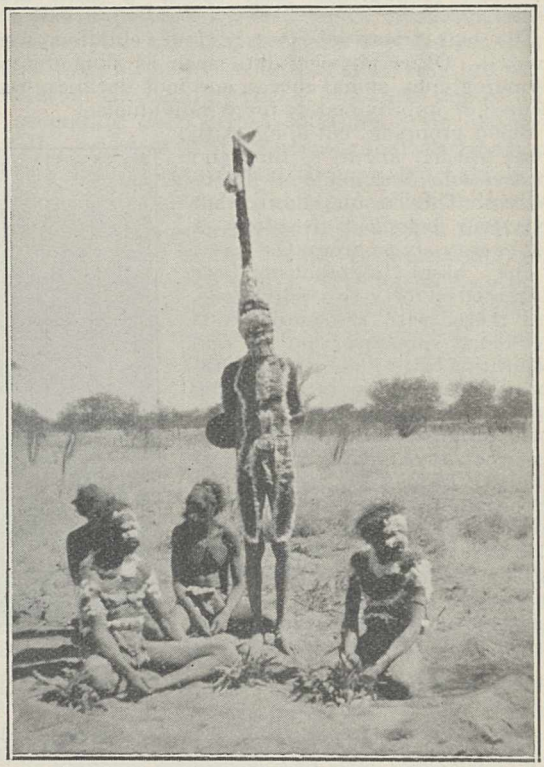


FIG. 2.—The principals in a kwatja or water ceremony.

pendent on their own resources; thus they formed admirable material for scientific study.

In commencing these investigations each native was allotted a number; in most cases on the recent trip it was necessary to mark them with the numeral in cellulose paint, owing to the absence of any sort of clothing. The following list gives an idea of the

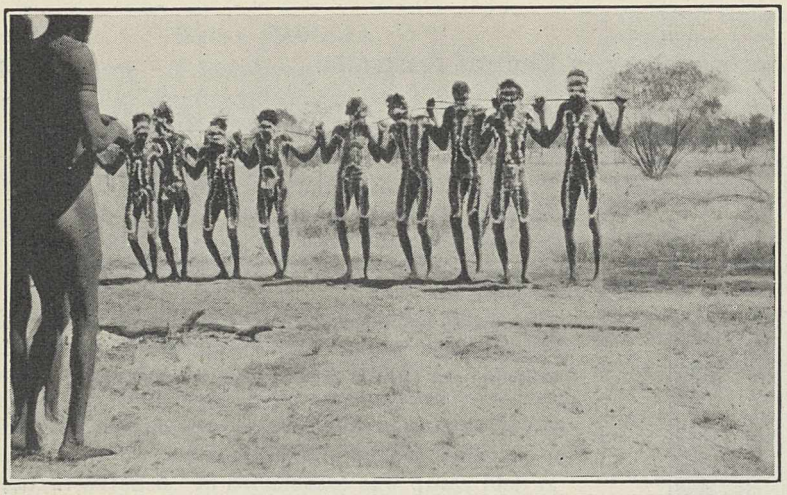


FIG. 3.—Performers in the tjilpa, a native cat ceremony.

scientific programme and the extent of the work carried out :

Genealogical data were recorded on ninety individuals. On fifty natives, routine anthropometric and descriptive anatomical observations were made. Standard photographs were taken of each individual.

The hair tracts of twenty-four children were charted. Other physical data such as skin creases, dermatoglyphs, spinal curves, and foot outlines, were secured on approximately forty individuals.

Blood grouping, entailing, with cross testing, about a thousand observations, was made on ninety natives. These results showed that sixty-four belonged to group A and twenty-six to group O.

The basal metabolism was estimated on forty-two individuals, and these, with associated tests on blood pressure, pulse, and respiration rates, etc., have produced some extremely interesting data.

On groups of individuals, varying from twenty-five to fifty in number, tests were carried out on the special senses, such as visual and auditory acuity ; pain tests, strength tests, and special perception and intelligence tests were also made.

Excellent plaster casts were obtained of the faces of seventeen natives, and also of scarred chests, of hands and feet, and of special anatomical features.

A considerable quantity of general ethnological data and photographs was secured on native customs, ceremonies, arts and crafts, as well as a valuable collection of native objects.

A vocabulary of approximately three hundred words was taken down, and native songs were recorded on phonograph cylinders. Cinematograph records were taken on both standard width and 16 mm. films, a certain amount of the latter being on natural colour film.

Although the natives were entirely uncivilised, no difficulty was experienced in obtaining their complete confidence and co-operation, a very interesting factor when it is considered that a number of the procedures, such as the routine of basal metabolism, the taking of plaster casts of the face, and the drawing of blood for blood grouping, might easily be expected to cause fear, resentment, or suspicion.

This expedition has been probably the most successful and fruitful venture that has yet been carried out in investigating the biological aspects of Australian aboriginal anthropology. The detailed results of the work will be published in due course.

FIG. 4.—Digging yelka (*Cyperus rotundus*) from the creek bank.

Genesis of Ores in Relation to Petrographic Processes.

THE development of theories of ore genesis since their discussion at the British Association meeting in 1833 was briefly referred to in his presidential address to Section C (Geology) by Prof. J. W. Gregory. He remarked that the belief in the deep-seated origin of ores had been at one time superseded by their assignment to lateral secretion and later to the igneous rocks. He assigned the source of the lode metals to a deep-seated zone below the level of the ordinary igneous rocks, and regarded the occasional occurrences of lode metals in them as secondary. The trend of the discussion in the Geological Section on Sept. 29 supported these views.

The conference had the advantage of being opened by Prof. G. C. Cullis, who gave a luminous exposition of the formation of ore deposits by the segregation of the more valuable metals into local

concentrations. The processes may be classified, as with rocks, into the sedimentary, of which the ore products except of iron, are relatively insignificant; the metamorphic, which are comparatively unimportant; and the igneous, which exceed the others in economic value. Prof. Cullis regards the segregation of the ores in igneous rocks as an extreme development of magmatic differentiation, and he explained the process as in most cases due to hydrothermal solutions forming mineral veins. He remarked in conclusion that although there is now a general approximation as to ore formation in the petrogenic scheme, agreement has not been reached as to the actual process of mineralisation in any one of the main metalliferous fields. This paper is being published in the Report of the Association.

Prof. P. Niggli, of Zurich, dealt mainly with metamorphic ores, as so large a measure of agreement has been reached regarding the two other groups. The magmatic ores he classified into three sections: the orthomagmatic, those formed during the main consolidation of the igneous rock; the pegmatitic-pneumatolytic, those due to volatile constituents at high temperatures; and the hydrothermal, those deposited by aqueous solutions, exhalations, thermal waters, etc. The second main group or sedimentary ores are concentrations of matter derived by the weathering of rocks, whether deposited mechanically or by solution. They are sometimes influenced by epi-metamorphism, as with the gold deposits of the Witwatersrand, which in his opinion are undoubtedly sedimentary placer deposits. He described the metamorphic ore-deposits as often characterised by a profusion of rare minerals, such as the two hundred species at the Langban mine in Sweden, more than a hundred species at the Franklin Furnace mine, New Jersey, and the varied sulpho-salts of Langenbeck in the Binnental. Remarkable mine structures are due to dislocation metamorphism, as at Rammelsberg in the Harz, and he suggests as possible examples the pyritic masses of Rio Tinto and similar deposits. The character of these ores is often due to their mechanical deformation and recrystallisation during rock metamorphism. The poverty of ores in the central Alps is due to the magmatic solutions being barred in their ascent. He urged in conclusion that the study of ore genesis is the starting-point for the estimation of the world's reserve of minerals and for the framing of future economic policy.

Prof. Percy Quensel, of Stockholm, also dealt with metamorphic ores and illustrated the need in their interpretation of dealing with the changes in the enclosing rocks by reference to the iron ores of central Sweden. His conclusions are similar to those advocated in a review in NATURE, Aug. 29, 1931, p. 384, of two recent Swedish monographs on these ores. These iron ores occur in the leptite formation, which consists mainly of altered acid lavas and tuffs that have been altered into granulitic gneisses. The bedded siliceous and calcareous ores in the lower part of the formation are altered sediments. The skarn ores are due to four stages: (1) metasomatic mineralisation of limestone and dolomite; (2) formation of the 'reaction-skarn' by thermo-metamorphism with production of simple ore minerals, and local enrichments along the axes of folds; (3) intense faulting and crushing with metasomatic formation of magnesian minerals, producing 'skol' or crush-rock, and the development of albite or quartzite in the adjacent leptite; (4) local contact alteration and renewed development of skarn-minerals by the intrusion of the younger pre-Palæozoic granites.

Such ores are therefore due more to metasomatic processes than to magmatic segregations. Dr. A. Brammall threw doubt on the primary nature of the lode metals found in granite as the results of a searching investigation of the Dartmoor granite. It contains rare gold which has been regarded, as in other cases, as a primary constituent. Dr. Brammall proved by an elaborate series of analyses and petrographic study that the Dartmoor granite has absorbed so much of the rocks into which it was intruded that the lode metals found in it may be regarded as derived from the assimilated sediments. He also threw doubt on the current theories of rock differentiation.

The lead-zinc veins of the north-eastern Pennines played a conspicuous part in the discussion on mineral veins in 1833. Current opinion on these ores was explained by Mr. K. C. Dunham, who contrasted the alternative theories—the formation of the lodes by meteoric waters dissolving ore particles from the country rocks, and their deposition by ascending deep-seated solutions. He showed that the evidence of the vertical zonal distribution of the ore, now established through the field as a whole, of the abundant fluor-spar which indicates the derivation of the ore-bearing solution from an acid magma, and of the various rare elements, all support a deep-seated origin. The surface waters, moreover, deposit only such minerals as calcite, limonite, and oxides even in the presence of abundant pyrite. The richness of the ore in the upper parts of the veins is due to the interaction there between the deep-seated and ground waters.

Mr. G. Vibert Douglas summarised the modes of origin of the chief mines of Northern Rhodesia. The Katanga type of copper and cobalt ores in dolomite he explained by an experiment he had made at N'Changa in which a solution of copper carbonate, after filtering for ten days through powdered dolomite, lost its copper; the dolomite was stained green by malachite. He attributes this type of ore, therefore, to the introduction of sulphide solutions and their concentration and deposition as carbonates. The ores of the Roan Antelope and N'Kana he attributes to the infiltration of primary sulphides, and their concentration near intrusive granite and pegmatite, and in places by deposition far from any igneous rock. The Broken Hill zinc-lead ore-bodies are pipe-like masses in dolomite. The iron-manganese ores are akin to bog iron and manganese beds, and the metals were derived from a shale that had been intruded by granite.

Dr. G. W. Tyrrell contended that it is not possible to deny the term 'magmatic' to ore deposits which

are due to the action of late magmatic residues in which water is always the predominating constituent. These deposits have been termed 'hydrothermal' by Niggli, but this usage does not distinguish between deposits of truly magmatic origin and those due to heated waters of non-magmatic derivation. There seems to be need for a term to cover the latter, although admittedly there is often difficulty in distinguishing between the two types. Perhaps the best solution would be to use the term hydrothermal for all cases of ore deposition by heated waters, and to prefix the term 'magmatic' for those in which the magmatic origin of most or all of the water is demonstrable.

Dr. Tyrrell also dealt with ore deposition and the distribution of igneous rocks, and contended that ore provinces follow the distribution of igneous provinces as between the kratogenic and orogenic regions of the crust in any given period of tectonic and igneous activity.

The complexity of origin of ores was emphasised by Prof. R. W. Brock, of Vancouver, and he welcomed Prof. Niggli's sharp distinction between ores due to the solidification of the main mass of a magma, the products of the semi-liquid extract, and the products of the fluid extract that remain in solution through a long range of temperatures. The diversity of opinions upon particular ore deposits, remarked by Prof. Cullis, he considered satisfactory, as it shows that each deposit is being treated individually, as is necessary since more than one process is involved in most cases. Thus the Kiruna iron ores he regards as due in part to ortho-magmatic differentiation from the local syenite-porphyry, in part to later pegmatitic injection, and in part also to vein formation. He was glad that the Kiruna ore may still be considered as in part orthomagmatic, as unquestionable examples of this mode of formation are now difficult to locate. As Prof. Cullis mentioned, the nickel-ores of Sudbury are not altogether safe examples, for Dr. Cyril Knight has assembled a large number of observations that cast great doubt on their ortho-magmatic origin, and Dr. T. C. Phemister has brought to light a disquieting amount of evidence that the Sudbury sill consists not of one rock showing pronounced gravity differentiation, but of two distinct rocks. Prof. Brock remarked that we can ill afford to lose this classical illustration of this possible type of ore formation, but it may be wise to prepare ourselves for such a calamity. He considers that small ore deposits are often the more instructive as to processes of formation, and that the problems of economic geology must be solved by patient and informed study in the field, laboratory work being accessory and supplementary.

Obituary.

DR. S. E. LANE-POOLE.

WE regret to record the death of Dr. Stanley Lane-Poole, the distinguished orientalist, which took place at his residence in Brompton Square, London, on Dec. 29, at the age of seventy-seven years. Dr. Lane-Poole, who was born in London on Dec. 18, 1854, was the son of Edward Stanley Poole, of the Science and Art Department, and a great-nephew of E. W. Lane, the translator of the "Arabian Nights", the author of "The Modern Egyptians", and the compiler of an Arabic lexicon—a connexion in which he took considerable pride and emphasised by incorporating "Lane" by a hyphen in his surname.

After being educated privately, Lane-Poole entered Corpus Christi College, Oxford, in 1874, with the declared intention of devoting himself to Oriental studies. Before he took his degree in 1877, when he obtained a third class in the honours school of modern history, he was already at work in the Coin Department of the British Museum, and in 1875 had begun the publication of the Museum catalogue of Oriental and Indian coins, which was completed in fourteen volumes in 1892. He was sent by the Government on archæological missions to Egypt in 1883 and to Russia in 1886, and from 1895 until 1897 was employed in archæological research in Cairo. From 1898 until 1904 he was professor of Arabic at Trinity College, Dublin, acting for part of that period as secretary to the Council of the Royal Irish Academy.

The remainder of Lane-Poole's life was devoted to literary work and research. He was the author of a number of works, some of a highly specialised character, some of a wider appeal, and of several biographies of notabilities, such as Lord Stratford de Redcliffe, Ambassador to Constantinople; Sir Harry Parkes, Minister to China and Japan; and others whose activities had been in fields in which he was interested. Two of his works of outstanding importance in Oriental studies were "Muhammedan Dynasties" (1893), a standard work of chronological reference for scholars, and the Arabic lexicon which he edited from the material amassed by Lane and published in 1893 after a labour of sixteen years. Of a large number of scholarly works dealing with the culture, art, and history of the Moslem world, the best known are "The Art of the Saracens in Egypt" (1886) and the volume on medieval India in the "Story of the Nations" series, which reached its ninth edition.

PROF. A. W. KIRKALDY.

PROF. A. W. KIRKALDY, until recently professor of economics and commerce at University College, Nottingham, and, prior to 1919, professor of finance in the University of Birmingham, who died on Dec. 29, 1931, aged sixty-four years, was one of the few British economists of the generation of teachers, now passing away, who had actual experience of routine business management for he did not enter Wadham College, Oxford, to take up academic studies until he had served in a family business in Sunderland, in many capacities, for several years. It was only natural, therefore, that

his work as teacher and as writer should be characterised by a certain impatience with the more abstract school, and by a desire to lay the foundations of economic science more securely on a basis of real fact than on speculation concerning the actions of imaginary business men and on abandoned psychological generalisations.

Prof. Kirkaldy's publications include descriptive works on the British shipping industry and on the economics of transport, in addition to certain useful elementary textbooks. He was president of Section F of the British Association at the Newcastle-on-Tyne meeting in 1926, and was editor of two important reports ("British Labour", 1914–21, and "British Finance", 1914–21) of committees of inquiry set up on that occasion. These have since been published in book form, and they constitute an authoritative and a permanent record of economic movements at a most important epoch. His knowledge of business and of business men made him exceptionally welcome on councils of merchants and industrialists.

In addition to being an appointed member of several Trade Boards, Prof. Kirkaldy served on the Nottingham Chamber of Commerce, taking his turn as president of that body and acting as its delegate and as economic adviser at important meetings of the Associated Chambers of Commerce. He also acted for many years as one of the honorary auditors of the accounts of the British Association. He was a valued member of the college staff at Nottingham, and he played a prominent part in the efforts there to raise the prestige of that institution and to secure a charter conferring full university powers. His loss is one which will be seriously felt in many varied spheres.

