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Practical Policies for the Countryside

INTEREST in the countryside for its own sake is penetrating into the life of the people more rapidly and more extensively than it has for two hundred years. Few would wish to range themselves, nowadays, with that eighteenth century parson of Elsdon in Northumberland who reported that the summer-time moors around him were covered by the purple flower of a plant called ling, which made the landscape "indescribably hideous"; and fewer still, as Prof. G. M. Trevelyan reminded us in his Rickman Godlee lecture, would agree with General Wade's civil adviser when he described the bare tops of the Scottish Highlands as producing "the disagreeable appearance of a scabbed head" and the hill-masses themselves as presenting no more than "stupendous bulk, frightful irregularity, and horrid gloom". The revived use of the highway, facilities for rapid transit, encouragement of walking, the resurrection of the foot bicycle, are at once the expression and in part the cause of this new appreciation of Nature. In the Northern Highlands this summer we have wondered at the full bus-loads of townsmen from Glasgow, Blackpool, London and elsewhere making the grand tour to John o' Groats and back: the choice of such a holiday is significant, the experience must be adding to the multitude of those who treasure memories of Nature's grandeur and beauty.

Clearly, then, there is a vast and increasing body of opinion in Great Britain, and that not confined to one or other of the artificial classes of the people, which is interested in the beauty of the countryside, and would resent interference with the amenities from which pleasure and inspiration are derived. Yet there can be nothing more certain than that in many places amenities are threatened and in others are rapidly disappearing. Industry lifts its smoking chimneys, or disfigures waterfalls, or remodels lakes far from the populous haunts of men. The town spreads into the country; it "must expand and the suburb is a straggling compromise between town and country, ill-planned from the urban point of view and equally disregarding the landscape as such", as the president of the Council for the Preservation of Rural England put it. The townsman spreads himself over the countryside, and thrust by the new facilities for travel into a Garden of Eden where flowers flourish without the toil of cultivation and the stimulus of artificial manures, plucks

to his heart's content, blazing his mark upon the face of Nature as senseless louts scratch their initials upon monuments of antiquity.

Some of these interferences may be necessary, for no one would hold that the well-being of mankind is to wait upon, say, the preservation of the natural margin of a Highland loch; but some are unnecessary in their present aggravated form, and yet they take place in spite of that vast body of public opinion to which we have referred. The reason is that for the most part the public sense of amenity is little more than a hazy goodwill, indefinite, unorganised, without a clear objective, unaware of a means of carrying out what it feels to be desirable. It receives a certain amount of expression through the activities of societies such as the Councils for the Preservation of Rural England and Scotland, the Society for the Promotion of Nature Reserves, the Commons, Open Spaces and Footpaths Preservation Society, the Road Beautifying Association, the Green Cross Society, the Men of the Trees, the Royal Society for the Protection of Birds, and so on; their very number and variety indicate the scattered forces behind them. But even these bodies, representing the enthusiasts, fail to reach and collect the mass of ordinary opinion altogether or almost ready to support their endeavours. What the countryside needs is the organisation of the hazy goodwill which so far, if it reaches the level of expression at all, finds expression only in subdued grumblings and in occasional outbursts in the daily Press.

The need has been foreseen and a way has now been pointed for the concentration of effort on behalf of the amenities, of landscape, of flora and of fauna. A year ago the Committee of the Corresponding Societies of the British Association for the Advancement of Science recommended the Council of the Association to instruct the president of the Conference of Delegates to direct attention to "the assistance local societies can render to the preservation of the amenities of their own areas and especially of the flora and fauna of the countryside". The president was Sir David Prain, and the sympathy and good wishes of the scientific world will be with him in the illness which unfortunately prevented him from delivering his address in person. But the address has been printed and, as becomes the product of Prain's nationality and boreal University, it is a dry, direct, practical document, a guide to practical policies in the countryside which ought to focus vague hopes and therefore ought to be the

constant companion of those country lovers who believe in getting things done.

There is a fundamental divergence of interest between the dweller in towns and the countryman, and to this Sir David Prain traces the inroads upon wild Nature which have been so marked in our land since the industrial revolution. Directly, it has destroyed "the amenities and the flora and fauna of the countryside by creating clouds of smoke that obscure the sun, discharging acrid fumes that vitiate the air, emitting fetid waste that pollutes our streams, and heaping mine tailings on what was once fertile soil". It was the scientific worker, by the way, who brought partial relief from these evils by convincing captains of industry that costs could be reduced if smoke were consumed, and profits could be increased by the utilisation of waste products.

Indirectly, the influence of industry crept still further into the heart of the country. Industry drew a proportion of the rural population to the towns, and having chained it there demanded that the depleted countryside should furnish more and more food to meet the needs of town workers, who no longer raised food for themselves. For a time town and country became linked in a common interest; agriculture, knowing that it had the solid support of the towns, cultivated the wastes, often at great capital outlay, it intensified its methods of husbandry, planted shelter belts of trees and larger woodlands; and the town on its side encouraged the building of highways along which agricultural produce reached the towns and manufactured goods the country. But the fundamental antagonism was hidden and not eradicated, for "the moment English industry found it possible to obtain supplies of food from other sources, English urban sympathy with English rural interests vanished like a morning mist". That may be true of the commercial side of urban life, but it surely fails to give due weight to the great body of townsmen who appreciate the open country, sometimes with fresher vision and deeper feeling than the countryman himself, and whose support is the mainstay of the associations created for the preservation of its amenities.

Whatever may be the relationship between town and country, it is certain that at the moment the latter requires all the forces it can muster on its behalf. Sir David Prain points to the local societies as the proper bodies for the effective organisation of goodwill towards the countryside and its wild inhabitants. They must sound, and

if need be create, local feeling to meet the threats of unnecessary encroachment. They must work hand in glove with the local authorities, supporting and forwarding their schemes if they are good, offering better suggestions, in place of sterile opposition, if they are unsatisfactory. They must make themselves familiar with the technique of saving and preserving landscape, flora and fauna ; and to this technique a great part, the most practically useful part, of the address is devoted.

We take it that the address will be used as a handy guide to the preservation of Nature in Great Britain, so that there is no need to discuss its recommendations in detail ; but a few samples of Sir David Prain's advice will show how directly he is driving at the mark. If the threat be to the general amenities of the area or to some special view-point or beauty spot, a local society can scarcely fail to benefit by the experienced advice of the Council for the Preservation of Rural England or of the executive committee of the National Trust for Places of Historic Interest or Natural Beauty. Experience shows that the only safe course in most cases is to purchase outright and render inalienable the threatened spot. But a local society should hesitate to burden itself with the possession and care of such a property ; it may raise funds for purchase, create an endowment for future maintenance, but as a rule its final step must be to request a permanent, legally constituted body such as the National Trust to accept the property. This course premises that before any steps have been taken the local society will have consulted the Council of the National Trust as to the suitability and desirability of preserving the particular place of interest and that, therefore, it will have the moral support of that body in its appeal for funds.

A difficulty arises, however, if the objects to be preserved are not places of beauty or general amenity, but particular representatives of the flora or fauna ; for "absolute protection of wild life in properties acquired to safeguard amenities is not easily provided : properties acquired to safeguard amenities must remain accessible to the public they benefit". Sir David Prain is of opinion, and many agree with him, that the rarities of fauna and flora can be retained for posterity only by the exclusion of the people. This calls for the creation of a special Nature reserve or sanctuary, and so for a different method of treatment. "A sanctuary need not be 'a place of natural beauty' ; even if it be, in fact, entitled

to be so regarded, the National Trust may be debarred from accepting the burden of ownership, because a sanctuary becomes valueless unless access to it is denied." In such case the local society interested would approach for advice and support the Society for the Promotion of Nature Reserves, a body empowered by charter to own sanctuaries of the kind, which, largely in view of the attitude of 'collectors', require much more strict patrolling, and therefore a larger endowment for upkeep, than simple beauty spots.

Sometimes local societies will find that "the agencies inimical to wild life in their own areas have become so powerful that the establishment of a 'sanctuary' is impracticable, and that the only means of conserving the wild life once characteristic of the neighbourhood is to acquire a suitable site and convert this into an 'asylum', for such plants, insects and birds, known to have been at one time native there, as can be placed in or attracted to the 'asylum'." Such an asylum must be as freely open to the public as "a place of natural beauty", but the difficulties arise that while its accessibility to the public should prevent the Society for the Promotion of Nature Reserves from accepting ownership, its artificial origin should preclude the National Trust from doing so. Here again the local society will find its course indicated ; upon it must fall the burden of raising funds for establishment and maintenance, but this done there should be no difficulty in obtaining the consent of the local authorities to accept the responsibility of ownership.

These are high ideals, difficult of attainment, which are held up for the consideration of the local societies ; but the very fact of their formulation may suggest a definite direction for activities hitherto dispersed in less important ways. The path will not be easy : "Local societies may anticipate many difficulties and much opposition, some of it due to self-interested motives, but more of it due to misunderstanding. That need not discourage them, provided they are on good terms with and enjoy the sympathy of their own local authorities. With that behind them, local societies can do much." Every likely problem Sir David Prain has passed under review and accounted for, and it will be a fitting crown to his labours in this field that in the years to come places of natural beauty will be preserved, and Nature reserves and asylums for the conservation of local wild life will spring into being through the organised efforts of local societies following his wise guidance. J.R.

Geographical Study of Society and World Problems*

By Prof. H. J. FLEURE

IT has been assumed in many discussions that mass-production and commerce on a large scale represent a new mode of life, a form of society, that is conquering the world and must disintegrate older modes of social life and organisation. However true this is, there are limitations, obvious now that production far beyond immediate selling possibilities is causing so much difficulty. It is truer to say that various types of society are trying to graft on to their ancient heritage this new scheme of mass-production.

It may have been useful, up to a point, to think out the increase of production through specialisation as Adam Smith does in his famous argument about pins, but there was need for far more thought than seems to have been given to the maintenance and development of social life in the various environments Nature provides and man adjusts. Social forms result from interaction between men and their environments, and the lessons learned and the ideas selected and developed in different cases have been very different. This is a legitimate and important sphere of work for the student of geography. In each case, the people and their form of society are so much a part of the other that, whatever changes mass-production may bring, they want to, they must in fact, keep a large measure of continuity from their past.

They have nearly all once been, in the main, self-contained groups, or, at least, external commerce has been subordinate to internal exchange. The idea of the self-contained unit is thus very deep-rooted. With great effort the village has come to feel itself part of the nation, which has clamoured for opportunities of self-expression. Many a nation naturally, therefore, seeks to be self-contained, all the more if it feels that specialisation and consequent dependence on imports is going to give it an inferior position.

HUNTING GROUPS

We may distinguish at least three main phases of expansion of hunting cultures, possibly all associated with *Homo sapiens*, from an Arabian-African zone, while another culture has its origins and associations still doubtful. The interest of these ancient cultures here is that the two or three later stages among them occur mingled in South Africa, apparently also in India, and among the Australian natives. In fact, if we use as a hypothesis the idea of drifts from northern Africa and south-western Asia, we have a key to some modern distributions of hunting peoples. These societies are either in what are ultimate corners or in areas of special difficulty; elsewhere they have been superseded by agriculturists. The pygmies of the equatorial forest of Africa are remnants in a region of hot, wet

climate where debilitation makes achievement difficult. The Bushmen of south-western Africa are in a region of sheer poverty in a far corner. The Veddah and some jungle tribes of southern India are in another far corner under conditions that forest or jungle makes difficult. The Australians and recently extinct Tasmanians are in a far corner, isolated by orographical changes. The pygmies and some other hunting groups of Malaya and the East Indies and Philippines are, again, in what are almost ultimate corners, isolated by land-sinking, and also in regions of warm, wet forest.

AGRICULTURAL PEOPLES

The post-glacial intensification of the desert in northern Africa and south-western Asia caused pressure of population on the Nile and Euphrates and possibly the Indus as well, all rivers with regular floods running through dry or then fairly dry open country with a warm season. In or near these river valleys there arose the art of cultivation. All these rivers permitted and encouraged irrigation, and the deposit of silt from floods gives a renewal of fertility, so exhaustion of the soil was not a problem of early cultivators near the rivers. The courses of the Euphrates and Indus were conspicuously subject to variation, whereas the Nile is confined in its famous slot and its peasantry has gone on from time immemorial until near our own day with a remarkable measure of constancy as regards the economic basis of life.

Domestication of animals was an achievement of very early times too, and, in such regions as the Fertile Crescent with its grass zones, it undoubtedly assumed great importance and led to the beginning of age-long conflicts and interactions between herdsmen and cultivators. The herdsmen, basically a close corporation gathering around the flocks and needing men to add to their strength for defence, as well as discipline and organisation to maintain unity, have often dominated peasant neighbours; but this special ability appears to have been much developed when the horse was acquired as a companion and helper.

The bearings of the introduction of cultivation on social life and organisation have obviously been of the first importance. There was an observable sequence that made argument more solid than it was likely to be in the days of hunting when accidental coincidences loomed larger. The habit of prevision extended itself through calculations of the coming of the floods and correlated study of the heavenly bodies to the framing of a calendar. There was a further extension of prevision beyond that to a succession of years—namely, to a succession of generations specially associated with the domestication of animals and with the family.

Thought, drawn out towards the future, seems just as naturally to have run back into the past,

* From the presidential address to Section E (Geography) of the British Association, delivered at York on Sept. 1.

giving rise to genealogies which are one of the germs of history and also to rites of reverence paid to ancestors. These rites, not unnaturally, are specially marked in regions such as China which owe so much of their civilisation to early interactions of herdsmen and cultivators on the ways from central Asia. It is of interest to note that the large household, linked by real or sometimes assumed blood relationship, seems a social feature of basic character among the cultivators of northern China, and in other forms is notable among other cultivators around the edges of the great steppe, the famous Zadruga of parts of the Balkan peninsula being a case in point in a region in which interactions between herdsmen and cultivators have been and still remain most important features of life. The Russian Mir sometimes had a like origin. It is naturally a social development in large measure antagonistic to the growth of nationalism.

Along with the primarily psychical development accompanying the rise of cultivation went the linking of society with a definite piece of land through the establishment of the settled life. This association is one of the most important features of settled society, and leads to the idea that the living hold a trust from their forefathers and will pass it on to future generations.

Whatever may be found hereafter concerning the phases through which the early cultivating societies developed in their primary homes, there is little doubt that the spread of their scheme of life occurred in most directions in two stages. The first went with the hoe, used chiefly by women, and with domestic animals for food or milk, but not for work, and the second with the plough drawn by domestic animals under male control.

The first of these two rather artificially contrasted stages is the one that spread into intertropical Africa. There were special difficulties here. First the climate made steady prolonged efficient exertion difficult in many areas. Then the fundamental crops, wheat and barley, would not thrive in most parts, and inferior grains and other plants became the important crops. Further, there were practically no wild plants in intertropical Africa that the native cultivator contrived to domesticate; so progress depended largely on plants deliberately introduced, as for example via Egypt or by Arabs, Portuguese, etc., in later times. The introduction of maize, manioc, etc., from America has made a huge difference to Africa. Fly belts in several regions, also lack of salt and phosphorus deficiency, and no doubt climatic factors, limited the value of domestic animals in intertropical Africa.

Archæologists think agriculture spread into central Europe at first with the hoe and the non-permanent village that is a feature of parts of intertropical Africa; and there are indications of the same scheme in forested and therefore backward parts of central India and elsewhere in south-east Asia as well as in north Korea.

Agriculture with the plough has now ousted this scheme from Europe and most of Asia and, in this superior stage, the village becomes more permanent: either a rotation in the use of lands is established and the households have their strips in each of the village lands, or a portion of the village land specially enriched by manure from stock folded on it may be cultivated nearly every year, and some portion of an 'outfield' may be used as may be required or may be possible.

In the regions with irrigation or plough agriculture or both, the differentiation of crafts went much further than among societies with hoe cultivation. Exchange developed more considerably and there are towns or cities, fundamentally centres of exchange and of handicraft, and often of a priesthood and government. Cities are not found in inter-tropical Africa save in a few spots where they are due to intrusive influences of fairly recent date.

The nomadic or semi-nomadic societies of inter-tropical Africa live on their cattle, and by hunting and collecting, as well as by raiding those which are more sedentary and less ready for war. The nomadic and semi-nomadic societies of Europe, Asia and northern Africa have in many cases the important auxiliary activity of trade, and use their beasts as carriers. Moreover, they have typically developed or contributed to the development of stations, which have in many cases become centres of trade and religion, that is, sacred cities, near the bounds of the waste or in oases. In China, India and the Fertile Crescent the semi-nomad, especially after he acquired the use of the horse, found it possible to dominate the cultivator, and seems often to have contributed an elaboration of organisation to the group of social units; villages and their focal towns become grouped into larger entities.