WE regret to announce the death of Mr. Francis A. Towle on Jan. 10, at the age of fifty-seven years. He will be remembered by a large number of scientific workers and others through his official connexion with the Royal Society, of which he had been assistant secretary since 1921, while for the preceding twenty years he had been clerk to the Government Grant Committee. Mr. Towle's earlier life was spent in Birmingham. His keen, incisive manner will be missed by many fellows of the Society that he served so zealously during a period of active expansion in many directions. Outside his work, he showed great interest and skill in all kinds of mechanism, and sometimes regretted he had not devoted himself to engineering. For example, he built model locomotives that ran on miniature railway systems of his own construction, and installed electric light plant in at least one country-house. Mr. Towle was also an enthusiastic photographer, and will certainly be missed in the Camera Club.

WE regret to record the death, at the early age of forty-eight years, of Marc Bridel, of the Muséum national d'Histoire naturelle and chief pharmacist to the Hôpital Lariboisière, Paris. M. Bridel, a pupil of the late Prof. Bourquelot, published numerous papers on vegetable glucosides and their hydrolyses by enzymes, and was a well-known figure in French chemical and biochemical circles.

News and Views.

Prof. J. C. McLennan, F.R.S.

THE announcement that Prof. J. C. McLennan, dean of the School of Graduate Studies, professor of physics, and director of the Physical Laboratory at the University of Toronto, has decided to retire and make his home in England, is a matter of international concern. His resignation means the departure from Canada of one of her most distinguished men of science. Someone has said that an institution is an elongated shadow of a man. Never was this more true than in the case of the Physical Laboratory of the University of Toronto. Its achievements are the work of many men, to whom they have brought deserved recognition. None the less, the laboratory as the entity and organisation which has made it possible is a projection of the personality of Prof. McLennan, and in this sense its achievements are his achievements. He became director of the laboratory under President Loudon in 1904, and professor of physics as successor to President Loudon in 1907. At that time he was the leading spirit of the Alumni Association of the University in a movement which resulted in the obtaining of permanent support for the University from the Government of the Province of Ontario. This led to the establishment of such organisations as the Faculty Union, the Students' Union, the University Press, and the erection of Convocation Hall and the Physical Laboratory. The interest then aroused has proved to be permanent, as shown by the generous support accorded by the Government of the Province in all plans of development and expansion in the University of recent years.

UNDER Prof. McLennan's guidance, the Physical Laboratory at Toronto has contributed numerous publications that have attracted wide attention in the scientific world. At the beginning of the present century there was Prof. McLennan's work in collaboration with Prof. E. F. Burton on penetrating radiation, better known now under the name of cosmic rays. His work with Carr on spark potentials is a classic in this field. About 1910 his attention was directed to the field of spectroscopy. This resulted in a flow of papers unravelling the mysteries of the structure of spectra of many elements and the laws connected therewith. This work was temporarily interrupted by the War, when Prof. McLennan was scientific adviser to the British Admiralty. On his return, new fields of research were opened up by the liquefaction of helium at Toronto. Utilising these low-temperature facilities, researches in spectroscopy were undertaken, in which it was proved that the excitation of atomic oxygen was responsible for the radiation of the well-known green line in the spectrum of auroral displays. This has stimulated further research

on the constitution and state of the upper atmosphere. The study of the spectra of gases at low temperature enabled the first experimental proof of the existence of para- and ortho-hydrogen to be established. The Raman effect with liquid gases such as oxygen, hydrogen, and nitrogen has been investigated and the crystal structure of solidified gases examined. At the present time two promising lines of research are in progress. One has to do with the evaluation of spin moments of atomic nuclei deduced from a study of the fine structure of spectral lines. The other is a continuation of a series of investigations on the superconductivity of elements and alloys. It has been found that the superconducting critical temperature is progressively lowered when currents of increasing frequency are used. This opens up an entirely new line of attack upon the problem of superconductivity.

Early Knowledge of Iron in the Pacific.

MR. T. A. RICKARD'S communication on "The Knowledge and Use of Iron among the South Sea Islanders", read before the Royal Anthropological Institute on Jan. 12, offered what may be regarded as a highly probable explanation of the fact noted by early navigators, that while the inhabitants of some of the islands showed themselves eager to obtain iron, in other islands they were indifferent. It is recorded, for example, by Wallis, Cook, and others that in the Sandwich Islands, Tonga, and Tahiti the natives were prepared to go to any lengths to get iron, whereas in New Zealand and the New Hebrides they showed no such desire. Mr. Rickard finds the clue to the explanation of this difference in statements in Mindana, a Spanish explorer, who in 1567 saw "a chisel made into a nail" in the Marshall Islands, and of a native historian of Hawaii, who in 1867 said that the Hawaiians recognised iron on Cook's ship because they "had found iron in sticks washed up on the land". Thus iron would appear to have become known in various parts of the Pacific through having been washed up in driftwood. The effect of drift in the distribution of culture in the Pacific is a subject which stands in need of closer investigation, especially in relation to the various theories of culture-distribution in that area which have been put forward. Drift has been suggested, for example, as probably an element entering into the distribution of the coconut, and some years ago the late Sir Henry Howorth was inclined to think that the adoption of red as the royal colour in Hawaii and other parts of the Pacific might have been derived from the use of that colour by the Buddhists in China and Tibet, and carried thence to the Pacific by Chinese junks which had drifted, or been driven, out of their course.

Glacial Man in America.

THE Division of Anthropology and Psychology of the National Research Council of the United States of America, which, by its scheme of organised co-operation throughout the middle west, is doing much to ensure the recording and preservation of objects of archæological interest already known or casually discovered, as well as to promote research, has now directed attention to the possibility of obtaining evidence relating to the existence of glacial man in America from casual or commercial excavation, especially in centres where there is evidence of glaciation. American anthropologists have been much impressed by the frequency with which relics of prehistoric man have been unearthed in Europe in the course of commercial excavation, to which the attention of the expert has been attracted, or on which the workmen have been warned to be on the look-out for anything of an unusual character.

IT is a well-known fact that the evidential value of a number of archæological finds in America, for which a special significance in prehistory has been claimed, has been vitiated by the lack of trustworthy corroboratory geological and other data. The Division of Anthropology is accordingly attempting to arouse interest in such discoveries, and to disseminate knowledge of the data required by science in relation to any chance find which may be brought to light in the course of the extensive excavations by commercial undertakings, such, for example, as the railways, in various parts of America. A conference of the leading archæologists of the United States and representative engineers was held at Chicago in April last for the discussion of this matter, and a report has now been issued by the Council (Reprint and Circular Series No. 100). The conference adopted a scheme of co-operative research, and a number of directions were prepared to be issued in leaflet form to bodies excavating in areas where evidence of glacial man is likely to occur.

Multi-Channel Television.

ONE of the difficulties met in designing a new system of television is the narrowness of the frequency band of the waves permissible when only one channel of transmission is used. At the Institution of Electrical Engineers on Jan. 6, C. O. Browne showed how this difficulty can be largely overcome by using a number of transmission channels. By using five channels, the frequency band is increased five times and the difficulties of design are greatly diminished. In addition, the velocity with which the scanning spots travel over the surface of the picture is decreased and the difficulties of good synchronisation are largely obviated. To get a moderately good picture, experience shows that the picture should consist of 15,000 picture points at least, and the picture must be scanned about $12\frac{1}{2}$ times per second. This number was chosen because the standard frequency of the supply mains in Great Britain is 50. With small screens, satisfactory results are obtained, but when a ground glass screen measuring 24 in. × 16 in. is used there is a decrease in the brilliance of the received image. With the large received picture, the effect of flicker is pronounced and a higher scanning speed than $12\frac{1}{2}$ pictures per second needs to be used. The author has investigated the best conditions for operating the Kerr cells used in the receiver, and discusses the effects produced by geometric, non-linear, and frequency distortion.

Electric Power in Italy.

THE generation and distribution of electric power in Italy began towards the close of the last century. Recently, owing to the great water power resources of the country, the industry has developed very rapidly. In a paper to the Institution of Electrical Engineers read on Dec. 17, Mr. A. Dalla Verde described the high voltage systems of Italy. In 1894 a bill was passed compelling every property owner in Italy to allow overhead or underground electrical lines for industrial use to pass through his property. There are other regulations in connexion with the use of water power, which is the property of the State. The Alps and the Apennines provide the two great sources of water power. The average flow of water in the Alpine region is a minimum in February and a maximum in June. In the Apennine region, however, the average flow is a maximum in February. The greatest amount of power is derived from the Alps. Owing to the difference in the flow characteristics of the rivers in these two mountain ranges, the combined water power available is more constant than that of either. As in England and America, the power stations are of various types, standardisation being little considered in the early days. In the high power transmission lines the pressures employed are 60, 125, 150, and 200 kilovolts. In Italy there is a strong tendency towards discarding lightning 'arrestors' altogether and experiments are being carried out with underground cables. There are many different frequencies of supply, and this makes interconnexion with the older systems difficult. Mr. Dalla Verde stated that the ratio in Italy of the steam power to the water power production of electrical energy is less than four per cent.

Unemployed Technical Men in the United States.

IN every part of the United States, various movements are under way to alleviate distress among scientific and technical men during the present unparalleled unemployment crisis. In the New York metropolitan area, local sections of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and other bodies have established the Provisional Engineers Committee on Unemployment. The chemical societies have adopted similar measures. An honorary unemployment committee has been formed, the chief function of which is to compile a register of those seeking work, and to undertake a very thorough canvass of industrial firms, etc., for suitable openings. A further important step has been taken at Columbia University, where classes in the engineering department have been opened free to all accredited unemployed professional engineers, the number being limited merely by the size of the lecture halls. A certificate is necessary showing status and confirming that the holder is out of work through no fault of his own. The principal purpose is, says Dean Barker, to preserve the morale of those skilled men during a period of enforced idleness. It is of course recognised that these various schemes are only palliative in the face of immediate necessity. They do not touch the great fundamentals of the problem. To achieve this far greater purpose it will be urgently necessary to contemplate some form of national unemployment insurance or some nation-wide plan on the lines of the Swope or Rochester or like suggestion.

Imperial Standardisation.

THE report of the joint meeting of the British Standards Institution and the Standards Association of Australia, which was held by wireless between London and Sydney on Jan. 14, has been published (C.C. (OC) 5929 British Standards Institution, 28 Victoria Street, S.W.1). Sir George Julius, chairman of the Standards Association of Australia, emphasised the importance of the present visit to Australia of Mr. le Maistre, director of the British Standards Institution, with the view of helping in the great efforts now being made to extend the Empire markets of Great Britain. That standardisation is growing very quickly in Australia is made quite clear by Sir Henry Barraclough, who stated, in support, that there are more than five hundred special and technical committees dealing with various aspects of standardisation in Australia. Standardisation must be still further developed, for, as Sir William Larke stated, it is the most effective means of securing economic production; and the greatest common measure of agreement on standardisation throughout the British Empire will ensure the greatest and most rapid development of inter-Imperial trade.

Viscosity of Liquids.

INTEREST has recently been revived in the subject of liquid viscosity, for many years a happy hunting-ground for framers of empirical equations. The *increase* of gas viscosity with increasing temperature was early accounted for on theoretical grounds, but the contrasted behaviour of liquids remained long unexplained, and theoretical bases were lacking for the equations proposed to represent the *decrease* of liquid viscosity with increasing temperature. Recently Prof. E. N. da C. Andrade has put forward a theory of liquid viscosity which envisages the transference of momentum between parallel-moving layers of the liquid as accomplished through the medium of temporary unions between contiguous molecules. The picture is that of "a transitory and fluctuating crystallisation". The theory leads to a remarkably simple exponential formula for the variation of viscosity with temperature, namely,

$$\eta = A \exp(bT^{-1}).$$

The formula is remarkable, inasmuch as *two* constants suffice to express the march of viscosity with temperature over the range between freezing point and boiling point. Moreover, as is readily seen, the equation provides a simple explanation of Porter's well-known relation, which states that if we determine the viscosity-temperature relation for two liquids, and take a number of pairs of temperatures T_1 and T_2 at which the viscosities of the two liquids are equal, then the relation between the reciprocals of T_1 and T_2 is linear.

MR. R. M. DEELEY has recently printed a pamphlet in which he considers briefly the problem of viscosity

and its relation to temperature. He discusses the relation between Langmuir's view that "atoms of tungsten, molybdenum, and platinum striking a clean dry surface in high vacuum are condensed as solids at the first collision" and "have a certain average 'life' on the surface", and the statement of Maxwell that "the collision between two hard spherical balls is not an accurate representation of . . . the encounter of two molecules. A better representation will be obtained by supposing the molecules to act on one another in a more gradual manner, so that the action between them goes on for a finite time." Mr. Deeley concludes that "this finite time would appear to be Langmuir's 'life' of chemical union". Mr. Deeley also describes certain experiments on stress-strain relations in a bar of pitch described by him in the *Proceedings of the Royal Society* in 1908, and points out that, so long ago as 1888, in a paper on the viscosity of ice, published in the *Philosophical Magazine*, he suggested that gravity "may give rise to a slow change of form in an elastic substance, in the interior of which liquefaction and resolidification are constantly going on".

Vanishing Life of Australia.

THE legal position regarding the preservation of the Australian fauna is put briefly in a letter received from an Australian correspondent in comment on our leading article of Sept. 12, which aroused interest in Australian newspapers. "The enactment of laws for the protection of the Australian fauna", he says, "does not come within the powers of the Commonwealth Government, except in so far as the export of skins, etc., is concerned; but the different States have all legislated to this end in a greater or less degree. Unfortunately, the laws (or their enforcement) are not strong enough to stop the traffic which goes on, particularly in skins of our fur-bearing animals. From the number of prosecutions, it is obvious that many evasions are taking place; and the penalties imposed upon those convicted, though often heavy, apparently do not act as effective deterrents." Our correspondent includes a cutting from the Melbourne *Argus* of Sept. 18, recording the conviction of a skin-buyer of unlawfully consigning 3821 skins of 'opossums' (really phalangers, to which an American Indian word has become mistakenly applied). The fine was £955 5*s*., and the dealer admitted five previous convictions, including fines of £234 10*s*. in 1927 and, with two other men, of £616 in 1929. Yet the trade apparently is worth the risk, and so long as that is so, these fur-bearing creatures stand a poor chance of retaining their foothold.

Interference during Pairing in Birds.

IN giving advice on the breeding of turkeys in the *Poultry World* for Jan. 1 (p. 292), Mr. Edmund Burr warns breeders against allowing a cock fowl (especially a game-cock) to run with breeding turkeys, as such a bird will often interfere with them when pairing. That cocks interfere with each other's pairing is well known, but it must be exceptionally mischievous birds that extend this interference to other kinds of poultry, while it is remarkable that a bird so powerful and fierce as the turkey-cock permits it, especially as, unlike the fowl, he has his beak free during the act, not using it to grip the hen. M. G. Rogeron, however, in his very instructive book "Les Canards", records a similar case in which a garganey drake, infatuated with female mandarin ducks, interfered with pairing with impunity, although the mandarin drake is larger and very high-spirited, being well able to hold its own with mallard. Interference with pairing by their fellows may be the reason why the act is observable with comparatively few birds; it is not practised by the rook, but is a perfect mania with the house-crow of India—so much so that in eight years' bird-watching there, the writer of this note never saw the act successfully performed by that species.

A Prismatic Derivator.

FOR many purposes, both in physics and engineering, the derivative of a graphical record has to be taken with all the accuracy that the record allows. For this purpose, either a numerical method of differencing is usually resorted to, or a mechanical process of laying a tangent. Perhaps the best known of this latter type is that which depends on the principle that a curve and its reflection in a plane mirror pass continuously into one another when the reflecting surface lies along the normal. A prismatic derivator has been designed by v. Harbou and has been produced by Askania-Werke A.G., Bambergwerk, Berlin-Friedenan, which avoids the difficulty usually experienced of recognising when a curve and its reflection are continuous. In this new instrument a right-angled prism is placed with its hypotenuse on the paper and with the intersection of the opposite edge approximately along the normal to the curve. The portions of the curve on each side of the point at which the tangent is required, as seen after refraction through the prism faces, will not join up at the prism edge unless that edge is accurately along the normal. From the published description of the instrument, it appears that there is a number of other adjuncts that tend to increase the accuracy and effectiveness of the apparatus.

Photographic Research.