CONSCIOUSNESS OF KIND

In west, north-west and parts of central Europe, early development was slow because the food plants and animal breeds had to be acclimatised, and the problem of soil exhaustion was serious even if mitigated where the subsoil was of loess or related material. Nevertheless, there can be no doubt that settled populations in central and western Europe practising agriculture and living in villages were much more numerous in far pre-Roman times than it was customary to think a generation ago.

The spread of Islam in the Mediterranean region cut old trade routes for a time, and this increased the poverty following the decline of the Roman Empire, so that towns and cities went through a bad time, but apparently in several areas there was a marked increase of rural settlement.

As a hierarchy of social units re-established itself, growing mainly from local roots instead of from an external influence such as that of Rome, it is natural that such hierarchies should spring up where there was mutual comprehension of language in groups of villages and their focal market towns,

and cathedral cities in France. Moreover, charters and grants and agreements written in the vernacular came to be increasingly important, while the use of the vernacular in courts of first instance developed folk-speech. It is apparently a combination of all these factors that has maintained the distribution of the peasant languages of Europe without any change of great importance since the Middle Ages.

The idea of the city can be traced eastwards and northwards from France and the Rhine in the early Middle Ages, and, in relation with this, often, at the present day, the life of a town connects it with regions farther west, while the peasant life round about knows nothing of this. The Renaissance, being essentially an urban movement, accentuated this, and we note the French leanings of part of the upper classes in Alsace contrasted with the Alemannic tradition of the peasantry, German aristocracy and Danish common folk in parts of Slesvig, German (including Yiddish) affiliations of towns in Poland as against Slavonic life among the peasantry, Polish affiliation of towns and the upper classes in East Poland as contrasted with Lithuanian (in the north) and Ruthenian (in Eastern Galicia) traditions of the peasantry.

TRADITIONALISM AND INDIVIDUALISM

The problem was greatly deepened by another sequence of development. The Renaissance, whatever else it may have done, was a potent factor of the rise and spread of individuality. After it, much larger numbers of men in Europe became less members of a traditionalist community and more definitely persons with ideas of their own to express.

In some parts, notably in France, these changes, and even great political convulsions, long left some basic facts of society untouched. The peasantry long remained attached to, almost worshippers of, their soil, even if in parts of the west and south of that country this is no longer the case. The peasant acquired more dignity, but the village remained an entity; men still often make it their main ambition to hand on an improved farm to their descendants. The town too is often still essentially the focus and market for its region, and it often still carries on a number of small industries for the benefit of its neighbourhood. Its bourgeois are peasants only slightly modified. The idea of maintenance, rather than that of expansion on an English, German or American scale, is strong in many minds and France, characteristically, makes external trade subordinate to internal production for use and exchange. The reasonable assurance of her wheat, root crop, potato, and, but for a few calamitous years, vine and apple harvests, thanks to sunshine, has contributed a great deal to this, and has helped the French people to modify into modern forms the age-old feeling of a trusteeship (of the sacred soil) handed along the generations.

Britain's harvests have long been less secure because of summer rains and coolness, and, in the

eighteenth and early nineteenth centuries, there grew first a widespread maritime commerce, and then manufacturing industries—in fact, the Industrial Revolution.

The home population came to exceed by a great deal the numbers that could be kept busy supplying the needs of their fellow citizens. Britain's export trade came to be her mainstay. The contrast between French and British development was thus extreme and startling.

Industrialism spread from Britain to Germany and led to a parallel increase of population. The German effort also had its aim moulded politically by the desire to rise out of an old position of political inferiority and disunion. Further, the historic cities of Germany in several cases, such as Nürnberg, Frankfurt-am-Main, Köln, Leipzig, and so on, had their situations predetermined by major physical considerations, and must be important centres so long as Germany is a land of organised civilisation. This fact and the related one of the finding of coal near the zone of gradation from the hills to the northern plain, that is, a zone of cities, led to the development of modern industry in several cases in historic towns, whereas in England the greatest developments took place in what had previously been small places. Both national and municipal authorities in Germany, therefore, had a larger and more direct share in the directing of industrial growth than was the case in Britain.

If we think along these lines we see why, quite apart from wars and questions of external political ambition on one side or the other, it has come about that the French people have been gravely anxious. Here are two enormously increased units, Great Britain and Germany, both dependent on export trade, neither able to live with any reasonable standard for the great multitude mainly on the produce of its soil.

The spread of large-scale industrialism makes the problems still more serious. There are now several States that have populations exceeding what their soils can support unless science intervenes afresh; all therefore compete for an increasingly precarious export trade, all are in danger of finding groups of their people, with highly specialised machine-tending activities and corresponding inelasticity of mind, suddenly thrown out of employment and unable to adjust themselves to new lines of enterprise.

Meanwhile, nearly half mankind, in the monsoon lands of Asia apart from Japan, is being shaken out of its traditionalist schemes by contact with the west, and nationalist ideas are germinating in various ways alongside schemes of industrial development that borrow from the west to such an extent as to be a danger to indigenous society. Then the newer lands which have received the later overflow of modern Europe, and seemed likely to become producers of raw material for Europe, are also being forced along the same line of nationalist development. They have borrowed

freely from Europe (chiefly Great Britain and France) and more lately from America, and have consequently found themselves faced with the duty of finding large amounts of interest. This interest often is not by any means earned by the working of the schemes on which the money was spent. To meet this call for interest, exports must largely exceed imports, and so tariffs are introduced to keep down imports, and local industries are started.

On all sides, in the first great burst of mass-

production, local boundaries seemed to have been swept away. It is probable that our social thoughts and plans will have to regain contact with mother earth, each group basing itself on its own soil, but evidently not in the old sense of a self-contained isolation. Interdependence of all on each is a new feature that will become increasingly important, and one of the geographer's tasks is to try to see both the roots of each society in its own soil, and its relations to others.

White Dwarf Stars*

IN this year's Halley Lecture, Prof. E. A. Milne presents us with a systematic account of white dwarf stars in theory and observation. There is no doubt that, in view of their peculiar physical properties and the excellent example they provide for a successful application of modern quantum mechanics, white dwarfs are among the most interesting of natural objects. But this interest arises, of course, not so much from the direct observations as from the derived density of the star and its theoretical interpretation. It is therefore very valuable, at least to the non-astrophysical scientific worker, to have the facts and theories about white dwarf stars reviewed in this systematic way.

Owing to the importance of the existence of matter of great density to general physical theory, it is important to appreciate how direct is the evidence and how independent of any detailed theory. The well-established white dwarfs like Sirius B have a mass directly deduced from the law of gravitation and an observed double star orbit. They have an absolute luminosity determined from their distance (parallax) and their observed apparent luminosity. In view of the simplicity and universality of the theories involved in these deductions, no one will dispute that mass and absolute luminosity have the certainty of direct observations. To determine a density, a radius is required as well as a mass, and the radius must be deduced from the absolute luminosity and the surface temperature via the thermodynamic laws of radiation and the theory of the flux of radiation emerging from a gaseous atmosphere. Even in this step the maximal observational and theoretical uncertainties are not very great. If we know the surface temperature and the absolute luminosity, we can determine the surface area of the star, apart from possible uncertainties, at most of the order of 50 per cent, arising from conceivable errors in the radiative theory. All depends, therefore, on a determination of surface temperature, to which parameter the resulting mean density is rather sensitive, as it varies as the sixth power of this temperature.

There are two main methods of determining surface temperature. One can assume that the quality of stellar radiation, apart from line absorptions, follows closely Planck's black body curve; after observing the energy distribution in the

spectrum of the star, one can fit Planck curves to it and thereby determine the temperature from the curves of best fit. This method is known to underestimate the temperature considerably, especially for the higher surface temperatures, and is not reliable for the stars in question. But the theory of ionisation in stellar atmospheres and of the production of absorption lines in an ionised atmosphere enables one to assign a surface temperature when the surface value of gravity is known and also the spectral *type*. The possible resultant uncertainties in this application of theory do not appear to be very great. It is true that the surface value of gravity is not known initially, but it is known when the radius is determined, and the problem of determining the surface temperature is therefore solvable in theory, and also in practice, at worst by a process of successive approximation. This is admittedly the most uncertain step in the deduction of the radius and therefore of the density, but if we suppose that a maximum uncertainty of a factor of 10 could thereby be introduced into the density, we shall have allowed more than amply for all errors at present conceivable, and the existence of excessively dense matter must be regarded as fully established. Taking a reasonable view of probable observational and theoretical uncertainties, it is most unlikely that the current accepted mean densities for the best determined white dwarfs, such as Sirius B, are in error by a factor nearly so large.

Prof. Milne then passes on to the problem of the frequency of such dense matter in our galaxy. There are very few directly well observed white dwarfs, but the conditions for a good determination, owing to absolute faintness and the necessity for a well determined parallax and double star orbit, are very severe, and the fact that we know only four such stars is consistent with a great abundance of such stars in our galaxy. The essential conditions for a white dwarf are a relatively low absolute luminosity combined with a high surface temperature. There is reason to believe that these properties are found together in two remarkable classes of stars, the central stars of planetary nebulae and ex-novae. The evidence is reviewed by Milne, who concludes provisionally that the case is proved.

If correct, this conclusion is of the utmost importance, not so much for the greatly increased abundance of known dense objects as for its possible

* "The White Dwarf Stars", being the Halley Lecture delivered on May 19 1932, by Prof. E. A. Milne. (Oxford: Clarendon Press. 1932.)

evolutionary significance. It has been suggested by Prof. Milne, on purely theoretical grounds, that stars in general are in one of two states which may be called expanded and collapsed (Milne's centrally condensed and collapsed configurations respectively), and that the passage from one state to the other sets in at a certain critical stage in the evolutionary history and is of a cataclysmic nature. It is suggested, in short, that the evolving star, perhaps towards the end of its radiating life, becomes a nova and then a white dwarf. The outburst of radiation during the transient nova stage is the star's means of getting rid of the great difference of energy between the contiguous expanded and collapsed states. While it is still too early to be confident of the correctness of the theory underlying Milne's suggestion, the suggestion itself is a very happy one, likely—right or wrong—to prove extremely fertile. Milne's discussion already shows that an evolutionary sequence, ordinary star—nova—white dwarf, is by no means irreconcilable with the known facts, and indeed co-ordinates a great part of the facts in a most satisfying manner.

The second half of the Halley Lecture describes the present state of knowledge of the theory of

stellar configurations—the generalisations that have sprung in the last three years from Eddington's pioneer work on the radiative equilibrium of a sphere of perfect highly ionised gas. These generalisations are still in an early stage of development. Milne himself, who initiated them and has been the prime mover in their development, would, I believe, be the last to claim that the equilibrium states of any model yet computed really reproduce the properties of any ordinary star. The collapsed white dwarf states appear to be simpler and to be satisfactorily accounted for by models already computed. They consist mainly of a rather cool, dense, almost isothermal core, the properties of which are controlled by those of a degenerate electron gas. But although existing models have not yet been made to mimic the observed properties of ordinary stars, we can see that this study of models has already infused new life into the theories of stellar evolution, and has taken us perhaps one long step nearer to the goal so rashly proposed as attainable in the last sentence of Eddington's "Internal Constitution of the Stars"—the goal of understanding so simple a thing as a star.

R. H. F.

The British Association Standards of Electrical Resistance, 1862-1932

FEW realise how much the electrical industry owes to the Electrical Standards Committee of the British Association, first appointed at the Manchester meeting in 1861. We welcome, therefore, the paper entitled "Material Standard of Resistance: the B.A. Coils, 1881-1932", read by Sir Richard Glazebrook and Dr. Hartshorn to Section A (Mathematical and Physical Sciences), at the York meeting on September 1. The Electrical Standards Committee in its first report (Cambridge, 1862) stated that it had first to determine the most convenient unit of resistance and, secondly, the best form and material for the standard representing that unit. The C.G.S. system of measurement was the outcome of its deliberations, and this decision has done more than perhaps any other single act in simplifying and unifying electrical measurements throughout the world.

Experiments were made at King's College, London, by Maxwell and Fleeming Jenkin to obtain the ohm in a material form, and reports giving their results were issued in 1863 and 1864. In Appendix A of the Report for 1865 it was recommended that the material of the wire from which the resistance standard be made should be an alloy containing 66 per cent silver and 33 per cent platinum. It was agreed that copies of the standard should be made and preserved at Kew Observatory. In the Report for 1867 a table is given of the values of the standards in question. This Committee was dissolved in 1870. Soon after Maxwell's appointment as Cavendish professor of experimental physics at Cambridge, the coils were brought to the Cavendish Laboratory and were used by Chrystal in 1876. Lord Rayleigh succeeded Maxwell in 1879 and at

once became interested in electrical measurements. Rowland of Baltimore had thrown doubts on the accuracy of the absolute measurements of the B.A. Committee. Rayleigh and Schuster's experiments at Cambridge confirmed these doubts, and from 1881 onwards great activity was shown at the Cavendish Laboratory in investigating the question of electric units. In 1879-81, Dr. J. A. Fleming made a very careful comparison of the B.A. coils. He found that their relative values had changed appreciably, and he adopted as a definition of the B.A. unit the mean value of the resistance found from all the coils at the temperatures at which they were originally said to be correct.

The Electrical Standards Committee was re-appointed in 1880; and in 1881, R. T. Glazebrook became connected with the work. He was appointed secretary in 1883, and the coils were in his charge from that date until 1919. They are still at the National Physical Laboratory. The Standards Committee was dissolved in 1912. Up to that date, comparisons of the coils between themselves were continually in progress, and their values were determined in ohms and also in terms of the length of a column of mercury by Rayleigh, Glazebrook, Fitzpatrick, and F. E. Smith. The records show that most of the coils have changed appreciably during their long life, but that the two platinum coils included in the original group have remained unchanged.

The point of most importance that emerged from Sir Frank Smith's measurements of 1908 was the performance of the two platinum coils, now marked 'D' and 'E'. The value of these coils in B.A. units in 1888, 1908, and 1932 obtained from a comparison

with mercury tubes, assuming that the resistance of 1 metre of mercury is 0.95352 B.A. units, is given in the accompanying table:

Coil.	1888 (R. T. G.).	1908 (F. E. S.).	1932 (Hartshorn).
D	1.00013	1.00012	1.00011
E	1.00073	1.00072	1.00071

The coils have been very carefully intercompared this year at the National Physical Laboratory and their value determined in terms of the international ohm by Dr. Hartshorn. The international ohm is defined as the resistance at 0° C. of a column of mercury 106.300 cm. in length and 1 sq. mm. in cross section. Tables are given illustrating how the values found for the coils during the last sixty-five years have varied. These show that considerable variations appeared prior to 1888. These depend probably on errors arising in the temperature determinations of 'D' and 'E', as an uncertainty in the temperature of these coils of 0.1° C. implies an uncertainty of 0.0003 B.A. units in the resistance measurements.

In the platinum-silver coils 'F' and 'G' appreci-

able changes were noted between 1880 and 1908. These are probably due to the fact that during that period the coils were on several occasions measured at 0° C.; strains may have been produced at the soft soldered joints. In recent years, when the coils have been maintained at a temperature not far removed from 16° C., the changes have been remarkably small.

The main conclusion to be drawn from the series of investigations from 1865 to the present date is that the platinum coils 'D' and 'E' have retained their value unchanged, while changes have occurred in all the coils made of alloys. These changes are partly due to the violent temperature changes to which all the coils have been subjected at various times.

We may also conclude that pure metals like platinum are usually more stable in their properties than alloys like manganin. Unfortunately, the pure metals suitable for standards have temperature coefficients varying from 0.003 to 0.007, so measurements would have to be taken at 0° C., as this is practically the only temperature at which they can be maintained sufficiently constant.

Obituary

PROF. W. STIRLING

WILLIAM STIRLING, formerly Brackenbury professor of physiology at the University of Manchester, died on October 1. Prior to his going to Manchester he held the regius chair of the Institutes of Medicine at Aberdeen.

Stirling was born at Grangemouth in 1851, received his early education at the Dollar Academy and then became an undergraduate at Edinburgh. Here he had a career of great distinction, graduating as B.Sc. in 1870 and two years later as D.Sc., M.B. and C.M. In his medical final examination he was awarded first class honours. He also gained the Baxter scholarship, the Falconer fellowship and Ettles prize. His thesis in 1875 on "The Summation of Electrical Stimuli applied to the Skin" brought him the M.D. degree and with it the gold medal. After his student career in Edinburgh he worked in Leipzig, Berlin and Paris, and then returned to Edinburgh as demonstrator under Rutherford. His election to the regius chair at Aberdeen shortly after this time and when he was but twenty-six years old, indicates clearly the great promise of his early years and the esteem in which he was held.

After eleven years in Aberdeen, during which time he introduced there the practical teaching of physiology, Stirling was elected as successor to Arthur Gamgee in the chair of physiology at Owens College, Manchester. Here he remained until his retirement in 1919.