"ABRIDGED Scientific Publications" from the Kodak Research Laboratories, vol. 14 (1930), issued by the Eastman Kodak Co., Rochester, New York, contains, in précis form, a number of papers previously published in various journals. An introductory note states that the Eastman Kodak Co. does not restrict publication to a privately issued journal but desires that the results of its scientific research may be easily accessible to all interested in special branches of science. The papers cover a wide range of subjects, including physics (for example, a study in condensation pumps, and a polarising apparatus for determining extinction angles), physical chemistry (for example, the lattice energies of silver halides, the electrolytic oxidation of some photographic developers), organic chemistry (for example, the preparation of *s*-diphenylcarbazide, a colour reaction for naphthol yellow), and colloid chemistry and photographic

technique. The volume brings together a large amount of research work of high standard, the results of which will be of value in many fields. Even biology is represented in a description of the production of a motion picture showing the movements of the vocal cords in the larynx.

Announcements.

THE twelfth International Congress of Zoology will be held at Lisbon in the summer of 1935, under the presidency of Prof. Arthur R. Jorge, professor of zoology in the University of Lisbon.

THE Duddell Medal for the year 1931 has been awarded by the council of the Physical Society to Prof. C. T. R. Wilson, Jacksonian professor of natural philosophy in the University of Cambridge.

PROF. ARTHUR HOLMES, professor of geology in the University of Durham, sails from England on Feb. 20 to deliver a course of eight lectures on "Radioactivity and Geology" at the Lowell Institute of Boston, Mass. The lectures begin on March 4. Prof. Holmes will also give a lecture on "The Age of the Earth", before the Royal Canadian Institute at Toronto, on April 2.

IT is announced by Science Service, of Washington, D.C., that Dr. John J. Abel, professor of pharmacology in the Johns Hopkins Medical School, Baltimore, Md., was elected president of the American Association for the Advancement of Science meeting at New Orleans, in succession to Dr. Franz Boas, the distinguished anthropologist of Columbia University. Dr. Abel was the first to obtain in chemically pure state the secretion of the suprarenal glands, to which he gave the name epinephrine, also known as adrenalin. He was also successful in isolating the active principles of the pituitary gland and was the first to obtain insulin in crystalline form. The prize of 1000 dollars offered for a paper read at the annual meeting of the American Association has been awarded to Dr. C. C. Speidel, of the University of Virginia, for a paper on the development of nervous tissue.

THE Council of the Geological Society has this year made the following awards: Wollaston Medal to Prof. J. H. L. Vogt, of Trondhjem, Norway, in recognition of the value of his researches concerning the mineral structure of the earth, and especially his pioneer work in the application of physical chemistry to the origin of igneous rocks and ore-deposits; Murchison Medal, together with the sum of ten guineas from the Murchison Geological Fund, to Prof. William G. Fearnsides, in recognition of the value of his researches in the Lower Palæozoic rocks of Wales and other geological investigations; a Lyell Medal, together with the sum of £30 from the Lyell Geological Fund, to Mr. Henry Dewey, in recognition of the value of his researches in the geology of the south-eastern parts of England, more especially the Quaternary deposits of the London Basin; another Lyell Medal, together with a like sum of £30 from the Lyell Geological Fund, to Dr. M. M. Ogilvie Gordon, in recognition of the value of her researches on the structure of the Western Dolomites (Tirol); the balance of the proceeds of the Wollaston Donation Fund to Dr. Ernest Neaverson, in recognition of the value of his researches in the structure and geological history of the Cephalopoda; the balance of the proceeds of the Murchison Geological Fund to Dr. A. K. Wells, for his contributions to petrology, and more particularly for his researches on the Ordovician igneous rocks of parts of Wales and the plutonic rocks of the Channel Islands; the balance of the proceeds of the Lyell Geological Fund to Mr. R. W. Pocock, in recognition of the value of his geological work on the older rocks of the Welsh borderland.

MESSRS. Longmans and Co., Ltd., announce for early publication "The Causes of Evolution", Prof. J. B. S. Haldane; "Sulphur Bacteria", Prof. D. Ellis; "Vision and Colour Vision", Dr. R. A. Houstoun; and "Modern Practice in Mining", Sir Richard Redmayne—Vol. 5: "Colliery Machinery and its Application".

PROF. F. SODDY is publishing through John Murray a new work entitled "The Interpretation of the Atom", which will take the place of the same author's "Interpretation of Radium". It will be in two parts, dealing respectively with the radioactive elements and isotopes, and the general progress of atomic chemistry.

WE have received a copy of a prospectus describing a facsimile edition of the most ancient manuscripts and maps of Ptolemy. The work, which is to be published in an edition of 350 copies by E. J. Brill, of Leyden, and O. Harrassowitz, of Leipzig, is edited by Dr. J. Fischer, who discovered in the Codex Urbinas Græcus 82 of the Vatican Library the oldest Greek maps and text of Ptolemy. These twenty-seven maps, which hitherto have not been published, are now reproduced full size. The work will also contain, in addition to the Greek text in full, twenty-seven maps of the oldest Latin manuscript, a large number of maps from various Greek and Latin manuscripts of Ptolemy giving all the known types, a monograph on the life and works of Ptolemy by Dr. Fischer, and a critical introduction to the Greek text. There will be four volumes, including one of folio size.

MESSRS. W. JUNK, of Berlin, publishers and dealers in second-hand books and pamphlets, have issued a sumptuous catalogue of their publications and stock. Zoologists need not to be reminded of the invaluable monographs which Messrs. Junk have made available for reference—the series of "Catalogi Coleopterorum, Lepidopterorum, Fossilium", and the six-volume "Tabulæ Biologicæ", which stands by itself as a work for consultation in its particular sphere. Almost exactly half the present book catalogue of 290 pages deals with the natural history publications of the firm, and the other half contains a list of second-hand books and pamphlets. The extent of the second-hand collection may be gauged by the fact that a single page is devoted to the briefest summary of a series of 75,000 papers on zoology, botany, palæontology, geology, and mineralogy, which is priced at £1275.

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.*]

Ovis astore, a Three-Coated Sheep.

ABOUT 1912 the many interesting experiments in sheep-breeding carried out at Colesbourne by the late H. J. Elwes directed the attention of both sheep breeders and wool users to the many types of sheep, wild and domesticated. It was left to Prof. Cossar

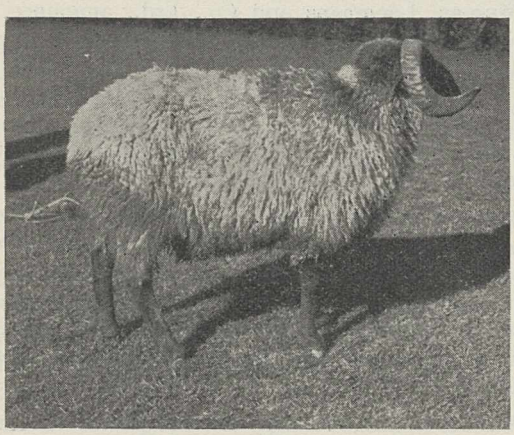


FIG. 1.

Ewart, of the University of Edinburgh, to evolve from the primitive characters and types a key scheme explanatory of the origin of the present-day breeds of domestic sheep. This he did by referring all breeds back to two fundamental types, namely, the Urial-Moufflon, which still has representatives in Asia, Europe, and America, and the fat-tail–fat-rump, based on the *Ovis ammon*, which seems to be a special development to meet the changed environment follow-

FIG. 2.

ing the drying up of the Gobi Sea. Many evidences of these two types of sheep are to be noted in carefully selected present-day flocks (see NATURE, May 6, p. 595; 1922).

Turning from an examination of the body contour of the various domestic sheep, Prof. Ewart next considered the woolly coat and at once made the discovery that the wild sheep is usually double-coated, carrying an outer coat of long, coarse fibre and an under coat of very fine fibre, and that the coats of many of the domestic breeds can be explained by postulating the casting of the outer coat of hair and the development of the under coat of wool. In 1923, during the meeting of the Pan-Pacific Congress in Sydney, attention was first directed to the fact that even our finest woolled sheep, the merino, usually carries a double-coat at birth, but that within a few weeks it casts the hair-coat, possibly as kemps, and becomes single-coated.

Since these facts and suggestions were put forth, endeavours have constantly been made to refer back every class of fleece to the double-coated type; but from time to time difficulties have been encountered, scarcely consciously realised, in doing this.

While in Srinagar (Kashmir) last July, a sheep was brought from Astore (Gilgit) for my inspection (Figs. 1 and 2) which seems to throw a flood of light upon the difficulties from time to time encountered, and may result in a more perfect explanation of the varying coats of our domestic sheep than has been

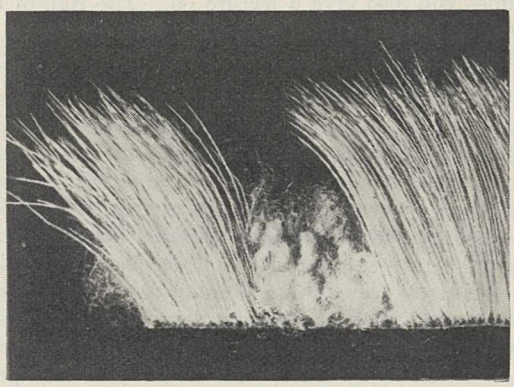


FIG. 3.

offered by attempting to refer every type back to the two-coated sheep (Fig. 3). The general appearance of the *Ovis astore* is black with bleached fibre tips, but I was surprised, on examining a staple of wool, to find that this appearance is due to a long, strong white fibre thrusting itself through an under coat of strong brown or black fibre, and that in addition to these two coats is a third coat of fine white wool. Careful measurements of these three types of fibres have been made, with the following result:

Fibre Type.	Minimum Diameter (in.).	Maximum Diameter (in.).	Average Diameter (in.).	Approx. per cent.*
White outer coat	1/582	1/339	1/447	12
Black under coat	1/700	1/223	1/397	17
White middle coat	1/1170	1/552	1/742	71

* This appears to vary according to the position selected on the sheep.

If a hundred measurements of each type of fibre are made and the results plotted as a diameter frequency distribution curve, the result shown in Fig. 4 is obtained.

The curves for each type of fibre show that the white outer coat and the white middle coat fibres come on to much shorter bases than the base of the black under coat fibres and are almost equally distributed on either side of the mode, as against the

black fibres, which, extending in an extraordinary manner towards the coarse end of the scale, are anything but balanced. The three scales overlap, but the fibres seem sufficiently distinct in appearance to warrant them being put into these three distinct classes.

As these sheep are sheared twice a year, it has not been possible to ascertain how the coats are shed. This particular sheep, however, is kindly being kept under observation by Mr. C. R. Kohli, Director of Industries for the Kashmir State, and within twelve months definite details of the shedding or non-shedding of the coats will be available. It will be noted that the head of the sheep is of the *Ovis poli* type, and an endeavour is being made to link the three coats up with the *Ovis poli* type of sheep, as distinct from the *Ovis ammon*.

This discovery leads to many important questions, of which perhaps the most important is: Can the types of fibres produced by the sheep be linked up in any way with the skin structure? The opinions of physiologists on this matter would be very valuable. If a small staple of fibres is pulled from a merino sheep, it has been observed that it brings with it the complete embedding skin. The wool of the normal British sheep seems more deeply embedded in the skin, and, so far as I am aware, a staple pulled away never brings the skin with it. This suggests that fine wool fibres grow shallower in the skin than the coarser wool fibres or hairs.

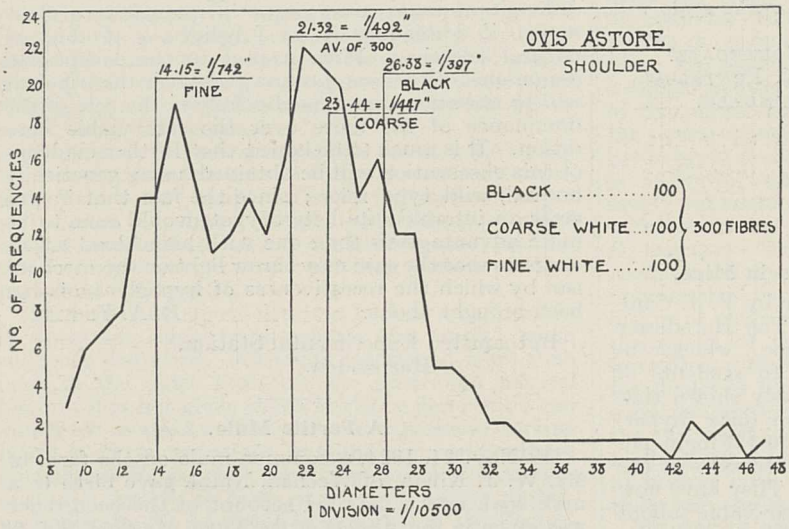


FIG. 4.

There is, however, an even more interesting problem involved. The blackface breed of sheep appears to grow the double coat, an outer coat of strong fibre and an under coat of fine fibre. The under fine coat is shed each year, usually in the late spring, whereas the outer coat is never shed, or at least never shed as one complete coat. Now, the coat of the merino sheep is supposed to be based upon the elimination of the outer coat of hair and the development of the under coat of wool. But, as we have already noted, the merino sheep, as a lamb, sheds its outer coat of hair but will retain its under coat of wool for five or more years without evidence of any break along the fibre length. Hence the question arises: Is the coat of the merino based upon the under coat of the wild sheep with a suppression of the shedding factor? Or is the coat of the merino sheep, after all, a modification—a most marked modification—of the outer coat of the wild sheep, the under coat being eliminated? Up to the present, we are really in a dilemma, although most authorities have accepted the first explanation. *Ovis astore*, however, seems likely to solve this dilemma.

ALDRED F. BARKER.

University of Leeds,
Dec. 5.

Death of Fish in the Tees Estuary.

FOR several years past, migratory fish passing through the Tees estuary have been killed in large numbers. This is most noticeable in the months of April, May, and June, during the seaward migration of young salmon (*Salmo salar* L.) and sea trout (*Salmo trutta* L.), when many thousands are found dead on the foreshore. An extensive biological, chemical, and hydrographical survey of the river, undertaken by the Department of Scientific and Industrial Research as part of the programme of the Water Pollution Research Board, has provided an opportunity for an investigation into the cause of this mortality.

The estuary is polluted by the untreated sewage from a population of about 275,000, and by large volumes of industrial wastes, produced mainly in the processes associated with the iron and steel industries, and consisting chiefly of coke oven effluents and spent pickle liquors from galvanising plants. As a result of this pollution, the waters of the estuary are partially deoxygenated, the deficiency increasing with increasing water temperature, and reaching values as low as ten per cent of saturation at maximum summer temperature. During the months April, May, and June, however, when the smolts are killed, the dissolved oxygen deficiency is usually insufficient to account for the mortality. An examination of the directly toxic effluents entering the estuary was, therefore, undertaken.

Spent pickle liquors contain about forty per cent of ferrous chloride in acid solution, and in the alkaline waters into which they are discharged the iron is almost immediately precipitated. In the concentrations in which they occur, these effluents have no appreciable effect on the toxicity of the estuary.

Coke oven effluents, on Tees-side, are of two kinds, resulting from the semi-direct and direct processes of ammonia recovery. By a series of experiments, in which the various groups of substances found, by analysis, to be present were each in turn eliminated, the toxicity of the semi-direct process effluents was shown to be due mainly to phenolic bodies, and that of the direct process effluents to cyanides.

The concentrations of both tar acids and cyanides normally present in the estuary are of the order to be expected from the volumes of effluents discharged and the volume of estuary water available for their dilution. The concentration of tar acids present, except in very restricted areas, is never sufficiently high to be toxic to fish, but cyanide is frequently found in lethal concentrations in the general body of the estuary water.

During the smolt migration of 1931, water samples from the mortality zone of the estuary were collected every day, their dissolved oxygen and cyanide contents were determined, and their toxicity to trout was measured by experiment. The oxygen concentrations ranged from forty to seventy per cent of saturation (water temperature 10°-14° C.), and were too high

to account for the observed mortality. It was found that the toxicity increased with increasing cyanide concentration. In 130 out of 138 toxic samples the toxicity was completely removed by the addition of a small quantity of formaldehyde, which removed the cyanide present by forming with it innocuous compounds, but did not alter the tar acid or dissolved oxygen concentrations. The colour of the gills of smolts dying at the surface of the estuary waters was found to be markedly brighter than that of normal fish. It was shown experimentally that, of the poisons likely to be present in the estuary, cyanide alone produced this effect.

The evidence therefore points to the conclusion that cyanide is the factor mainly responsible for the death of fish in the Tees estuary. The importance of cyanides in the study of pollution has been noted by Lehmann,[1] but his work has attracted little attention in Great Britain.

A method whereby cyanide-containing effluents from coke ovens are rendered innocuous by the addition of spent pickle liquors is being worked out, and it is hoped that treatment on a works scale will soon be possible.

B. A. SOUTHGATE.
F. T. K. PENTELOW.
R. BASSINDALE.

The Marine Biological Association,
Cleveland Shipyard,
Middlesbrough, Dec. 24.