Stirling became a professional physiologist at a time when the teaching of physiology in many of the medical schools of Great Britain was inadequate and very little research work was done. In France and Germany, however, the subject in the

hands of such masters as Bernard, Helmholtz and Ludwig, had developed into an important experimental science. It is not surprising, therefore, that Stirling's sojourn abroad inspired in him a great affection for the men under whom he had studied, and this was apparent from his frequent references to them in his lectures and in private conversation. Carl Ludwig especially was held by him in great regard.

Nevertheless, although in his early post-graduate days Stirling carried out promising research work, he eventually became an interpreter of the work of others rather than an investigator himself. Both at Aberdeen and in Manchester, he introduced elaborate methods of teaching and was largely responsible in the latter school for the extension of the medical building which houses the present physiological laboratories. In addition to his work for his own department at Manchester, Stirling acted as Dean of the Medical School from 1902 until 1913, showing himself to be a capable administrator and devoting himself wholeheartedly to the general welfare of the School. It is probable that these heavy administrative duties coupled with the labours involved in bringing into being the new medical buildings were largely responsible for the attention he devoted to exposition rather than to physiological research. Of his publications, probably the best known are his "Apostles of Physiology", "Outlines of Practical Physiology" and the "Text Book of Physiology" by Landois and Stirling; the last-named being a translation of Landois's book, to which Stirling made many valuable additions.

Stirling was a man who made many friends and did not easily lose them. His fine stature, impres-

sive manner and mode of dress made him a striking figure. Men who were his students still talk of his attractive personality, the great clarity and interest of his lectures and the minute detail with which his practical classes were organised. As a popular lecturer he was in great demand and through this became widely known. This stimulation of interest in biological science in the latter part of last century was probably of great value in gaining support for the scientific departments of the university colleges of the north of England in their earlier days.

In 1904 Stirling received the honorary degree of LL.D. from the University of Glasgow and in 1906 he was Fullerian professor of physiology at the Royal Institution, London. H. S. R.

Dr. F. H. HATCH

THE death of Dr. Frederick Henry Hatch on September 22, at sixty-eight years of age, will be regretted by numerous friends in mining and metallurgical circles. Dr. Hatch was born in London, and after studying at University College, proceeded to the University of Bonn, where he took the degree of Ph.D. He spent six years as a member of H.M. Geological Survey, when his work was largely petrological, dealing especially with the igneous rocks of Scotland.

Dr. Hatch recognised, however, that there was a great opportunity for a geologist in the then newly discovered goldfield of the Witwatersrand, and in 1892 he resigned his appointment and went to the Transvaal, where he soon achieved a high reputation as a mining engineer and consulting geologist. He undertook exploration work of the highest importance for various gold-mining interests, his most significant work in Africa being that in connexion with the development of the eastern extension of the Rand goldfield, in the region where the reefs disappear below a great thickness of newer rocks.

In 1895 Dr. Hatch became associated with Cecil Rhodes and John Hayes Hammond in the development of Rhodesia, but the Jameson Raid and the Boer War caused such a general disturbance of this and all his other work that he left Africa for some time, visiting the United States, Canada, British Columbia, and Abyssinia. He also spent a year in India, investigating the gold resources of that country for the Government. His report on the Kolar goldfield may be regarded as a classic in mining literature. At the close of the Boer War he returned to Johannesburg. An intensive boring campaign under his advice finally revealed the structure of the East Rand, which is now the most important producing area, and rendered its development practicable. About 1906 Dr. Hatch left Africa for England, where he established a large practice as a consulting mining engineer, visiting Siberia and other countries. In 1909 he undertook on behalf of the Government an investigation of the mineral resources of Natal.

From 1910 to 1913 Dr. Hatch resided in Cambridge, where he lectured on economic geology and presented to the University a very fine collection of specimens of metalliferous ores collected during the course of his professional work. In 1914 he was president of the Institution of Mining and Metallurgy.

After the outbreak of the War, during which he lost his two elder sons, Dr. Hatch was engaged in the Ministry of Munitions and played a prominent part in the organisation of home supplies of iron ores, a piece of work which was of immense service in the organisation of victory. After the War he reported on the condition of the iron and steel works in Lorraine, in the occupied areas of Germany, in Belgium and in France, and then became director of the Mineral Resources Development Branch of the Board of Trade and technical adviser to the Mines Department.

In addition to all this, however, Dr. Hatch was a man of high attainments on the side of pure science. He was the author of books on mineralogy, petrology, and ore deposits which did much to render these subjects intelligible to the average student. The number of editions is evidence of their success and usefulness. In the last few years petrology has become infinitely and perhaps unnecessarily complicated, but nevertheless many of the existing classifications of rocks bear a strong imprint of the common-sense system of the editions of Hatch's "Petrology" of 1907 and later years. R. H. R.

SIR EVERARD IM THURN, K.C.M.G., K.B.E.

THE death of Sir Everard Ferdinand im Thurn, colonial administrator, anthropologist and naturalist, at eighty years of age, took place on October 8 at his residence, Cockenzie House, Prestonpans. The son of John Conrad im Thurn, merchant-banker, he was educated at Marlborough and at Exeter College, Oxford. Before going to Oxford he had already in 1869 published a book on the birds of Marlborough. In 1877 he went to British Guiana as curator of the museum. He there took up the scientific study of the country and its peoples, being the first to ascend Roraima, and publishing a work on the botanical results of that expedition. In 1882 he was appointed judge in the Pomerun District and in 1890 was made Government Agent in the North-Western District. He joined the staff of the Colonial Office in 1899, having been made C.M.G. in 1892, and was made C.B. in 1900. He was appointed Colonial Secretary and Lieutenant-Governor of Ceylon in 1901 and Governor of Fiji and High Commissioner of the Pacific in 1904. In the following year he was promoted to K.C.M.G. and in 1910 he retired. In 1918 he was made a K.B.E. From 1919 until 1921 he was president of the Royal Anthropological Institute, and on taking up his residence in Scotland shortly after he had held that office, he helped to organise and became the first local president of the Edinburgh branch of the Institute.

Sir Everard im Thurn was the author of many papers on the history and geography of British Guiana, Ceylon and the South Seas. He also wrote a number of books. "A Tramp with Red-Skins" appeared in 1886 and "A Sketch of the Ceylon Pearl Fishery" in 1903. It was, however, by his "Among the Indians of Guiana" (1883) that his work was best known throughout his life. This, especially in view of the date at which it was written, is an outstanding piece of work, showing a remarkable range in knowledge and understanding of the ways of thought of a people of backward culture—qualities which served im Thurn well as an administrator in the Pacific. The book was for long, and still continues in some degree to be, a standard work of reference for anthropologists in comparative work. His last considerable undertaking was the editing, in conjunction with Mr. L. C. Wharton, for the Hakluyt Society, of "The Journal of William Lockerby, Sandalwood Trader in the Fijian Islands, 1808-9", published in 1925, to which he contributed an introduction and notes embodying a mass of valuable information. Sir Everard himself considered that this book contained his best work.

After his retirement, Sir Everard's leisure was far from unoccupied, and his advice, assistance and knowledge were freely at the disposal of all who were interested in geographical and anthro-

pological questions relating to the South Seas. In 1925 his services to science were recognised by his old college when he was elected an honorary fellow.

WE regret to announce the following deaths :

Mr. A. Chaston Chapman, F.R.S., a past president of the Society of Public Analysts, the Royal Microscopical Society and the Institute of Chemistry, on October 17, aged sixty-two years.

Prof. O. D. Kellogg, professor of mathematics at Harvard University, known chiefly for his work in the calculus, on August 27, aged fifty-four years.

Prof. Edgar James Swift, professor of psychology at Washington University, St. Louis, who has carried out many investigations in applied psychology, on August 30, aged seventy-two years.

Mr. Arthur Silva White, formerly secretary of the Royal Scottish Geographical Society and assistant secretary to the British Association in 1904-9, author of books on Egypt and Africa, on October 12, aged seventy-three years.

Prof. Max Wolf, professor of astronomy in the University of Heidelberg, associate of the Royal Astronomical Society and foreign associate of the U.S. National Academy of Sciences, on October 3, aged sixty-nine years.

News and Views

A Self-Styled Faculty of Sciences

SEVERAL correspondents have sent us copies of a letter and circular which they have recently received inviting them to become fellows of a body having the title "The International Faculty of Sciences", with an office at 36 Gordon Square, London, W.C.1. The preliminary prospectus, issued more than a year ago, did not include the word "International" and was the subject of some severe comments in *Truth* of September 16, 1931. The new circular, which appears to have been widely distributed, invites application to be made for admission "as a Fellow of the Faculty of Sciences" and states that "The application of every candidate for fellowship must be accompanied by a remittance of one guinea." After election, "every Fellow is entitled to use after his name the initials 'F.F.Sc.'". There is, of course, no relation whatever between this International Faculty of Sciences and the Faculty of Science of the University of London, though the similar title adopted by the new body must lead to misunderstanding in the minds of many people. The president and vice-presidents of this body are stated upon the circular to be as follows:—"President: Prof. H. W. Blood Ryan, M.A., D.Sc., LL.D., Ph.D. Vice-Presidents: Prof. Ingo W. D. Hackh; Prof. R. F. Hunter, D.Sc., Ph.D., D.I.C., A.R.C.Sc.; Prof. Nicholas Knight, A.M., Ph.D.; Prof. Cyril Krauz; Prof. Marius Rebek, Ph.D." As the body is "Inter-

national" in its title, it is perhaps not surprising that only one of these names appears in the "Universities Year-Book" which includes members of staffs of all the universities of the British Empire, namely, that of Prof. Hunter, who occupies the chair of chemistry in the Aligarh Muslim University, Aligarh. The president himself does not appear in the "Year-Book", but we believe he has associations with Cornell College, which is at Mount Vernon, Iowa, affiliated with the Methodist Episcopal Church, and not in any way to be confused with the great Cornell University at Ithaca, New York.

A "College" in an Office

IN addition to his association with the International Faculty of Sciences, H. W. Blood Ryan is also honorary director of the College of Pestology. We referred to that institution so long ago as December 12, 1925, when we pointed out that it is a propagandist body and not an educational institution. The "College" has a registered office at 52 Bedford Square, London, W.C.1; but though it seems to be concerned mainly with insect pests, not a single entomologist of eminence or authority is included in the list of political and other public people whose names appear upon its publications. There is apparently nothing to prevent any individual or group adopting the designation University or Faculty or College and inviting persons to join

such a self-styled body. We have no observations to make upon the objects and activities of the two bodies of this type referred to above, but scientific workers must themselves decide whether either a "Faculty" or "College", constituted as we have stated, merits their support.

Major E. E. Austen

MAJOR E. E. AUSTEN retired from the keepership of the Department of Entomology in the British Museum (Natural History) on October 19, when he reached the age limit of sixty-five years. After an education at Rugby School and the University of Heidelberg, he entered the service of the Trustees of the British Museum as second class assistant (now termed assistant keeper) in what was then the entomological section of the Department of Zoology on October 30, 1899, and was placed in charge of the Diptera; to this group of insects he has devoted his scientific life. The entomological section was separated from the Department of Zoology in 1913 with Dr. C. J. Gahan as the first keeper; on his retirement, Major Austen succeeded to the office on January 21, 1927. His last official act was to bring out the long wanted number on Clothes Moths and House Moths in the Natural History Museum economic series. As the blood-sucking flies are in the group studied by him, he has been brought closely into contact with tropical medicine. He was with the first expedition of the Liverpool School of Tropical Medicine to Sierra Leone in 1899, and has been a member of the council as well as vice-president of the Royal Society of Tropical Medicine and Hygiene. He has served on many committees including those on sleeping sickness, tsetse fly, and locust. He is a member of the committee of management of the Imperial Institute of Entomology. In early days a volunteer and later a territorial, he saw service in the Boer War and in the European War; in the latter he was twice mentioned in dispatches and was awarded the Distinguished Service Order. Mr. N. D. Riley succeeds Major Austen as keeper, and Mr. K. G. Blair has been appointed deputy keeper in the Department of Entomology of the Museum.

The Asiatic Society of Bengal

ALTHOUGH scientific workers in many fields are familiar with the publications of the Asiatic Society of Bengal, few, probably, are aware of the mass influence of this ancient foundation upon Indian progress. A glimpse of the long history of the Society was given by Dr. Rai Upendra Nath Brahmachari, in his presidential address in 1929, just published in the *Journal and Proceedings* (N.S., vol. 25, 1932). Founded in 1784, as the result of an appeal by Sir William Jones for the institution of a society to inquire into the history, civil and natural, the antiquities, arts, sciences and literature of Asia, and numbering amongst its early patrons Warren Hastings and Lord Cornwallis, the Asiatic Society set going inquiries of a kind which had fallen into abeyance in the India of the late eighteenth century. Its "Asiatic Researches" created so great an impression in the

literary world that in 1798 a pirated edition was brought out in England, and on the Continent a French edition, "Recherches Asiaticques", appeared in Paris. So early as 1808, a year after the formation of the Geological Society of London and only eighteen years after Werner had propounded at Freiburg his doctrine of "Formations", a special committee was formed "to propose such plans and carry on such correspondence as might seem best suited to promote the Natural History, Philosophy, Medicine, improvements of the Arts and Sciences and whatever is comprehended in the general term Physics".

AT first geology and mineralogy received most attention, and the names of many distinguished workers figure amongst the early contributors—Voysey the father of Indian geology, Oldham who created the Geological Survey of India, Lambton of the Indian Survey, Schwendler one of the chief founders of the Calcutta Zoological Gardens, Falconer, Cautley, Colvin, Baker, Durand, to mention a few. Indeed there are few activities in the scientific life of India which have not been linked with the Asiatic Society, from the early ethnological survey of Col. Dalton, and the grand series of papers on the fossil mammalian fauna of the Sub-Himalayas, to the foundation of the Indian Museum and its off-shoot the Zoological Survey. The president added a note of warning about the risk of starting new scientific periodicals, the competition of which might result in the double misfortune of loss both to the new and the old, and made a plea for consideration of the possibility of concentrating upon the oldest journal of all, the *Journal of the Asiatic Society of Bengal*, with which, he considers, many of the new journals might be amalgamated profitably.

Ultra-Short Wave Radio Link across Bristol Channel

ONE of the results of the study of the mode of propagation of ultra-short electric waves has been to show that for wave-lengths of from one to about nine metres, the effective range is limited to the horizon or the optical distance for ordinary vision. While this property prevents the application of such waves for long distance radio communication, it has for some time been recognised that this range of wave-lengths would be very suitable for providing a radio link in the ordinary telephone system. This application is of particular advantage in spanning short stretches of water, such as a channel or river estuary, where the present alternative is a submarine cable or a land-line following a circuitous route. According to recent reports in the *Times* and the *Wireless World*, the Post Office Engineering Department has been investigating the possibilities of this application for some time past, and experiments have now successfully terminated in the setting-up of a radio link across the Bristol Channel. This link, which is twelve miles long, connects up the ordinary telephone land-lines at Lavernock, near Cardiff, on one side, with those at Hutton, near Weston-super-Mare, on the other. The wave-length employed is about five metres, and the transmitters and receivers are placed in separate huts at each site. The aerial

system consists of horizontal dipoles connected to the terminal apparatus by special transmission lines, and the whole equipment has been designed to work unattended, apart from periodic maintenance operations.

British Standard Specifications

THE British Standards Institution has for its principal object the co-ordination of the efforts of producers and users for the improvement, standardisation, and simplification of engineering and industrial materials. It specifies standards both of quality and of dimensions in order to assist production and distribution and to eliminate waste of time and material involved in the unnecessary variation of articles made for the same purpose. Thereby it contributes to safety as well as to efficiency in industry, as is evidenced by the recent publication of a British standard specification for the identification of chemical pipe lines. The proposed scheme, which was prepared at the joint request of the British Chemical Manufacturers' Association and the British Chemical Plant Manufacturers' Association, identifies the nature of the liquids or gases conveyed by means of coloured plates, bearing a distinctive letter or sign, which are to be placed adjacent to the control valve and at intervals along the pipe. Thus a workman can immediately ascertain whether a certain pipe conveys inflammable, explosive, toxic, or corrosive material, whether the contents are under pressure, or whether the pipe line is safe. The matter might at first sight appear to be a trivial one which could be left to the common sense of works managers; in practice, however, the proposed universal device will help to avoid the possibility of emergencies ending in tragedies.

Research on Coal and Coke

THE third annual report of the Northern Coke Research Committee records the many-sided activities of its staff working in the Armstrong College, Newcastle, on problems of the coals and cokes of the north of England. Like most organisations, the Committee now labours under restrictions imposed by the financial stringencies of the times. Apart from fundamental long-range investigations, there is an immediate need for documented information about the characteristics of commercial fuels, which is felt by anyone concerned with the rational choice and utilisation of available coals. To-day coal is no longer the unchallenged king of fuels. The tendency with all commodities is to look for products regular in supply, of high and uniform quality. In all these respects coal has displayed an inferiority against its competitors, and it is hard to see how the industry can maintain its position against its competitors by abandoning or diminishing efforts to inform itself about the properties of its wares. The Report for 1930-31 of the Department of Mining and Fuel Technology of the University of Sheffield also records a wide range of investigations connected with the winning and utilisation of coal, many of which have already been noticed in our pages.