[1] Lehmann, C., *Z. Fischerei*, **24**, 401; 1926.

A New Series of Allelomorphs in Mice.

THERE appeared recently [1] a paper by P. J. Cammidge and H. A. H. Howard on "The Hereditary Transmission of Hypoglycæmia in Mice" which contains facts of considerable interest to students of genetics. These authors had previously shown that the condition of high blood sugar in mice (hyperglycæmia with blood sugar values of 110-125 mgm. per 100 c.c. of blood) behaves as a simple recessive to the normal condition (about 80 mgm.).[2] They have now found mice with very low blood sugar value (about 60 mgm.), and this condition also behaves as a simple recessive to the normal. Segregation in both cases is clear, no intermediate values having been found.

The experimental evidence, allowing for a lower viability of hypoglycæmic animals, seems sufficient to justify the authors' conclusions that they have discovered another recessive gene influencing the blood sugar level of the blood. They seem, however, not to have noticed the important fact that the three blood sugar levels—high, low, and normal—appear from their evidence to be due to three allelomorphic conditions of the same gene. A summary of the crosses which show this follows :

High × normal : F_1, normal ; F_2, ¾ normal, ¼ high (actually 81 : 28).

Backcross, F_1 × high ; ½ normal, ½ high (actually 45 : 44).

Low × normal ; F_1, normal ; F_2, ¾ normal, ¼ low (actually 45 : 10 + 5 dead).

Backcross, F_1 × low ; ½ normal, ½ low (actually 77 : 26 + 40 dead).

Low × high ; F_1, high ; F_2, ¾ high, ¼ low (actually 46 high, 10 low + 6 dead).

If the mice born dead are assumed to be hypoglycæmics, the results fit the expectations remarkably well. But the results of crossing low by high show that these conditions are not only allelomorphic with normal, but also are probably allelomorphic with each other as well. Normal, high, and low appear to form a series of triple allelomorphs with dominance in the order given. This dominance order is unusual, if not unique, among multiple allelomorphic systems, since a high quantitative effect on blood sugar appears between two lower values. Further evidence from crosses of high by low and of each by the same normal stocks would seem desirable to test the possible influence of modifying genes in producing this unusual result.

L. C. DUNN.

Columbia University,
New York City.

[1] *Proc. Roy. Soc. Med.*, vol. 23 ; 1930.
[2] *J. Genetics*, vol. 16 ; 1926.

THE case to which Prof. Dunn alludes is of very great interest in the question of the origin of dominance. It will be observed that the gene for normal blood sugar is dominant both to the hyperglycæmic and to the hypoglycæmic genes. In the "Genetical Theory of Natural Selection" (Chap. v), I had inferred that such dominance in opposite directions to different mutants must occur in quantitative characters, if dominance is, as I believe, a product of natural selection. With respect to the exceptional dominance of the one mutant gene over the other, it will be observed that this also follows the rule of the dominance of the more over the less viable condition. It is much to be hoped that further evidence of this observation will be obtained, using genetically normal, wild type mice ; since the fact that in this cross an intermediate heterozygote would seem to be more advantageous than one with high blood sugar, suggests that the case may throw light on the mechanism by which the recessiveness of hypoglycæmia has been brought about.

R. A. FISHER.

Rothamsted Experimental Station,
Harpenden.

A Fertile Mule.

ON Nov. 24, 1924, a common mule on the farm of Mr. W. J. Kilian, of Weenen, Natal, gave birth to a male foal, and a detailed account of the occurrence was given in the *Annals of the Natal Museum*, vol. 5, pt. 5, 1926. The mule in question was bred by Mr. W. L. Eales, of Fullerton, Cape Province. It is a typical mule in every way, and has a considerable preponderance of the characters of the ass.

The foal was suckled by the mother mule. The foal grew rapidly and the adult animal is now a reliable riding horse, and from the accounts received it is practically indistinguishable from a pure horse.

The subject has again been brought to my notice, in that on Nov. 21 of this year the same mule, which is about fifteen years old, gave birth to a second male foal, and this foal was sired by a different stallion from that of the first foal. Thus, between the births of the two foals there has been an interval of seven years, although the mule has been repeatedly served. In the present foal the characters of the horse would appear to be markedly prepotent over those of the mule, just as in the case of the first foal.

It would seem as though South Africa were in some way favourable for mule-fertility, in that in 1904 the late Dr. Gunning, director of the Transvaal Museum, informed me that he was acquainted with an undoubted case in the Transvaal, but, so far as I am aware, the exact details were never published.

That the common mule may be sometimes fertile has been long disputed, although certain alleged cases have been quoted from America, but they mostly seem to lack strict authenticity. Also, on cytological grounds even the possibility of back-crossing

has been questioned, owing to the fact that a highly confused chromosome complex has been found in the mule.

There is here, however, an indisputable case of mule-fertility, and the theoretical assumptions are thereby shown to be invalid.

ERNEST WARREN.

Natal Museum, Pietermaritzburg,
Nov. 22.

Vocal Powers of Kangaroos.

IN the notes on Sir Peter Chalmers Mitchell's address to the British Association on "Zoos and National Parks",[1] the statement is made that the "kangaroo is never known to utter any kind of sound normally", etc. This is misleading, as, under entirely 'normal' conditions, kangaroos of several species, both 'in the wild' and in captivity, frequently make two distinct sounds and occasionally a third:

(1) A soft, frequently repeated, 'chittering' sound, made without perceptible movement of the lips and possibly produced by expulsion of air through the nostrils. In pet kangaroos it is frequently produced when the animal responds good-humouredly to gentle teasing, but amongst the gregarious small wallabies (*Thylogale*) a very similar sound is used by females to recall young to the pouch.

(2) A loud, discordant, aspirate sound, which may be roughly imitated by the long-drawn-out enunciation of the word 'harsh'. Chiefly indicative of anger and of pain, it is almost always heard when a wounded male is approached, and is sometimes used also by the rutting bucks, in the concluding phases of their pursuit of the females.

(3) A distinct, short, clear-cut bark or cough, made as a warning signal by a member of a 'mob', when suddenly disturbed. Although mentioned more than once in the older literature on Australian natural history, it is not given much credence here, but I can vouch for its reality from personal experience, having heard it on two occasions, in Gippsland and southern New South Wales, when observing parties of *Macropus giganteus typicus* at close quarters in heavy timber, and once (by *M. giganteus fuliginosus*) in the Zoological Gardens at Adelaide.

H. H. FINLAYSON.

South Australian Museum,
Adelaide,
Nov. 22, 1931.

[1] NATURE, **128**, 578, Oct. 3, 1931.

St. Kilda House Mouse.

THE St. Kilda house mouse (*Mus musculus muralis*, Barrett-Hamilton) received great notoriety when the island was evacuated in 1930, because it was confidently expected to become extinct. Some previous writers (Ritchie, *Scot. Nat.*, 1930) stated that the mouse was confined to the Post Office buildings on the island. A visit to St. Kilda this summer proved to us that the mouse has become extremely rare and at present only inhabits two houses in which food was left behind. It is particularly interesting to note that neither of these houses is the Post Office, and the evidence of the inhabitants, and of previous visitors, confirms the view that the mouse was never confined to one building.

Waterston (*Ann. Scot. Nat. Hist.*, 1905) described a number of house mice from Lochmaddy, N. Uist, which in every way resembled the light-bellied *Mus musculus muralis*, and were found living with the normal *Mus musculus*, but apparently without hybrids. This discovery seems to have been overlooked by subsequent investigators, and points to the mouse not having such a confined geographical distribution as is generally credited to it.

T. H. HARRISSON.

Pembroke College,
Cambridge.

J. A. MOY-THOMAS.

Department of Zoology,
The University,
Leeds.

Cytology of Mycetozoa.

IN her paper entitled "The Life-History and Cytology of *Didymium nigripes* Fr.",[1] Dr. E. J. Cadman has made a valuable contribution to the literature on Mycetozoa. The principal points described by her are the following: the active swarm-cells possess what she terms a "centroblepharoplast" and cone apparatus connecting the flagellum with the nucleus; the nucleus of the swarm-spores has four chromosomes; a definite myxamœboid stage occurs when all trace of cone-apparatus disappears; the myxamœbæ unite in pairs as gametes to form a zygote or young plasmodium, and their nuclei also fuse; the fusion nucleus contains eight chromosomes, a diploid number characteristic of all succeeding nuclei of the plasmodium; meiosis occurs in the nuclei of the young sporangium before spore-formation, when a heterotypic division with four U-shaped chromosomes is swiftly followed by a homotypic division with four nearly spherical chromosomes.

Schunemann,[2] working with the typical form of *D. nigripes*—Dr. Cadman deals entirely with var. *xanthopus* of that species—also observed the union of myxamœbæ to form gametes, but he did not see fusion of their nuclei; he also describes meiosis in the nuclei of the young sporangium before spore-formation. He found the number of chromosomes in the nuclei of the swarm-cells and plasmodium to be eight and sixteen respectively. It is interesting that the var. *xanthopus*, a variety apparently closely allied to the typical form, should be found by Dr. Cadman to possess only half the number of chromosomes in those two stages.

By way of criticism, several points may be noted. Dr. Cadman says (p. 106) that "the spore-membrane consists of a single membrane, not a double one as stated in Lister's Monograph". The statement is undoubtedly too general and should have been qualified; double spore-walls occur, however, in several species of the genus *Didymium*, in *Mucilago*, and in species of *Trichia*, as observed by De Bary[3] and others. Dr. Cadman disregards the numerous completely satisfactory monospore cultures carried out by Jahn[4] in *Didymium squamulosum* Fr., and by Miss Cayley[5] and also by Schunemann in *D. nigripes* and *D. difforme* Duby, when all stages in the life-history, the germination of the spore, the increase of swarm-cells, and the formation of healthy plasmodia and sporangia were followed. Dr. Cadman seems scarcely to give due weight to the observations of Miss Cayley and Miss Waterhouse, who succeeded in watching in thirteen instances the gradual fusion of flagellate gametes in living monospore and plurispore cultures of *D. difforme*. She is not quite correct in stating that Miss Cayley considers that sex-segregation is closely connected with meiosis, for, although Miss Cayley's diagram illustrating the stage at which sex-segregation might occur is rather misleading, she writes (l.c. 245), "there is no experimental proof that the first division of the emerging swarm-spore is the critical one as far as sex is concerned"; and indeed her view is that, although the evidence is not conclusive, her observations, and Jahn's, tend to show

that sex-segregation does not take place at meiosis. Dr. Cadman herself is of the opinion that in the two species of Mycetozoa she has investigated, *D. nigripes* var. *xanthopus* and *Reticularia Lycoperdon* (Bull.), "there is no difference, morphological or physiological, between the gametes in either species".

In conclusion, it may be said that anyone who has worked at the cytology of this group will appreciate the technical difficulties that are involved in its investigation.

G. LISTER.

871 High Road, Leytonstone, E.11,
Dec. 13.

[1] *Trans. Roy. Soc. Edinburgh*, **56**, 93-142; 1931.
[2] "Untersuchungen über die Sexualität der Myxomyceten", *Planta*, **9**, 645-672; 1930.
[3] "Comp. Morph. and Biol. Fungi, etc.", Oxford Ed., p. 441; 1887.
[4] "Myxomycetenstudien 8", *Ber. Deutsch. Bot. Gericht*, **29**, 239; 1911.
[5] "Observations on Mycetozoa in the Genus *Didymium*", *Trans. Brit. Myc. Soc.*, **14**, 227-248; 1929.

Carbon/Nitrogen Ratios in Cacao Soils.

BY tabulating and comparing the results of a detailed laboratory examination of profile samples of cacao soils collected in January 1930, in the island of Tobago, British West Indies, one of us (G. G.) was able to demonstrate [1] a close correlation between the yielding capacity and the carbon/nitrogen ratio for the organic matter contained in the surface six-inch layer of soil. The mean ratio for 'good' soils yielding more than 8 bags (or 1320 lb.) of fermented and dried cacao beans per 1000 trees (pickets) is 8·3 (21 samples), and for 'bad' soils yielding less than 8 bags per 1000, 6·8 (10 samples). Statistically, this correlation is highly significant ($t = 4{\cdot}5$), and the C/N ratio is not necessarily dependent on the total amount of organic matter present ($t = 1{\cdot}1$). Although a complete explanation of this relationship is not yet forthcoming, the result implies that the nature of the organic matter present, rather than its total amount, is the primary factor concerned in the productivity of cacao soils under the climatic, cultural, and soil conditions that obtain in Tobago.

Afterwards, similar comparisons of yields and C/N ratios for cacao soil—profile samples collected in Trinidad and in Grenada, B.W.I.—have been established. The following additional results have been demonstrated:

	Mean C/N Ratios (Top 6 in. Soil).	
	'Good' Cacao Soils. (Yield, more than 8 Bags/1000.)	'Bad' Cacao Soils. (Yield, less than 8 Bags/1000.)
Trinidad . .	7·0 (54 samples)	5·7 (46 samples)
Grenada . .	8·0 (23 samples)	6·5 (12 samples)
(Tobago; for comparison) . .	8·3 (21 samples)	6·8 (10 samples)

Whilst these results substantiate the earlier Tobago result, the numerical values of the C/N ratios for the Trinidad and the Grenada soils are not identical with those for the Tobago soils, but they are of the same order of magnitude, and their differences are approximately the same.

A comparison of the climatic, cultural, and soil conditions within the three areas is instructive. The climatic differences are not very marked. Within each area, the annual rainfall (45 to 120 inches) is distributed between seven wet months (June to December) and five dry months. The cultural treatment is somewhat similar, except that leguminous shade trees (Immortel) are generally grown in the cacao fields of Trinidad and Tobago, but not in those of Grenada, whilst artificial manures are regularly employed in Grenada but not in the other islands. The soil types are markedly different. The cacao soils of Trinidad are mainly derived from Tertiary sedimentary rocks and from their recent alluvial representatives, but some alluvial soils of the Northern Range of mountains are derived from Palæozoic dynamo-metamorphosed sediments. The cacao soils of Tobago are about equally distributed between—(*a*) metamorphic sedimentary rock types, similar to those of northern Trinidad; (*b*) partly metamorphosed, intrusive basic igneous rock (epidiorite) types; and (*c*) alluvial equivalents of both. The cacao soils of Grenada are derived from Pleistocene basic volcanic rocks (hornblende and augite andesites and olivine basalts; lavas, intrusions, and fragmental rocks) or their alluvial derivatives. Detailed studies of all these soil types are now being prosecuted at the College, and include a special investigation of the transformations of their organic matter contents. It is hoped thereby to discover the true significance of the C/N ratio of soil organic matter in its relation to nutrition of the cacao tree.

F. HARDY
(Imperial College of Tropical Agriculture).
G. GRIFFITH
(Dept. of Agriculture, Uganda).

Trinidad, Nov. 28.

[1] Unpublished Thesis in part fulfilment of the requirements of the Associateship of the Imperial College of Tropical Agriculture, Trinidad, B.W.I., session 1929-30.

Raman Lines and Infra-Red Bands in Nitrous Oxide.

THE question whether or not the N_2O molecule is linear, and if so, whether the oxygen atom occupies a position between the two nitrogen atoms or at one end, was discussed by Snow [1] some time ago. The incomplete evidence then available seemed to favour the symmetrical configuration. We have, however, been able to show conclusively that the molecule is unsymmetrical, though linear.[2] The form of the bands and the spacing of the rotation lines is inconsistent with any but the linear model. The selection rules for vibrational transitions and for the appearance of zero branches, and the fact that all three fundamental frequencies are optically active, indicate the asymmetry.

The lowest frequency fundamental vibration, designated as ν_2, involves simultaneous displacements of the three atoms perpendicular to the linear axis, the central atom moving toward one side and the extreme atoms toward the other. Dennison [3] has shown that in the first excited state each atom executes a circle about its normal position as centre. The molecule thus becomes a very slender rotating triangle the lengths of the sides of which *do not vary*. Consequently there is no change in polarisability with phase, and, according to Placzek,[4] no Raman scattering. A second fundamental frequency, designated as ν_1, involves simultaneous displacements of the two extreme atoms towards and away from the centre, with rapid changes in polarisability, and should give an intense Raman line. We find this band in the infra-red at 1285 cm.$^{-1}$.

The third fundamental frequency, ν_3, which we find at 2224 cm.$^{-1}$, involves displacements of both extreme atoms in one direction along the axis and of the central atom in the opposite direction. If the molecule were symmetrical (both extreme atoms identical) the configurations at phases one-fourth and three-fourths would be mirror images of one another. At zero phase the polarisability would be either a maximum or a minimum, the sequence of values assumed during half of the period being repeated precisely during the next half period. Thus no Raman displacements of the fundamental frequency would occur. For the

unsymmetrical molecule, however, this would not be the case, and Raman lines would be expected, though perhaps with low intensity.