Modern Tendencies in Bird Taxonomy

THE appearance of a fourth edition of the American Check List of Birds in 1931 has suggested to Joseph Grinnell a comparison between its contents and that of previous editions (*Auk*, Jan. 1932, p. 9). The result is a vivid picture of the tendency of modern taxonomic studies. The first edition appeared in 1886, and subsequent editions in 1895, 1910, and now the fourth in 1931. The total number of forms, species, and sub-species listed in these editions was 951, 1068, 1196, and 1420, a very considerable increase in about a working life-time. But a further examination shows that the increase is not equally distributed: the numbers of full species were 768, 799, 802 and 811, a remarkable stability of numbers during the period, less than one new species a year being described. On the other hand, the number of sub-species has mounted very greatly—183, 269, 394 and 609—and the tendency to multiply sub-species is shown most strongly in the last edition. There has been a great advance in the identification of fossil species, the numbers of which run, 46, 64, 72, and 156, but this is a very natural development, for recent years have seen intensive fossil collecting in many areas. The author's idea is that the tendency marked in the new edition is bound to grow, that interest in phylogeny and species-making are counterparts, and that the "species factory in nature is the only resort in final analysis for learning the true nature of the speciation process. More and more alert, students in the field of systematics will develop a facility and technique of discrimination scarcely to be dreamed of now." On the other hand, it is possible that the future will bring, rather than a development of description for its own sake, an association between specific or sub-specific forms and their environment so close that systematic description apart from reference to peculiarities of life-conditions will be regarded as inadequate.

Progress at Colombo Museum

THE building of a new west wing, a new isolated archaeological gallery for stone remains, and a small building for the entomologists' department and reserve collections, has provided nearly 13,000 square feet of additional space for the public collections of the Colombo Museum. The exterior of the west wing conforms with the style of the older portion of the museum, and the block, which, as a photograph shows, is a very handsome structure, stands out as one of the finest buildings in Colombo. It is illustrative of the difficulties of museum lighting that although at most seasons the light is too intense for specimens and sight-seeing, during cloudy days in the monsoon period the lighting in the old building was found to be inadequate, and accordingly special provision has been made for artificial lighting from the roof and within the cases (Administration Report of the Director of the Colombo Museum for 1931). Many additions have been made to the Museum collections, but the section which still retains greatest hold upon the visitor is the collection of living animals, which contains a good selection of mammals

and birds, and to which a large new aviary has been added. Schools in and about Colombo make increasing use of this collection, and 8,127 scholars visited the Museum with their teachers during the year. Approximately 225,000 people entered the Museum in 1931, amongst which there were three times as many 'strangers' as European residents.

Work of the Meteorological Office

THE Annual Report of the Director of the Meteorological Office for the year ended March 31, 1932 (London: H.M. Stationery Office. 1s. net.), deals with the seventy-seventh year of the Meteorological Office. Although the work has continued on the main lines followed in recent years, this year has seen the conclusion of a scheme of re-organisation of the arrangements made at the London headquarters for the preparation of weather forecasts. Under the revised arrangements a single branch only is concerned with forecasts, whereas formerly forecasts for aviation were done by one branch and all other forecasts by another—an awkward arrangement involving a certain amount of duplication, and one which is not justified by any essential difference between the two types of forecast. This internal re-organisation has had its counterpart in a simplification of the exchange of weather information by wireless telegraphy between different countries. This year has also seen the commencement of a scheme of co-operation with the Automobile Association in the supply of meteorological information, including forecasts, to private persons flying their own aeroplanes. The only other work of an exceptional character was in connexion with the second International Polar Year. A number of countries, including Great Britain, are co-operating in obtaining data from high latitudes for the study of meteorology and terrestrial magnetism, and are organising expeditions for that purpose. The share allotted to the Meteorological Office consists of an expedition to Fort Rae, in Canada.

Warfare on Eddystone Island

A COMMUNICATION received from Mr. R. A. Lever of Tulagi, British Solomons, referring to a Research Item in *NATURE* of June 11, p. 872, based on a paper by Mr. A. M. Hocart on warfare in Eddystone Island of the Solomons (*J. Roy. Anthropol. Inst.*, vol. 61, pt. 2) points out that the only weapons to be seen now among the islanders are light spears and bows and arrows for shooting fish and small birds, while head-hunting, murder and adultery, to which Mr. Hocart had referred as the causes of strife, have long been dealt with under the British protectorate, as in all other parts of the globe where we have any share in the government. In fairness to Mr. Hocart, it must be pointed out that the brief paragraph in our columns summarises a paper of 24 pages. Reference to Mr. Hocart's complete paper will show that he was dealing with conditions in the island when he visited it in 1908-9, and further, that in describing as a whole this aspect of native culture, he covered practices which were obsolete, or had fallen into

disuse not long before his visit, as well as customs which he himself observed or of which he was informed. At times, both in his own narrative and in that of his informants, he makes use of the historic present, but the context makes it clear whether he intends a reference to what was then current or to what had become obsolete.

The New York Aquarium

THE most noteworthy event at the Aquarium of the New York Zoological Society, recorded in the Director's Report for 1931, was the establishment and opening of a new department for the exhibition of the smaller fresh-water tropical fishes. At the opening in December, 120 species of diminutive fresh-water fishes from many distant tropical localities were shown, and since many of these are suitable for keeping in home aquaria, part of the exhibit was a demonstration tank showing a balanced aquarium of mixed fishes suitable for such a purpose. The thoroughness with which the world is combed for the stocking of the tropical fresh-water tanks is well illustrated by a map showing collecting grounds in 43 localities, ranging from the Americas to Africa, India, Malaya, and Australia. Only one European locality, in Spain, has contributed to the tropical collection and only one to the collection of temperate fishes. An interesting activity of the Aquarium is the distribution from the hatchery of quantities of fish eggs and young fishes at different stages of development to high schools for biological studies. In addition to the year's grant of 76,167 dollars, the City of New York voted 245 dollars towards salaries for temporary labour and 1,000 dollars for the hiring of labourers for 200 days at 5 dollars a day, thereby helping to relieve the condition of unemployment. The Zoological Society provided from its own funds an additional 22,761 dollars. In the course of the year the Aquarium was visited by 2,453,806 persons.

Destruction of Hawks in the United States

IT is remarkable that the many ornithological associations in the United States were unable for thirteen years to prevent the State-encouraged slaughter of hawks in Maryland. In a short article in the *Condor* (1932, p. 187), Prof. A. Brazier Howell gives some indication of what the bounty payment of 50 cents for each hawk (the law was intended to apply to the sharp-shinned and Cooper's hawks only) meant to the hawk population and to the public purse. From a total of 7 individuals killed in 1918, the year of the passing of the anti-hawk legislation, the annual slaughter reached 20,081 in 1923-24, and 22,283 in 1929-30, when the bounty was repealed. In all, during the thirteen years when the bounty was in force, 62,543 dollars were paid for 125,086 hawks. Unfortunately, the effect spread far beyond the bounds for which the Maryland legislators were responsible, for the inducement of the bounty led individuals to make a profitable business of hawk-hunting, particularly during autumn, when thousands of migrating hawks remain for short periods on passage. In the five years 1926-1930, a well-known

resting ground of such migrants furnished 40,003 hawks, or 55 per cent of the total kill during that period, and a single hawk-hunter was rewarded in 1930 to the tune of 900 dollars. It was against much opposition that Mr. E. Le Compte, the State game warden, finally succeeded in inducing the legislature to withdraw the bounty.

A Capsid Bug New in Britain

IN the *Entomologist's Monthly Magazine* for August 1932, Mr. W. E. China, of the British Museum (Natural History), discusses the occurrence of large numbers of a very small capsid on apple trees in a nursery near Chertsey, Surrey. The species *Campylomma nicolasi* Put. and Reut. is an inhabitant of the Mediterranean region and its appearance in Surrey in large numbers is of special interest. The genus *Campylomma* contains ten palæarctic species but none has previously been found in Britain. It seems unlikely that the species *C. nicolasi* is an indigenous insect, since it could scarcely have been overlooked in so well-worked a county as Surrey. Mr. China is of opinion that it is more likely to have been introduced with some Mediterranean plant, since the eggs of the family Capsidæ are almost invariably inserted into plant tissues. Whether a southern insect of this kind will survive the English climate seems questionable: the description and figure given by him will enable it to be identified should it be found again in subsequent years.