The observations of Bhagavantam [5] corroborate in a satisfactory manner our conclusions regarding asymmetry. He finds an intense Raman line with the displacement 1283 cm.$^{-1}$, and a rather weak line with the displacement 2226 cm.$^{-1}$, in very good agreement with our values for ν_1 and ν_3. The former corresponds to the intense scattering in CO_2 associated with the symmetrical and optically inactive vibration at about 1338 cm.$^{-1}$, but for the latter CO_2 has no counterpart, in spite of the fact that its strongest infra-red absorption band occurs at 2349 cm.$^{-1}$.

Because of the small energy and double weight of the first vibration state ν_2, a large fraction of the N_2O molecules (about one-eighth) are excited to this level at room temperature. The Raman displacements for light scattered by these excited molecules would be slightly different from those for normal atoms, giving rise to satellite lines. From combination relations we are able to predicate the positions of these weaker lines, not yet observed; their displacements should be 1278 cm.$^{-1}$ and 2210 cm.$^{-1}$. Lines corresponding to the stronger of these have already been observed in the Raman spectra of CO_2 and HCN precisely at the positions indicated by the infra-red observations.

E. F. BARKER.

University of Michigan,
Nov. 30.

[1] *Proc. Roy. Soc.*, A, **128**, 294; 1930.
[2] *Physical Review*, **38**, 1827; 1931
[3] *Rev. Mod. Phys.*, **3**, 280; 1931.
[4] *Z. Physik*, **70**, 84; 1931.
[5] NATURE, **127**, 817; 1931.

Selective Action of Living Tissue to Homogeneous Radiation.

A SELECTIVE action has been observed [1] when the allantoic membrane of the embryo chick is exposed to homogeneous X-radiation obtained by crystal diffraction.

The biological response, depicted in Fig. 1, *A*, may be described in terms of a series of maxima connected by an empirical formula $\lambda = kn^2$, where λ is expressed in cm., k is a constant equal to $3{\cdot}2 \times 10^{-10}$,

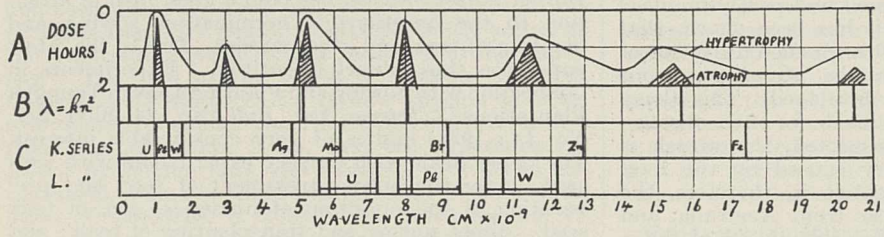


FIG. 1.

and n is given successive integral values from 2 to 8 (Fig. 1, *B*).

A 'maximum' is predicted at a wave-length of $3{\cdot}2 \times 10^{-10}$ cm. by making n equal to 1, but unfortunately the experimental investigation would be very difficult.

The position of a 'biological maximum' is only known within a margin of $\pm 0{\cdot}25 \times 10^{-9}$ cm., owing to the use of comparatively wide spectrometer slits, and the experimental evidence is somewhat scanty for high and low values of n. Nevertheless, there are great difficulties in associating the selective action with the K and L levels of heavy atoms, some of which are present in minute quantities (Fig. 1, *C*). (Tungsten, silver, and bromine are not present, but of importance in energy measurement.)

The suggestion is made that the above formula might be associated with a series of nuclear energy levels in one of the light atoms which form the main bulk of living tissues.

W. MOPPETT.

The University of Sydney,
Oct. 12.

[1] Moppett, *Proc. Roy. Soc.*, B, **105**, p. 402.

Effect of Light on the Surface Tension of Boys's Soap Solution.

IN his letter in NATURE,[1] Dr. P. Lecomte du Noüy says: "As the concentration of the *soap solution + glycerin* which he [L. D. Mahajan [2]] uses is not stated, but may be as high as 2·5 per cent—which should give a very small drop—it is indeed quite possible that illumination plays a part in this case".

Dr. du Noüy and others who are interested in the subject may be interested to know that I used Boys's soap solution and its various dilutions—even up to one per cent of the Boys's soap solution in the dilution. The minimum strength of the sodium oleate in the dilution which I studied was $2{\cdot}5 \times 10^{-4}$. In all observations the results obtained were found constant throughout for all dilutions. The details of the above work [3] are published in the *Indian Journal of Physics*.

I am now trying still higher dilutions, even up to 10^{-8}. The results are appearing hopeful again, and interesting, and will shortly be published.

L. D. MAHAJAN.

Physics Laboratory, Mohindra College,
Patiala, India, Nov. 20.

[1] P. L. du Noüy, NATURE, Oct. 17, 1931, p. 674.
[2] L. D. Mahajan, NATURE, Sept. 19, 1931, p. 496.
[3] L. D. Mahajan, *Indian J. Phys.*, Calcutta, vol. 6, part ii., pp. 147-153.

An Agricultural Pamphlet.

IN 1905, Wilfarth, Römer, and Wimmer published in the *Landw. Versuchs. Stat.*, vol. 63, a paper, "Über die Nährstoffaufnahme der Pflanzen in verschiedenen Zeiten ihres Wachstums". The importance of this paper in agricultural science was soon recognised, and before long an English translation was published in pamphlet form. Copies of this were obtained by the libraries at Rothamsted and at the Ministry of Agriculture, but not apparently by the British Museum or the Science Library.

The Rothamsted copy was obtained in the days when our library was not properly constituted; we had only very few books and no librarian, and we did not take the full bibliographical details. Our copy has long been missing, and on inquiry at the library of the Ministry of Agriculture we find that by a strange coincidence theirs also cannot be found, so that we know neither the translator nor the publisher, and consequently cannot take steps to obtain a new copy.

I should be grateful for bibliographical information, or, better still, to learn where I can now obtain another copy.

E. J. RUSSELL.

Rothamsted Experimental Station,
Harpenden, Herts,
Dec. 21.

Research Items.

Eyebrows and Eyelashes in Man.—A preliminary report on a study of the eyebrows and eyelashes in man, a subject not hitherto treated in anthropological literature, is published by Prof. V. Suk and Dr. F. Rozprým in *Pub.* No. 142 of the Faculty of Science of the Masaryk University, Brno. The study deals specifically with form and colour and the question of heredity. Eyebrows are divided into 11 types according to form, which varies extensively. Of 470 cases the greatest number are classified as 'spreading', those which are evenly formed on each side occurring much more rarely, 96 cases of the latter as against 157 of the former. The 'even' occurs 20 times as frequently in women. 'Peaked', rising in the middle, is rare, occurring 12 times only. 'Narrowing', in which the eyebrows are thick at the medial end and narrow towards the distal side, seems to be a feminine form, occurring three times as often in women. A whorl running outward from the nose is also feminine. There is no correlation between form and colour. In the eyelashes the upper are more characteristic than the lower. The long curved eyelashes occur 150 times in a total of 470, being present twice as often in children under sixteen years of age. It is an infantile form, for this type of eyelash is shed at puberty and often replaced by a different type. It is generally dark brown to black. Short and straight occur equally often in men and women, but never in childhood. Short-curved is least represented, and occurs most frequently in men, never in children. Two apparently abnormal types were observed, one bent inward toward the eye, the other long and straight but hooked at the end. Inheritance of these characters having been neglected, there are no data for comparison, but one family tree shows interesting characters. Form and colour are not inherited together, but the inheritance of form is clearly to be seen.

Black Disease and Sheep.—Pamphlet 19 of the Australian Council for Scientific and Industrial Research contains a concise account by Dr. A. W. Turner of the nature and means of prevention of the much-dreaded black disease of sheep (infectious necrotic hepatitis). As a result of extensive investigations carried out by the Council and partly financed by the graziers themselves, it has been shown that this disease, which is responsible for such heavy losses in Australia, is largely preventible. An effective, but not costly, vaccine has been developed. This alone, however, will not prevent the incidence of the disease, for, as had already been suspected, the attack is dependent on previous injury caused by the liver fluke. The fundamental problem is, therefore, the elimination of this latter pest from Australia, and details of suitable methods for getting rid of fluke, such as drainage, treatment of marshy ground with copper sulphate, and drenching sheep with a mixture of carbon tetrachloride and liquid paraffin are described. Vaccination of sheep with the appropriate anti-black disease vaccine is also advised, and the necessity for burning infected carcasses strongly advocated. The cost of these operations is not prohibitive. Apart from labour, drenching and vaccinating sheep amounts to little over 2½*d.* per sheep per annum, and considering the economic significance of the disease the outlay would seem more than justifiable.

Power of the Adductor Muscle of Bivalves.—The power of the adductor muscle of the larger bivalves has often been remarked: Darwin referred to it in the case of the tropical *Tridacna*, and Vaillant in 1865 found that the absolute power of the adductor of *Tridacna elongata* ranged from 4919 gm. to 7200 gm. per sq. cm. of section area of the muscle. Tadashi Tamura has now tested the power of the adductor muscle of thirty species of tropical marine bivalves, and has found it to range from 1071 gm. in *Coralliophaga* to 11,381 gm. in *Chama* per sq. cm. of section area (*Science Reports, Tôhoku Imp. Univ.*, vol. 4, Sept. 1931). A comparison of the power of the adductor among different species of bivalves shows that the specific difference amongst lamellibranchs is far greater than in any other phylum of animals where such differences have been studied.

Chromosomes of an Unfixable Dwarf Wheat.—In 1902 the late M. Philippe de Vilmorin found two dwarf types in commercial wheats, but was unable to fix them by inbreeding, as the descendants always gave some tall progeny which bred true. Engledow and Wadham studied the problem and suspected chromosome irregularity. The solution has now been reached by Prof. C. L. Huskins (*Jour. Genetics*, vol. 25, No. 1), who investigated plants grown at Merton from seeds of Prof. Engledow. It is shown that the dwarf plants in this unfixable wheat produce three main types of progeny: normals, dwarfs, and pigmies. The first two occur in ratio approaching 1 : 1, while the pigmies are rare. The talls have 42 chromosomes, the dwarfs 43, and the pigmies 44. In the dwarfs the extra chromosome is usually included in a trivalent in the pollen mother cell during meiosis, but is sometimes by itself or may form part of a quadrivalent or quinquevalent combination. Quadrivalents also frequently occur in the tall segregates. The extra chromosome in a dwarf is sometimes a long one and sometimes short, and the redistribution of these chromosomes produces smaller variations (noted by Engledow and Wadham) within the three main types which are due to the chromosome numbers. The main results are therefore similar to those obtained in the analysis of speltoid wheats and fatuoid oats.

Germination of Teak.—Mr. H. R. Blanford, of the Burma Forest Service, has paid a great deal of attention to the questions of germination, sowing, and planting of teak and other species. One of his latest papers on this subject is entitled "Experiments in Connection with Sowing and Planting Teak in Taungya Plantations" (*Burma For. Bull.* No. 24, Silvi. Ser. No. 14; 1931) and is of very considerable interest. The paper deals with nursery experiments with teak seed, under the heads—treatment of seed and preparation of soil—position of nurseries—size of teak seed; direct sowing and transplanting of teak; and transplanting with stumps. Owing to the cheapness of seed in Burma in the past they have been content with a comparatively low germination percentage, but the importance of securing early germination would seem to justify extra treatment. It appears to have been finally established that it is moisture and not heat that is required for teak seeds sown during the hot weather. There does not seem to be much difference in seedlings originating from small and large seed, so that there is no reason for sifting the seed. Some valuable information has been obtained on the question of the comparison of the different methods of direct sowing and transplanting in a taungya plantation. The experiments apparently strongly confirm the very great advantage of planting as against direct sowing. The work carried out with teak stumps has not as yet reached a conclusive stage.

Pliocene and Pleistocene Mollusca of California.—The main part of a "Catalogue of the Marine Pliocene and Pleistocene Mollusca of California and adjacent Regions", by U. S. Grant and H. D. Gale (*Mem. San Diego Soc. Nat. Hist.*, **1**, 1931, pp. 1036, pls. 32), consists of a monograph of the species of Mollusca, but is preceded by a summary of the stratigraphy. It is pointed out that correlation by means of the percentage of extinct species may lead to erroneous conclusions. Thus some of the cold-water horizons seemed to be older than they really are, because of the apparently large proportion of extinct species; but with the fuller knowledge of northern faunas now available this percentage is known to be too high. It follows that faunas which lived under climatic conditions similar to those now existing in the neighbourhood will give the impression of being more like living faunas than those which lived during colder periods. Climatic changes are a fundamental cause of differences in faunas, and it is believed that these changes were widespread, especially in Pleistocene times, and are therefore of value in correlation over wide areas. The number of extinct species in the Californian Pliocene is already known to be much less than half the total number of species, and, when the living faunas of western Mexico and central America are better known, the number is likely to be further reduced. A number of striking similarities between Californian species and corresponding forms in Japan, the eastern United States, Europe, and Africa have been noticed. In California there appears to have been one well-marked sedimentary cycle in the Miocene and another in the Pliocene, and the beginnings and endings of these seem to have coincided with the beginnings and endings of the Miocene and Pliocene periods in Europe. It is believed that California remained relatively stable during the Miocene and Pliocene periods, and that the only widespread deformation that would upset the orderly sequence of sedimentary cycles did not come until the middle of the Pleistocene.

Giant Pleochroic Haloes.—In 1920 Hirschi discovered abnormally large pleochroic haloes in the biotite of an Alpine syenite (radii, 54 μ). Ten years later Wiman recorded the presence of similar haloes (55-60 μ) in the biotite and hornblende of the Pre-Cambrian granites near Uppsala. As such haloes have not been generally observed, Wiman thought it improbable that they could be ascribed to the action of the long-range α-particles from radium-C or thorium-C (see "The Age of the Earth", *National Research Council Bull.*, **80**, p. 187). It now appears from an examination of similar giant haloes in cordierite-gneiss from Madura, South India, that the hypothesis rejected by Wiman may, nevertheless, provide an explanation. At the eighteenth Indian Science Congress (*Proceedings*, p. 309) M. S. Krishnan and C. Mahadeven claimed to have shown conclusively that the dimensions of the giant haloes in cordierite correspond to the ranges 9·3 cm. for radium-C and 11·5 cm. for thorium-C in air. The full development and excellent state of preservation of the structures in these haloes is ascribed to the richness of the cordierite in radioactive nuclei-minerals and the long period of activity of the latter. The gneiss dates from early Pre-Cambrian times. The intensity of pleochroism in the haloes varies with the directions of light absorption in the cordierite.

Auroral Heights in Canada.—The *Canadian Journal of Research*, vol. 5, Sept. 1931, pp. 285-296, contains an important article on auroræ by J. C. McLennan, H. S. Wynne-Edwards, and H. J. C. Ireton. On four dates in January and February 1931, photographs of auroræ (mainly of arc or band type) were taken simultaneously from two stations, 46 km. apart, alongside the Temiskaming and Northern Ontario Railway, the telephone system of which was made available to the observers. The main station (Onakawana) was at lat. 51° N., long. 81° W. A Krogness auroral camera was used. The heights found ranged from 70 km. to 130 km., the height of most frequent occurrence being about 95 km. These are a few kilometres lower than the corresponding heights found by Størmer in Norway. The geographical situation of the auroræ is shown on a map: the arcs and bands lie, as elsewhere, roughly at right angles to the magnetic meridians. The paper is enriched by beautiful reproductions of twelve pairs of auroral photographs.

Correlation of Pressure and Temperature in the Upper Atmosphere.—The exploration of the upper atmosphere by means of sounding balloons equipped with apparatus for measuring pressure, temperature, and sometimes humidity, has been pursued to an increasing extent during the past twenty years, in the hope that this may lead to an understanding of the causes of the cyclones and anticyclones that are of such importance in governing the day to day variations of the weather. In Great Britain W. H. Dines showed that there is high positive correlation between pressure and temperature at any level between about 2 km. and 8 km. W. Van Bemmelen found a somewhat similar relationship for the upper atmosphere over Java, the principal difference being that the largest coefficients found there were not so large as those found for the British Isles, while they occurred higher up, between heights of about 8 km. and 16 km. S. Gopal Rao has now given an analysis of 185 soundings made at Agra in 1925–29, and compared the results with those obtained by Dines and Van Bemmelen (India Meteorological Department, *Scientific Notes*, vol. 3, No. 26, March 1931). He divides the material into two parts—winter and summer monsoon. The correlation coefficients for winter show a variation with height that agrees more nearly with the results of Dines, with the difference that the positive correlation disappears at 13 km. instead of 11 km. The variation of those for the summer monsoon, on the other hand, agrees fairly well with that for Java. It appears that adjustment to conditions normal for a given latitude takes considerable time, considering that when the air supply to India is tropical, as happens at the height of the summer monsoon, conditions are found there such as are normal to a place near the equator. The gradual extension of such statistical inquiries to new regions is obviously desirable, and it is greatly to be hoped that the forthcoming Polar Year of arctic research may result in high latitudes receiving attention.

Fundamental Physical Constants.—In two recent papers in the *Philosophical Magazine*, Dr. W. N. Bond has developed a new way for reducing the experimental data used in connexion with determinations of the electronic charge (e) and Planck's constant (h), based on the observation that each group of experiments connects h and e by an equation of the form $h = Ae^n$, where n is either 1, $1\frac{1}{3}$ or $1\frac{2}{3}$, according to the experiments, and A expresses the results of the measurements made. By taking two types of experiments with different values of n, e and h may be found with previously unattained precision. By this method Dr. Bond showed that Eddington's constant had a value of $137{\cdot}02 \pm 0{\cdot}06$, in excellent agreement with theory. The subject has now been taken up again by R. T. Birge, and in a note appearing in the *Bulletin of the American Physical Society* for Dec. 6 he expresses the opinion that Bond's method

for evaluation of e is far more reliable than any direct determination, but disagrees with the way in which it has been followed up. In Birge's new calculation by Bond's method, the values of e and h are found to depend chiefly upon the value adopted for the specific charge (e/m) of the electron, which he takes to be $1{\cdot}761 \times 10^7$, remarking that this now seems well-established. It leads to a value of $137{\cdot}28 \pm 0{\cdot}07$ for Eddington's constant, whereas if this were 137 exactly, e/m would have a value which he regards as improbably high.

Constant Monochromatic Spark Illumination.—Forbes and Brackett, in the November *Journal of the American Chemical Society*, describe an apparatus by means of which a spark between metal electrodes can be maintained automatically constant over fairly long periods. The spark is struck between adjacent edges of two square bars moving in horizontal planes at right angles to each other, the bars being retracted by threaded rods passing through sleeves rotated by worm gears. In the case of zinc bars 400 mm. long and 25 mm. square, a life of one and a half hours per pair of edges was obtained with a 5 kw. transformer operated on 35 amp. and 110 volts. Measurements showing the constancy of the energy of emission from a monochromator for various metal electrodes are given, and also a simplified method of following the energy of emission through a measurement.

Thermodynamics of Gas Reactions.—H. Scheibel, in the *Sitzungsberichte* of the Vienna Academy of Sciences, Abt. IIb, vol. 140, p. 183, discusses in detail the calculation of gaseous equilibria by means of three types of formula: (1) the classical formula, with observed values of specific heats; (2) the formula making use of Nernst's chemical constants; and (3) the formula using the specific heats calculated by the quantum theory from the results of band spectra. The results show that the first type of formula gives the most reliable values, although it is based on empirical results. The other two formulæ, although they have a theoretical basis, involve so many approximations and (in the third case) uncertainties that it is not surprising that they do not, in general, show very good agreement with experiment. In the case of complicated molecules, for example, there is doubt as to the number of degrees of freedom involved, and the extension of the Planck-Einstein function, deduced for monatomic solids, to gases is not strictly justified by theory. It is to be expected that further experimental investigation will lead to improvement in this respect, when the third formula will probably be the only one in general use.

Freezing Point of Platinum.—*Research Paper* No. 326 of the U.S. Bureau of Standards, by Roeser, Caldwell, and Wensel, deals with the freezing point of platinum on the International Temperature Scale, measurements being made of the ratio of brightness of black bodies maintained at the freezing points of gold and platinum, the black bodies consisting of hollow enclosures of fused thorium oxide immersed in the fused metals. The metals were heated in air in a high frequency induction furnace to secure automatic stirring of the freezing metals and to avoid contamination from furnace windings. The International Temperature Scale adopted in 1927 by the General Conference of Weights and Measures defines temperatures above the freezing point of gold in terms of Wien's law of radiation, and the method adopted was therefore one which permitted direct reference to this scale. The mean value of the freezing point of platinum, obtained with two lots of pure platinum, two optical pyrometers, and observations by three observers, was 1773·5° C. Other recent measurements, when reduced to the International Scale, are 1769·5° by Hoffmann in 1924, and 1762° by Ribaud and Mohr. The paper also contains a list of fourteen previous independent determinations of the melting point of platinum.

Astronomical Topics.

Eclipse of the Moon of Sept. 26, 1931.—*L'Astronomie* for November contains a series of photographs of the partially eclipsed moon, also diagrams by M. Ananoff showing the distribution of colours on the lunar disc during the total phase. The most interesting point is that there was a region described as "Bleu-verdâtre" throughout totality, though it changed its position on the disc. Blue is not very often seen on the moon (witness the phrase 'once in a blue moon'), but the writer of this note recorded that part of the disc was of a decided blue colour in the eclipse of Oct. 17, 1902: dawn ensued shortly after this, and it was of a pure blue colour, without any admixture of red; this probably had some connexion with the blue on the moon. A note, with a diagram, was published in *Observatory* for November 1902.

Astronomical Society of South Africa.—Vol. 3, No. 1, of the *Journal* of this Society begins with a well-deserved eulogy of Rev. Fearon Fallows, the first director of the Cape Observatory, who died in 1831, aged forty-two years. His death was hastened by overwork and anxiety. In spite of grave difficulties, due to inadequate assistance and unsatisfactory instruments, he made a creditable beginning in the work for which the observatory has since become so famous; his wife took observations with the mural circle, since he was deprived of an assistant. This circle had been sent out to him in an unfinished condition, the steel collar not having been properly attached. The article closes with the words: "May a long succession of His Majesty's Astronomers, and the people of South Africa, never forget how much they owe to the patient, self-sacrificing, and arduous labours of Rev. Fearon Fallows". An account follows of a large meteor seen to fall in 1838, the explosion being heard over a radius of 70 miles. A number of fragments were collected, some weighing 3-4 lb. This meteor is omitted from many lists of meteors seen to fall.

Four photographs of the total lunar eclipse of April 2, 1931, are reproduced. The gradation of shading at the edge of the shadow is well brought out. The fourth picture was taken during totality, with exposure only two seconds; the limb is clearly visible, and some trace can be seen of the maria. The report of the comet section notes that this is the first report since 1916 that does not include the discovery of a comet in South Africa. Mr. Blathwayt spent 130 hours in searching for comets, but without success. A very complete series of observations of Encke's comet was made at Johannesburg.

Nova Pictoris is fading very slowly, and is still of magnitude 8·4. The light of the central star is nearly constant, but the components B and C are fading. Dr. Spencer Jones reports that the spectrum is of Wolf-Rayet type, but with a strong emission of unknown origin at 6087 A. His conclusions as to the present condition of the star were communicated to the Royal Astronomical Society, and have already been noted in this column.

Early Scientific Worthies of America.

IN 1661, John Winthrop, son of John Winthrop the first governor of Massachusetts, visited England for the purpose of securing from Charles II. a royal charter for Connecticut, of which colony he had himself for many years held the governorship. Born in 1606, he had travelled and studied, was a capable physician, possessed a knowledge of chemistry and metallurgy, and had promoted the iron and other industries of the American colonies. Twice before he had visited England, but his third visit coinciding with the birth of the Royal Society, at a meeting of the Society in the old Gresham College in December 1661 he was chosen one of the members, and in May 1663, after the Society had secured its charter, his name was included in the list of original fellows.

Already known to many European men of science, after his return home Winthrop became the western correspondent of the Royal Society, and it was mainly through his letters from Newton, Boyle, Hooke, Barrow, and others, and the *Transactions* of the Society that the mathematicians and naturalists in the colonies learnt of the progress of science in Europe. Winthrop's active and useful life came to a close on April 5, 1676, and he was buried in King's Chapel, Boston, where his famous father and some of his distinguished descendants also lie.

Such, briefly, is the biography of the earliest of the scientific worthies of America, to whom Mr. F. E. Brasch refers in two historical articles on the Royal Society of London and its influence upon scientific thought in the American colonies, published in the *Scientific Monthly* for October and November. When Winthrop lived, the colonies were still but sparsely populated, and the conditions of life could have provided little opportunity for the pursuit of knowledge for its own sake. Yet long before he died Harvard College was a flourishing institution, and, as Mr. Brasch shows, with the growth of the college, the effects of the intercourse between the Royal Society and America, which began with Winthrop, were more and more fully felt, with advantage to both the Society and the colonies. To this intercourse may be traced, among other things, the founding of both the American Philosophical Society and the American Academy of Arts and Sciences.

Mr. Brasch's review covers the latter half of the seventeenth and the whole of the eighteenth century, and in that period he recalls no fewer than eighteen fellows of the Royal Society who were connected with American science in one way or another. Among these were Thomas Brattle, a successful merchant and treasurer of Harvard, whose astronomical observations of the comet of 1680 were of use to Newton and Halley; William Brattle, his brother, the first tutor of philosophy in the colonies; William Byrd, who sent plants and minerals to Sir Hans Sloane; John Leverett, president of Harvard; Cotton Mather, who corresponded with John Woodward and sent him fossils; Paul Dudley, Chief Justice of Massachusetts, who communicated to the Royal Society papers on natural history and is regarded as the first horticulturist in America; and John Winthrop (1681–1747), a diligent collector, to whom the fortieth volume of the *Transactions* of the Royal Society was dedicated.

Valuable as were the efforts of these individuals in furthering the claims and interests of science, of still greater importance was the work of Benjamin Franklin, John Winthrop (iv.), Dr. John Morgan, and David Rittenhouse, who were admitted to the Royal Society in the years 1756, 1766, 1765, and 1795 respectively. Franklin is rightly regarded as the foremost American man of science of the eighteenth century, and not the least of his services was the constant solicitude he showed when abroad for the reputation of his fellow-workers at home. He was "virtually the intellectual ambassador of his fellow-beings".

Mr. Brasch calls John Winthrop (iv.) the first real scientific astronomer and the first Newtonian disciple in America. Born in 1714, eight years after Franklin, Winthrop at the age of twenty-four years was chosen professor of mathematics and natural philosophy at Harvard, a post he held with distinction until his death in 1779. He introduced the study of fluxions, he established a laboratory for experimental physics, for more than thirty years he made astronomical observations, he contributed eleven papers to the Royal Society, and to him can be attributed the founding of the American Academy of Arts and Sciences.

Of John Morgan (1735–1789) it is sufficient to say that he was the founder of the first medical school in America; while David Rittenhouse (1732–1796), who as a boy drew mathematical figures on fences and barn-doors, planned the first observatory in the colony and was the successor of Franklin as president of the American Philosophical Society.

The Physics Workshop at the Imperial College.

ON Wednesday, January 6, during the special session for members of the Annual Exhibition of the Physical and Optical Societies, Prof. C. V. Boys, in the presence of about a hundred subscribers, presented Mr. W. J. Colebrook, formerly superintendent of the physics workshop of the Imperial College of Science and Technology, with a cheque for £100 on the occasion of his retirement. Mr. Colebrook had been connected with the workshop for forty years, and in addition he had acted during the War as workshop consultant to the War Office X-ray Committee, and from 1914 to the present time had been superintendent of the Air Ministry workshop. The testimonial represented the good wishes and appreciation of a large number of scientific workers.

During the course of an interesting address, extracts from which are subjoined, Prof. Boys outlined the early history of the physics workshop, with which he himself had been closely associated, and described how he had 'discovered' Mr. Colebrook.

Lord Rayleigh, who occupied the chair, added that during the years in which he had worked at the Imperial College he had been impressed by the efficiency of Mr. Colebrook's workmanship and his capacity for organising his department with a complete absence of friction and ostentation. Further appreciations were expressed by Lieut.-Col. K. Edgcumbe and Mr. Watson Baker, representing the British Electrical and Allied Manufacturers' Association and the British Optical Instruments Manufacturers' Association respectively, and the former presented Mr. Colebrook with an additional cheque on behalf of fifty-seven exhibitors at the Annual Exhibition of the Physical and Optical Societies, of which he had been organiser during the twenty-one years since its establishment. Mr. Colebrook, acknowledging the testimonials in an interesting and appropriate speech, expressed his gratitude for the invariably friendly relations which had always existed between him and those with whom he had worked.

In the course of his speech, Prof. Boys said :

" We have met to-day to express our appreciation of the valuable services which have been rendered by Mr. Colebrook during the last forty years. During this time he has made us all his debtors on account of his industry, his good temper, his willingness and desire to help, and, above all, by his consummate skill as a craftsman.

" When I see now the magnificent collection of tools which in the present century has grown up under his guidance, and contrast it with the meagre equipment of my time, I feel that the early history of the workshop—which no one else but myself can give—and of the introduction of Mr. Colebrook is of sufficient general interest for me to recount.

" About the year 1873, Prof. Guthrie made out an order for a small general purpose lathe, but this order was stopped when it got to the museum, and the official answer, put colloquially, was—' Lathe ? What can you possibly want with a lathe in a physical laboratory ? If you have anything which you want to be turned, let us have it and we will get it turned in the museum workshop.' Well, Prof. Guthrie was Scotch and very persistent, and General Festing, R.E., the engineer in charge of the museum and workshops, was a delightful, genial, and jovial friend of all who came his way. The result was, skipping intermediate steps, that a little 4-inch Cotton and Johnson lathe was acquired, and, though a poor little thing, it was in constant use and proved itself invaluable.

" Coming now to the second chapter, about the year 1890, Prof. Rücker and I felt that we must have something better, and it was left to me to select a suitable lathe, but with the strictest attention to cost. There was very little money, and we did not want to draw a second refusal similar to the first. I selected what I considered the best possible lathe for physical laboratory requirements that was not too expensive. This was the Barnes 5½-inch centre lathe, and after forty years I still consider that I could not have done better. I got the identical lathe for myself a few years later, and this is all I have for my own use to the present day. It may be interesting to state that when Prof. Mendenhall came to see me, he said—' Why, that is the lathe on which Rowland cut his famous screw—the screw of his diffraction grating machine '.

" Having now a suitable lathe, it was essential that there should be a skilled mechanic to use it and to protect it from misuse, and again I was asked to find him. I heard of Mr. Colebrook, and got him to come for a preliminary discussion. I asked him to do something with the new lathe and with a file, and, being a bit of a mechanic myself, I saw with half an eye that his handling of these tools showed him to be a skilled craftsman.

" This was the time when I was preparing my apparatus for weighing the earth, which I did at Oxford. The main apparatus was made by the Cambridge Scientific Instrument Co., but much had to be done besides, and this construction was done partly by Colebrook (I must now drop the Mr.) and partly by myself. It was then that I learned to appreciate not only Colebrook's skill but also his conscientious devotion to the work. About the same time I was photographing bullets, and I required a very perfect revolving mirror to analyse the sparks that I used in order to get one bright enough, small enough, and of short enough duration so that the bullet should not travel more than $\frac{1}{3000}$ inch while it was being photographed. I designed this to be made in dead-hard tool steel. Colebrook made it to perfection, and it was figured by Hilger. We ran this at 500 revolutions per second for ordinary use, but we did run it up to 1500 revolutions per second, at which it ran well. This is nearly twice the speed at which Foucault ran his mirror when determining the velocity of light, and my mirror would have shown the time taken by light to traverse the length of this lecture table. It was to Colebrook that I owed the success of this mirror."

A New Method of Measuring High Frequency Voltages.

IN the *Elektrotechnische Zeitschrift* for Aug. 13, L. Pungs and H. Vogler describe a new electro-optical method of measuring voltages of very high frequencies. In practice, some type of electrometer is generally employed, but with very high frequencies its readings are untrustworthy. The authors made a test on a good electrometer of a type usually employed, and found that up to one and a half million cycles per second it gave accurate and consistent results, but at twelve million cycles its readings were incorrect by errors lying between thirty and forty per cent. As these instruments are largely used in radio work for making investigations on the dielectric behaviour of insulating materials, it was necessary to find the cause of the inaccuracies and either correct their design or try to invent a new method. The errors of the instrument were found to be mainly due to the fact that its capacitance varied with its deflexion, for this led to resonance effects which made the readings quite irregular.

The authors have found a practical solution applicable to many cases. They utilise the well-known Kerr effect in electro-optics, which has been studied carefully by many physicists. The physical basis of their method is to use a monochromatic source of light, a Nicol's prism as polariser, a cell containing nitrobenzene subjected to electric stress between two parallel metal plates, maintained at the voltage to be measured, and a second Nicol's prism as analyser. The field of view is first extinguished by crossing the prisms when the voltage is not applied. On applying the voltage, light comes through owing to the Kerr effect. If the voltage be alternating, the intensity of the light is a periodic function of the time.

The authors obtain a mathematical formula for the mean intensity of the light passing through, showing that, on the supposition that there is no inertia effect, it is independent of the frequency of the alternating voltage. Making sine wave assumptions also, they prove that it is proportional to the maximum value of the electrostatic field. With the help of tables of Bessel's functions they calculate the maximum voltage, which can be found in terms of the mean light intensity. Since the mean light intensity is independent of the frequency, the instrument can be calibrated with low frequency voltage.

The main difficulties that had to be overcome in connexion with the method are, first, that the Kerr constant varies very appreciably with temperature. Hence unless the temperature remains constant it has to be measured and a correction applied. The calibration also depends on the intensity of the source of light ; it is therefore necessary to specify accurately the source of the light. The calibration is only accurate for light of a definite wave-length. The authors, therefore, were led to develop a comparison method which enables a higher accuracy to be obtained.

In this method the Kerr arrangement is adjusted so that the field is dark with zero voltage, a photo-electric cell being employed. The voltage is then applied to the Kerr cell, and the illumination of a second photoelectric cell is adjusted to a balance by

means of an electric circuit. The high frequency voltage is then cut out and a fifty cycle voltage applied, and the electric circuit is adjusted until the balance is the same as before. In this way the effective value of the high frequency voltage can be found. The comparisons are made rapidly, so that the temperature of the Kerr cell remains practically constant and the necessity of applying a temperature correction is eliminated. So long as the colour of the light is the same when making the two comparisons, it is not necessary to know its wave-length.

According to results obtained by physicists, it can be assumed that up to frequencies of thirty million cycles per second the Kerr effect is free from inertia. In this case the wave-length is ten metres. The authors suggest that it can probably be used down to five metre wave-lengths. They have used the method for voltages lying between 300 and 4000 volts. The highest frequency they used was twelve million cycles (25 metres). By using a Pulfrich photometer and applying a direct method they found that the error was 1 per cent when the applied voltage was 800 and 0·33 per cent at 1800 volts. With the photoelectric method the error was 2 per cent at 800 volts and 0·1 per cent at 1800 volts. This method has the disadvantage that the photoelectric cells and the amplifying apparatus have to be carefully screened.

Annual Conference of the Geographical Association.

THE Annual Conference of the Geographical Association was held at the London School of Economics, by kind permission of the director, Sir William Beveridge, on Jan. 6-8. As usual, the Conference was well attended by delegates and members from all parts of Great Britain, and at some of the lectures the audience exceeded four hundred. A representative publishers' exhibition, in which twenty-six firms took part, was held in conjunction with the Conference. At the termination of the proceedings in London, according to established custom, a party of members spent the week-end in a country town, this year at Rochester.

Of outstanding importance was the presidential address by Sir Leslie Mackenzie, entitled "A Health Administrator's Attitude to Geography". The work of the medical profession deals increasingly with the prevention of disease as opposed to the cure of disease, and for the medical officer of health geography must be his guide; for geography is the study of the earth as the environment of man, and Sir Leslie referred to the "flowingly intimate" correlation between health conditions and geography. In Scotland the three million population of the Midland Valley contrasts with the 420,000 people of the Highlands—a reflection of relatively favourable and relatively unfavourable geographical conditions. A study of malnutrition amongst Highland schoolchildren has shown an intimate connexion with bad harvests, which in turn reflect fluctuations in climatic conditions from year to year in a region where other geographical factors such as physiography and soil exercise a somewhat rigid control.

Coming to details, Sir Leslie pointed out that geographers have long emphasised the importance of aspect in influencing the distribution of natural vegetation and crops. It is equally important in determining health conditions. There are valley sides "half starved of sun for a million years" which must inevitably remain disease traps for their human inhabitants when compared with the opposite slopes of the same valleys. Further reference was made to the geographical methods of mapping distributions and of determining limiting factors in each case. There is need for the health administrator to follow these methods. What, for example, is the limit of distribution of tetanus in the soil of France? Is it coextensive with a certain type or certain types of soil? The widespread distribution of tetanus in Flanders soil was one of the great problems which had to be tackled by the medical service during the War. Modern developments, for example, in the field of transport must not be ignored by the medical officer; it has been shown, for example, that disease-bearing mosquitoes can be carried 12,000 miles by aeroplane. In short, the work of the health officer provides a new *motif* for the study of geography and the employ of cartographical methods of studying distributions.

The work of the Conference included also an important joint discussion with the Historical Association on "What is Historical Geography?" Prof. C. B. Fawcett undoubtedly stated the main difficulty when he said that there are so few equipped with an adequate training in both geography and history, and that until students so equipped are forthcoming the present confusion is likely to continue. He referred to Sir Halford Mackinder as a historian who has become a great geographer, and has expressed the relationship between the two sciences by saying that every event occurs both in space and time and is thus the concern both of geographer and historian, though, of course, not all events are of equal importance to either student.

The discussion made it clear that many of the historians present were inclined to equate 'geography' to 'physical geography' and failed to appreciate the modern human geography. Thus, Dr. J. E. Morris stated: "A geographer can only introduce the subject, for, when he has told us all about climate and situation, environment and stimulus, geological conditions and rainfall, it remains for the historian to show how men have used their opportunities". There was clearly no appreciation of geographical synthesis, of the study of the environment as a living concrete whole, continually acting and reacting on the central figure of man. Similarly, Prof. F. S. Marvin referred to the natural factors, "the river, the mountain, or the sea", and was obviously limiting his conception to the factors of physical geography. On the other hand, Prof. A. P. Newton showed clearly that he represents a school of historians having a clear conception of the methods and value of modern geography. Prof. E. G. R. Taylor showed how a descriptive topographical introduction accompanying historical works has come to receive the label 'historical geography' for what should be merely the geography of history. Indeed, the whole discussion made it clear that both geographers and historians have been guilty of selfishness: geographers using some of the results of historians to further geographical knowledge, historians using fragments of geography here and there for the advancement of historical studies. A plea was made whereby the Geographical and Historical Associations might devise some scheme for the exchange of research data. Miss Jeffries Davis, editor of *History*, surprised many of her listeners by finding a common requirement of both historians and geographers outside the direct sphere of either—the early completion of the 'drift' edition of the geological maps of Britain.

Dr. Gerhard Schott, the well-known oceanographer

of Hamburg, was the Association's principal foreign guest this year, and gave a lecture on the "Humboldt Current in relation to Land and Sea Conditions on the Peruvian Coast". Dr. H. R. Ormsby lectured on the part played by the limestones in the human geography of France, and afforded thereby a delightful example of the broader conceptions which can be drawn from a study of the detail accumulated in her recent book on "France".

At the annual general meeting, Dr. L. Dudley Stamp reported on the progress of the Land Utilisation Survey of Britain, and referred to the urgent necessity of completing the Survey in the present year, so that the record for the whole country would be for 1931–32. He asked especially for volunteers (to communicate with him at the London School of Economics) to complete areas in Oxfordshire, Huntingdon, West Suffolk, Essex, West Sussex, the Isle of Wight, Gloucester, Leicester, and North Yorkshire.

Brigadier H. S. L. Winterbotham gave the Association an account of new developments in the Ordnance Survey one-inch maps. Mr. S. A. S. Hozayen lectured on the Arab geographers, Mr. J. Fairgrieve dealt with several aspects of the cinema in schools, and the Association welcomed an old friend in Prof. P. F. Kendall.

L. DUDLEY STAMP.

University and Educational Intelligence.

CAMBRIDGE.—It is announced that Mr. R. H. Fowler, fellow of Trinity College, and University lecturer in mathematics, has been appointed to the John Humphrey Plummer professorship of mathematical physics. Prof. Fowler is distinguished for his theoretical investigations of the structure of the atom and related subjects.

LEEDS.—The University has received the legacy of £100,000 bequeathed to it for general purposes by the late Lord Brotherton. In conveying thanks to the executors for making the presentation in person and for their expressions of goodwill towards the University, the chairman of the Finance Committee stated that Lord Brotherton, during his lifetime, made gifts to the University amounting to £120,150, chief amongst which were £20,000 for the endowment of the chair of bacteriology and £100,000 for the building of a new library. The erection of the latter—to be known as "The Brotherton Library"—will be commenced shortly, the foundation stone already having been laid by Lord Brotherton himself.

Mr. T. H. Blakeley has been elected to the Gas Research Fellowship endowed by the Institution of Gas Engineers, which has been rendered vacant by the appointment of the previous holder, Dr. A. H. Eastwood, to the staff of the Joint Research Committee of the Institution and the University. Mr. Blakeley has carried out an investigation into the thermal conductivity of materials used for the insulation of high temperature furnaces. As holder of the fellowship, he will undertake further research work in the University under the direction of the Livesey professor of coal gas and fuel industries, on the reactivities of carbonised fuels at high temperatures.

Two special lectures of the series dealing with aspects of biochemistry being given at the Chelsea Polytechnic, Manresa Road, London, S.W.3, will be delivered by Dr. Colin H. Lea, of the Low Temperature Station, Cambridge, on Jan. 28 and Feb. 4, at 6 P.M. The subject of Dr. Lea's lectures will be "Some Recent Advances in the Chemistry of the Fats". Further particulars can be obtained from the principal of the College.

TECHNICAL Colleges in Great Britain differ noticeably from one another in respect of their devices for maintaining close touch with the changing needs of the various industries which look to them for recruits or for the further education of persons already in employment. This remark is prompted by an inspection of a number of prospectuses for the current session. The Heriot-Watt College, Edinburgh, is conspicuous for the completeness of its system of associating itself with industrial firms. On its board of governors are representatives of printing and kindred trades and engineering employers' associations, coal owners and miners and building trades associations, local trade unions and the fermentation and pharmaceutical industries, and it has advisory committees for the printing trades (8), central mine-rescue station, engineering, mining, building, pharmacy, commercial studies, and stock exchange. The Royal Technical College, Glasgow, has on its committee on chemistry and metallurgy representatives of four firms and the president of the West of Scotland Iron and Steel Institute, and has representatives of firms or industrial associations on committees on engineering, textiles, building, navigation, pharmacy, bakery, and watch- and clock-making. The Technical College, Bradford, has on its college committee the presidents of the Chamber of Commerce and of the Trades and Labour Council. The Manchester Municipal College of Technology has sectional committees for textile industries, pure and applied chemistry, engineering and handicrafts and an advisory committee on industrial administration. Unfortunately, many prospectuses give no indication of the existence of any systematic check being applied to the tendency commonly to be found in teaching institutions in Great Britain to become too academic and out of contact with our industries.

Calendar of Geographical Exploration.

Jan. 24, 1616.—Le Maire Strait.

Two Dutch navigators, Willem C. Schouten and Jacob le Maire, discovered the strait between Tierra del Fuego and Staten Island. They had sailed from the Texel on June 14, 1615, hoping to discover a passage to the South Sea south of Magellan Strait, since only members of the Dutch East India Company might sail either by the Cape route or Magellan's Strait. On Jan. 29 the vessels were off Cape Horn, the southernmost point of the Tierra del Fuego Archipelago, which received its name from Schouten's birthplace, Hoorn. On their journey across the Pacific they discovered Dog Island, in the Low Archipelago, and Boscawen and Keppel Islands, between the Fiji, Tonga, and Samoan groups. They then touched the hitherto unvisited coast of New Ireland. They had hoped to reach the supposed southern continent, and made a survey of the north coast of New Guinea, thinking that this island might be part of Terra Australis. At Java their vessel was confiscated because it was thought that they must have used one of the forbidden routes. They were sent home on another vessel, Le Maire dying on the voyage home. His father, after two years' effort, secured recognition of the fact that a new strait, south of Magellan's, had been discovered.

Jan. 26, 1621.—The Gambia.

Richard Jobson left Tenda, after having sailed up the Gambia river. There he had heard stories of a city in the interior the roofs of which were covered with gold. He concluded that this was Timbuctoo, but that city was really 1000 miles from Tenda.

Owing to the shallowing of the river when the dry season set in, Jobson was compelled to start his return journey on Feb. 10, and not for a century was any further effort made to reach the Niger river and inner Africa. Jobson had been sent out by a company formed in Britain in 1618 with the purpose of exploring the Gambia. Their first expedition was entrusted to Richard Thompson, the pioneer of British exploration in Africa. But attacks by the Portuguese, mutiny among his own followers, and the deadly climate resulted in failure, Thompson being murdered by his own men. Jobson escaped with his life, but the company was dissolved.

Jan. 26, 1903.—Coats Land and the Weddell Sea.

W. S. Bruce in the *Scotia* left Port Stanley, in the Falklands, on a voyage to the Weddell Sea for purposes of scientific examination, Dr. R. N. Rudmose Brown and other scientific workers accompanying him. The vessel was anchored off Laurie Island for the winter, and scientific work and sledge exploration were carried on. In November 1903 the *Scotia* left Laurie Island, the meteorologist of the party, Mossman, remaining behind with five companions. The *Scotia* proceeded to Buenos Aires and brought back a party of Argentine meteorologists, who remained with Mossman on Laurie Island, while the vessel steamed southwards, discovering Coats Land and reaching 74° 1′ S. in 22° W. The *Scotia* carried a line of deep soundings across a vast stretch of previously uncharted ocean, and corrected Ross's marking of a point "4000 fathoms, no bottom", to 2660 fathoms, the powerful undercurrent and the less perfected instruments of Ross having caused the error.

Societies and Academies.

DUBLIN.

Royal Irish Academy, Dec. 14.—J. M. O'Connor: The nature of the metabolic regulation of the body temperature, and its relation to temperature sensations. The oxygen consumption of rabbits under urethane anæsthesia in relation to the rectal, brain, and mean skin temperature is analysed statistically. When the animal is not shivering, the oxygen consumption as determined in short periods (about 6 minutes) is closely correlated with the rectal temperature and is not appreciably influenced by the dose of anæsthetic used. The results obtained coincide with values previously established under the influence of curare. When the animal is shivering, there is an additional consumption of oxygen, which rises as the skin temperature falls from 35° C. to 28° C., after which it declines and disappears at a skin temperature of about 23°. These short period results were confirmed by the examination of 40-minute periods during which the animals' temperatures were maintained approximately steady at various levels. No influence of the head temperature could be demonstrated. It is further shown that when the surface temperature of an area of human skin is lowered to about 21° C. its power of originating sensations of cold becomes faint or is obliterated. The evidence supports the view that 'chemical temperature regulation' is a reflex response of the muscles to sensations of cold.—Miss W. E. Frost: Observations on the reproduction of *Nyctiphanes couchii* (Bell) and *Meganyctiphanes norvegica* (Sars) off the south coast of Ireland. These two euphausians are the species most abundant in the plankton of the waters off the south coast of Ireland. An account is given of their reproductive cycles, showing the seasonal occurrence and varying abundance of their larvæ in the plankton; a few notes are given on the distribution of the larvæ; the reproduction of the two species is compared. Some remarks are made on the euphausians included in the dietary of herring and mackerel taken off the south, east, and north-east coasts of Ireland; attention is directed to the fact that the larval as well as the adult forms had been eaten.

PARIS.

Academy of Sciences, Dec. 7.—The president announced the death of Sir David Bruce, *correspondant* for the Section of Medicine.—H. Vincent: Notice on Sir David Bruce.—Georges Perrier: Work carried out at the southern end of the Delambre base line, at Melun. The pillar carrying the line indicating the southern end of the Delambre base line (1792–98) has become an obstruction to traffic: it has been lowered below the surface of the road, with precautions to prevent alteration in the length of the base line.—L. Blaringhem, M. Bridel, and Mlle. C. Bourdouil: The dominance of the starchy character in hybrids of the first generation of two varieties of pea (*Pisum sativum*).—Jean Rey: The invention of the periscope. A claim for priority.—E. Mathias: Forms of lightning. Theory of formation of lightning resembling a string of beads.—P. Vincensini: A transformation of isotropic congruences.—G. Tzitzéica: Quadratic curves.—F. Marty: The determination of periodic minimum surfaces.—Georges Calugaréano: The necessary and sufficient condition for the univalence of a holomorph function in a circle.—Miron Nicolesco: Harmonic and subharmonic functions of p order.—Jacques Devisme: Some partial differential equations.—J. Karamata: The applications of some theorems of inversion to exponential summability.—B. N. Prasad: The convergence of the conjugated series of a Fourier's series.—Florin Vasilesco: A method of Riabouchinsky having for its object the solution of the problem of Dirichlet, in view of the calculation of the velocity potential.—J. Leray: The slow movement of a viscous fluid in two dimensions limited by fixed walls.—Ch. Racine: The gravitation equations of Einstein.—B. Lyot: The photography of the solar corona apart from eclipses. A detailed account of the precautions found necessary to reduce the instrumental and atmospheric diffusion to a minimum and to amplify the contrasts of the negative. The first results, although imperfect, show that it is possible to follow the changes in the appearance of the interior corona between eclipses.—Ernest Esclangon: Remarks on the preceding note. Emphasising the importance of direct observations being possible on the solar corona.—Ch. Fabry: Remarks on the preceding note.—Jacques Métadier: The general equation of Brownian movement.—Henri Chaumat and Edouard Lefrand: The realisation of electrostatic machines.—A. Grumbach and F. Taboury: The discontinuous variation of the electromotive force of photoelectric batteries with coloured liquids.—R. Hocart and Mlle. A. Serres: The magnetic properties and crystalline structure in the different varieties of anhydrous cobalt sulphate. Two varieties of anhydrous cobalt sulphate exist, both crystallised and of orthorhombic symmetry. Their crystalline networks have the same dimensions, but the different structures and change of structure run parallel with the change in magnetic properties.—E. Darmois and Mlle. R. Peyroux: The action of boric acid and borax on the rotatory power of glucose, galactose, and fructose.—L. Jacqué: The action of petrols arising from the catalytic hydrogenation of coal-tar as stabilisers. The stability of mixtures of ethyl alcohol and petrol from petroleum is increased by the addition of petrol produced by hydrogenation of coal-tar light oil.—

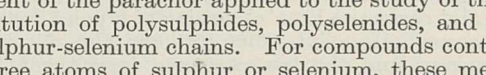
T. Karantassis and L. Capatos: The action of ammonia and amines on germanium tetriodide. Ammonia gives the compound $GeI_4.8NH_3$. Germanium iodide gives addition compounds with amines containing 4–10 molecules of the base to one of the iodide.—Martineau: The oxidation of ethyl alcohol by air in the presence of carbon-copper catalysts. The preparation of a copper-coated carbon of high activity, capable of oxidising alcohol at 66° C., is described.—Émile André and Charles Vernier: The preparation of α-phenylethylamine and its separation into its optical isomers.—Sébastien Sabetay: The synthesis of the *p*-alkyloxy-methyl-benzaldehydes.—M. Battegay, L. Denivelle, and J. Meybeck: The *N*-chlorosulphonylamides and the *N*-chlorosulphonyl-sulphonamides.—André Kling and Daniel Florentin: The mode of action of scission catalysts in hydrogenation cracking of hydrocarbons with a polycyclic nucleus. Details of the results obtained by cracking naphthalene and anthracene in the presence of various catalysts. Anhydrous aluminium chloride proved the most effective catalyst.—Mlle. Eglantine Peytral: A method of preparation of ketene. By a modification of Wilsmore's method gaseous ketene containing only 0·5–1 per cent of impurities (carbon monoxide and ethylene) can be collected over mercury.—V. Babet: The organic remains and oolithic rocks of the old sedimentary formations of French Equatorial Africa (basins of the Niari and Nyanga).—Breistroffer: The Albian level in Chartreuse (Isère and Savoie).—Louis Barrabé: The existence of three layers comparable with those of the Germanic Trias in the eastern Corbières.—J. Devaux: The study of the infra-red radiation emitted by the terrestrial atmosphere. A preliminary account of results obtained at the summit of the Pic du Midi (2860 metres) with a spectrograph containing a rock salt prism. A band at 10μ appears not to be due to water vapour or carbon dioxide. This is probably an emission band of atmospheric ozone.—J. de Lagaye: The visibility of Mont Blanc at the summit of the Puy de Dôme. A statistical study of the visibility, with a discussion of the influence of moisture, state of the sky, and barometer.—Coulomb: Certain rapid long waves (due to earthquakes), and in particular, the wave *PL* of O. Somville.—Marc Simonet: The genetic and cytological study of the hybrid *Iris pallida* × *Iris tectorum*.—Comandon and de Fonbrune: Rhythmic contractions in the pigmentary cells under the action of various poisons.—M. Fontaine and P. Portier: The proportion of calcium in the blood of marine fishes. In marine fishes the ratio of the globular calcium to the serum calcium is of the same order of magnitude as in the higher vertebrates. No relation has been found between the calcium in the serum and the nature of the skeleton, bony or cartilaginous.—L. Lutz: The soluble ferments secreted by the hymenomycete fungi. The alcoholic constituents of essential oils and the antioxygen function.—A. Paillot: The morphological variations of the symbiotic bacillus of *Macrosiphum tanaceti*.

CAPE TOWN.

Royal Society of South Africa, Oct. 21.—G. Slater: The glaciated surfaces of Nooitgedacht, near Kimberley, and the upper Dwyka boulder shales of the eastern part of Griqualand West (Cape Province). The evidence in Griqualand West contributes notably to our knowledge of glacial erosion and sedimentation. Nooitgedacht is a classical area for the study of progressive erosion of the topographical features by land-ice. The rock basin contains large outcrops of jointed diabase which display excellent examples of crag and tail phenomena showing in plan the streamline form. The iceward limb increases in length with progressive decrease in height of the obstruction to ice-movement, and terminates at the crest of a sigmoid curve. Abrasion was therefore the dominant form of erosion in the later stages of ice action. The leeward limb is associated with 'pluck', more especially in the larger outcrops. The section at De Kalk is a type example of the sedimentation of glacial detritus in water. The hard bands of tillite-like material represent englacial substance from land-ice which has been deposited as cakes from floating ice.

ROME.

Royal National Academy of the Lincei: Communications received during the vacation.—L. Laboccetta: Geometric generation of the function $I\ x$ and of the other numerical functions, $Fr\ x$, $Cm\ x$, $R\ x$, associated with it.—G. Scorza Dragoni: Concerning a theorem of Rosenblatt. The author's recent criterion of unicity for the solutions of a differential equation assuming definite values in pre-established points, which partly includes an analogous criterion due to Rosenblatt, is developed further.—D. Mercogliano: The equations of the surface of Veronese.—G. Palozzi: Correspondences projectively associated, in a point, to a surface.—A. Masotti: Observations on the plane motion of a system of points in which the centre of the velocity is stationary.—A. Belluigi: The gravimetric depression of Gattatico-Parma.—A. Baroni: Measurement of the parachor applied to the study of the constitution of polysulphides, polyselenides, and mixed sulphur-selenium chains. For compounds containing three atoms of sulphur or selenium, these measurements indicate a linear chain, which branches in the case of the tetrasulphide, and exhibits a ring of three sulphur atoms for the two isomeric diethyl pentasulphides; the latter have the structures,



—L. Passerini and M. Baccaredda: Researches on spinels (4). Sulphochromites of manganese and of cadmium. Both manganese sulphochromite, $MnCr_2S_4$, and cadmium sulphochromite, $CdCr_2S_4$, exhibit a structure of the spinel type.—G. Natta and L. Passerini: Sulpho-salts having spinel structures. Zinc sulphochromite belongs structurally to the spinel class and, given the small ionic radius of zinc, it may be assumed that the sulphochromites of other bivalent metals with ionic radii slightly greater than that of zinc possess the same lattice structure.—Giulio Cotronei and Celso Guareschi: Zoological constitution and grafting. Experiments with Anura and Urodela (6).—M. Ghiron: Enzymes and immunity. When the tubercle bacillus is grown in glycerin-broth containing a sterile glycerin suspension of an active lipolytic enzyme isolated from liver, an enfeebled strain of the organism is obtained. Moreover, systematic inoculation of the same enzyme during the development of the tubercular process determines an arrest of such process at the first phase of the inflammatory process, which may be followed by cure without further progress of the lesion.—G. Mezzadroli and E. Vareton: Action exerted on the development of silkworms by an open oscillating circuit of copper and zinc, functioning in proximity to a short wave-length radio oscillator. Under the influence of these circuits, the whole of the life-cycle of the silkworm is accelerated and its development is enhanced, the worms attaining increased robustness and weight. Further, spinning is commenced earlier, and the yield of cocoons is augmented 10-15 per cent.—P. Pasquini: Correlative differentiation of the crystalline lens and cornea in the development of anuran and urodele amphibians.—

Ada Bolaffi: Investigations on the lipoids of human tumours, particularly on the sulphophospholipids of the tumour. All the neoplastic tissues—human or otherwise—investigated by the author exhibit distinct analogies in their lipoidal constitution. They invariably contain a complex sulphophosphorated lipid extractable by means of acetone of specific gravity 0·85, but, if pure, insoluble in the anhydrous solvent. This lipid, which is moderately concentrated in the tumour, probably exhibits a constitutional character specific for each tumour, and represents a substance to some extent characteristic, if not quite specific, for neoplastic tissue. That occurring in human tumours is probably identical with the so-called jecorin.

Forthcoming Events.

Societies.

FRIDAY, JANUARY 22.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: Malformations of the Human Body considered from a New Point of View (Hunterian Lecture).

SOCIETY OF CHEMICAL INDUSTRY (Liverpool Section) (jointly with Manchester Section) (at Liverpool University), at 6.—Dr. A. E. Dunstan: Liquid Fuels, To-day and To-morrow (Jubilee Memorial Lecture).

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Sir Arthur Eddington: The Expanding Universe.

SATURDAY, JANUARY 23.

MATHEMATICAL ASSOCIATION (London Branch) (at Bedford College for Women), at 3.—A. R. Green: Some Interesting Practical Problems in Elementary Geometry.

MONDAY, JANUARY 25.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: Malformations of the Human Body considered from a New Point of View (Hunterian Lecture).

ROYAL SOCIETY OF ARTS, at 8.—Capt. O. A. Barrand and G. A. Green: Life Saving Appliances on Merchant Ships (Thomas Gray Lectures) (2).

TUESDAY, JANUARY 26.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. C. A. Edwards: The Progress of Research relating to Physical Metallurgy (2).

WEDNESDAY, JANUARY 27.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: Malformations of the Human Body considered from a New Point of View (Hunterian Lecture).

BRITISH WOOD PRESERVING ASSOCIATION (at 29 Lincoln's Inn Fields), at 6.—K. St. G. Cartwright: Diseases of Timber.

ROYAL SOCIETY OF ARTS, at 8.—Noel Heaton: The Permanence of Artists' Materials (Lecture).

THURSDAY, JANUARY 28.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. H. G. Cannon: Feeding and Digestion in Invertebrates (2).

FRIDAY, JANUARY 29.

ROYAL ASTRONOMICAL SOCIETY (Geophysical Meeting), at 5.—Prof. E. V. Appleton: Upper Air Ionisation.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: Malformations of the Human Body considered from a New Point of View (Hunterian Lecture).

Public Lectures.

FRIDAY, JANUARY 22.

IMPERIAL COLLEGE OF SCIENCE (Royal College of Science), at 5.30.—Dr. T. M. Finlay: The Evolution of Landscape: Mountains (Swiney Lectures) (8).

UNIVERSITY COLLEGE, LONDON, at 5.30.—Prof. H. A. R. Gibb: The Expansion of the Arabs, A.D. 600–750.

SATURDAY, JANUARY 23.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—M. A. Phillips: In the Haunts of the Sea-Birds.

MONDAY, JANUARY 25.

KING'S COLLEGE, LONDON, at 3.—C. J. Gadd: Assyrian Dealings with Israel.

GUY'S HOSPITAL (in Physiological Theatre), at 5.—Prof. J. M. W. Morison: The Use of X-Rays in Physiological Investigations (2): Respiratory Movements.

KING'S COLLEGE, LONDON, at 5.30.—Prof. S. H. Hooke: The Myth and Ritual of the Old Testament and the Cultural Patterns of the Ancient East (1).

IMPERIAL COLLEGE OF SCIENCE (Royal College of Science), at 5.30.—Dr. T. M. Finlay: The Evolution of Landscape: Glaciers and Land Sculpture (Swiney Lectures) (9).

TUESDAY, JANUARY 26.

UNIVERSITY COLLEGE HOSPITAL MEDICAL SCHOOL, at 5.15.—Dr. R. A. O'Brien: The Preparation, Testing, and Use of Antitoxin (2).

KING'S COLLEGE, LONDON, at 5.30.—H. A. Sieveking: Peak Load and Energy Storage (1). (Succeeding Lectures on Feb. 2 and 9.)

WEDNESDAY, JANUARY 27.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Dr. R. Fortescue Fox: The Rise of the Conception of Rheumatism as a Social Problem.

SCHOOL OF ORIENTAL STUDIES (jointly with Royal Anthropological Institute), at 5.15.—Prof. C. G. Seligman: Races of Africa.

IMPERIAL COLLEGE OF SCIENCE (Royal College of Science), at 5.30.—Dr. T. M. Finlay: The Evolution of Landscape: Britain during the Ice Age (Swiney Lectures) (10).

BELFAST MUSEUM AND ART GALLERY, at 8.—A. J. B. Wace: Linen Damask.

ESSEX HALL (Essex Street, W.C.2), at 8.—Dr. F. H. Hayward: The Message of J. L. Tayler (Tayler Memorial Lecture).

THURSDAY, JANUARY 28.

SCIENCE MUSEUM (South Kensington), at 4.30.—Capt. C. J. P. Cave: Clouds.

KING'S COLLEGE, LONDON (at 16 Russell Square, W.C.1), at 6.—S. P. Turin: Economic Conditions in Russia To-day (2): Unemployment in Russia.

FRIDAY, JANUARY 29.

IMPERIAL COLLEGE OF SCIENCE (Royal College of Science), at 5.30.—Dr. T. M. Finlay: The Evolution of Landscape: The Desert (Swiney Lectures) (11).

SATURDAY, JANUARY 30.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Dr. A. I. Richards: Women's Life and Work in a Central African Tribe.

Official Publications Received.

BRITISH.

University College of Wales, Aberystwyth: Welsh Plant Breeding Station. Self- and Cross-Fertility and Flowering Habits of certain Herbage Grasses and Legumes, together with Studies in Bulb Development and Spikelet Characters in *Arrhenatherum*. (Series H, No. 12, Sessions 1921–1930.) Pp. 240+2 plates. (Aberystwyth.) 5*s*.

The British Mycological Society Transactions. Edited by J. Ramsbottom, B. F. Barnes and H. Wormald. Vol. 16, Parts 2 and 3, December 18. Pp. 89-208. (London: Cambridge University Press.) 15*s*.

Canada: Department of Mines: Mines Branch. Chrysotile Asbestos in Canada. By James Gordon Ross. (No. 707.) Pp. x+146+34 plates. (Ottawa: F. A. Acland.) 25 cents.

Torquay Natural History Society. Transactions and Proceedings for the Year 1930-1. Vol. 6, Part 1. Pp. 82. (Torquay.)

Department of Scientific and Industrial Research. Building Science Abstracts. Vol. 4 (New Series), No. 11, November. Abstracts Nos. 2010-2237. Pp. 367-402. (London: H.M. Stationery Office.) 9*d*. net.

Museum and Public Gardens. Administration Report 1105 M.E. Pp. 18. (Trivandrum.)

County Borough of Southport. The Fernley Observatory, Southport: Meteorological Department. Report, and Results of Observations, for the Year 1930. By Joseph Baxendell. Pp. 28. (Southport.)

New Zealand: Department of Lands and Surveys. Annual Report on Public Domains and National Parks of New Zealand. Pp. 8. Annual Report on Scenery-Preservation for the Year ended 31st March 1931. Pp. 8. (Wellington, N.Z.: W. A. G. Skinner.)

The South African Journal of Science. Vol. 27: Being the Report of the Twenty-ninth Annual Meeting of the South African Association for the Advancement of Science, Grahamstown, 1931, 6 July to 11 July. Pp. lii+618. (Johannesburg.) 30s. net.

List of the Transactions, Periodicals and Memoirs in the Library of the Royal College of Surgeons of England. Second edition. Pp. v+169. (London: Taylor and Francis.) 2s. 6d.

The Medical and Scientific Archives of the Adelaide Hospital. No. 10 (for the Year 1930). Pp. 83. (Adelaide: Harrison Weir.)

The Journal of the Institute of Metals. Vol. 46. Edited by G. Shaw Scott. Pp. xii+571+47 plates. (London: Institute of Metals.) 31s. 6d. net.

The Physical Society and the Optical Society. Catalogue of the Twenty-second Annual Exhibition of Scientific Instruments and Apparatus at the Imperial College of Science and Technology, South Kensington, London, S.W.7, January 5, 6 and 7, 1932. Pp. 160+xxxvi. (London: The Physical Society.)

The Journal of the Astronomical Society of South Africa. Edited by Dr. H. Spencer Jones. Vol. 3, No. 1, November. Pp. 59. (Cape Town.) 2s.

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