South London Entomological and Natural History Society

THE *Proceedings of the South London Entomological and Natural History Society* for 1931-32 forms the record of its sixteenth year of existence and contains several articles of interest to students of insects. Mention may be made of the contribution of Mr. A. E. Tonge, dealing with the characters of the eggs of British noctuid moths. The eggs of a large number of the species have been examined by him and briefly described and a proportion of them figured in four excellent photographic plates. Dr. E. A. Cockayne describes the larva of *Dysstroma concinnata*, and Mr. C. N. Hawkins discusses the pupæ in that genus. Among other articles, Mrs. K. Grant's account of aquatic Hymenoptera and Mr. H. J. Turner's discussion on the classification of the British plume moths are also noteworthy. The volume is well produced and fully indexed, and may be obtained at the Society's rooms in Hibernia Chambers, London Bridge, S.E., price 12s. 6d.

Congress of Polish Physicists

THE sixth Congress of Polish Physicists was held in Warsaw on September 29-October 1, under the presidency of Prof. Ladislas Natanson, professor in the Jagellonian University, Cracow. The president, in his introductory address, spoke on "James Clerk Maxwell's Childhood and Boyhood". The principal subjects chosen for discussion included: the fortunes and misfortunes of physical theories, the polarisation of dielectrics, the physical interpretation of quantum mechanics, problems of nuclear physics, the con-

nexion of physical science with engineering, general relativity, theory of band spectra, teaching of physics, etc., the chief contributors being Profs. Rubinowicz, Zakrzewski, Bialobrzewski, Wertenstein, Wolfke, Weyssenhoff, Patkowski, and others. Prof. Malarski, of Lwow (Leopol), dealt with "Maryan Smoluchowski's Life and Work". More than 120 miscellaneous papers were also presented. The Congress was decidedly successful, about three hundred members taking part in the proceedings. The next Congress will be held in Cracow in 1934.

Engineers' German Circle

THE Engineers' German Circle (Deutscher Ingenieurzirkel in London) was formed in 1931, with the joint support of the Institution of Mechanical Engineers, London, and of the Verein deutscher Ingenieure, Berlin, to further the study of technical German, to give opportunities of hearing lectures in German by eminent German-speaking technical men, and to bring together engineers interested in Continental technical developments. Meetings are held at the Institution of Mechanical Engineers about once every four weeks during the sessions, on Mondays at 6 P.M. Members meet for tea and social intercourse from 5.15 P.M. Lectures are, so far as possible, illustrated with lantern slides, in order to help members to understand better the technical terms involved; and as a rule, they last about forty minutes, which allows time for a short discussion in German to follow. The lecturers are asked to use simple language and to speak slowly for the benefit of those not very familiar with German. The present session opened on Oct. 10. The subscription to the Circle is 5s. a year, and the Secretary is Mr. H. P. Spratt, Science Museum, London, S.W.7.

Researches in Wood Preservation

IN addition to some useful notes on timber-treating plants in the British Isles, and on the preservation of timber investigations being carried out at research institutes and forest products laboratories, vol. 2 of the *Journal of the British Wood Preserving Association* includes some interesting papers read before meetings of the Association during the year, accompanied by valuable discussions both from the point of view of the expert and the practical commercial man. Amongst these are "The Structure of Wood", by L. Chalk; "Recent Developments in Wood Preservation", by H. Fergusson; and a general discussion on the fire-proofing of timber. Other interesting material was afforded by the papers on "The Preservation of Mining Timber on the Witwatersrand", by H. A. Read; "Experiments on Wood Preservation in the Sea", by J. H. Orton; and "Wood Structure and Penetration of Preservatives", by F. J. Popham. In an editorial note it is stated that the steady growth of the Association continues. The exhibits at agricultural shows and the lectures given by the Secretary to the various clubs and scientific associations in many parts of the country bring the merits of scientific wood preservation before a large public. Inquiries from abroad have increased, particularly from the Colonies,

and the Secretary is now in direct touch with a large number of timber users and research workers throughout the world.

Psychology of Delinquency

"STUDIES IN THE PSYCHOLOGY OF DELINQUENCY", by Grace W. Pailthorpe (Medical Research Council, Special Report Series, No. 170), represents the result of five years work on the psychology of inmates of prisons and of preventive and rescue homes. The investigation aims at finding out what treatment would lead to a restoration of these people to the ranks of the normal. It is necessary to note that a criminal is not necessarily quite different from other people; he has been found out. Dr. Pailthorpe gives details of an investigation of 200 subjects, 100 in prisons and 100 in homes. The subjects were tested for intelligence, and classified accordingly, as normal, sub-normal, and defective. The prison group proved to have a higher proportion of normals. It is not infrequently asserted that prison people are defective in intelligence: some certainly are, but some are not. They were also interviewed, and classified according to their emotional attitudes. This part of the report is excellent and the detailed case histories are very valuable. It seems obvious on reading them that our present alternatives in dealing with criminals are hopelessly inadequate and wasteful of money as well as of the human material. A large number show clear signs of mental lack of balance, and it should be part of an enlightened society's work to try to find out the cause. Hence the writer makes a plea for a study of the mentality of the criminal as well as of the crime, and discusses various alternative methods of treatment, including segregation, permanent supervision, education and psychotherapy. Many of the prisoners are really mentally sick, and if there were legal recognition of these conditions some murders might be prevented. In an appendix there is an account of some prison systems abroad.

Announcements

PROF. J. A. CROWTHER, professor of physics in the University of Reading since 1924, has been elected honorary secretary of the Institute of Physics, in succession to Prof. A. O. Rankine.

REFERRING to Prof. P. G. H. Boswell's letter in NATURE of August 13 on the subject of the age of the Oldoway skeleton, Dr. L. S. B. Leakey writes to say that he is returning to England at the end of December, and hopes then to be able to place the whole evidence against Prof. Boswell's conclusions before scientific investigators.

THE first Hinchley Memorial Lecture of the Institution of Chemical Engineers will be delivered at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1, by Mr. H. T. Tizard, on October 28, at 6.30 P.M. The subject of Mr. Tizard's lecture will be "Chemical Engineering and the Aircraft Industry".

THE Lord President of the Council has appointed Prof. A. Fowler and Sir Clement Hindley to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research in succession to Sir Alfred Ewing and Sir David Milne-Watson, who have retired on completion of their terms of office. The Lord President of the Council has also appointed Brigadier-General Sir Harold Hartley to be chairman of the Fuel Research Board, and Dr. N. V. Sidgwick to be chairman of the Chemistry Research Board of the Department of Scientific and Industrial Research, in succession to the late Sir Richard Threlfall.

THE eighth volume (Pt. 2, Science Section) of the Allahabad Univ. Studies (1932) contains half a dozen papers from the Department of Zoology, five from that of Chemistry and one each from the Departments of Botany and Physics. In the first group it is natural that the work of the head of the department (Prof. Bhattacharya) should be reflected in the investigations of his pupils and two of the papers are on the Golgi bodies and other cytoplasmic structures in the eggs of Indian snakes and of the crab, *Scylla serrata*. Other papers record the congenital absence of limbs in tortoises, the structure of the gonad in a hen-feathered cock, and a number of new species of trematodes. Of the chemical papers, that on the formation of inorganic jellies may be noted.

MESSRS. NEGRETTI AND ZAMBRA have placed on the market a portable sampling hygrometer adapted for the measurement of the hygrometric conditions inside bundles of fabric, wool, fibres, etc. The instrument is of the hair hygrometer type fitted with a tube through which a sample of air is withdrawn from the bundle and circulated through the hygrometer case, which is completely air-tight except for the inlet and outlet air connexions.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A research student in the Institute of Pathology and Research at St. Mary's Hospital, Paddington, W.2—The Secretary (Oct. 24). An assistant lecturer in mathematics at the Technical College, Cardiff—The Director of Education, City Hall, Cardiff (Oct. 29). A junior lecturer in the Department of Pathology at the University of Liverpool—The Registrar (Oct. 31). An assistant lands officer in the Works and Buildings Directorate of the Air Ministry—The Secretary (S.2), Air Ministry, Adastral House, Kingsway, W.C.2 (Nov. 1). An assistant lecturer in metallurgy at the University of Leeds—The Registrar (Nov. 7). A part-time instructor of economics and economic history at the Kingston-upon-Thames Technical College—The Principal. A teacher of elementary science, including biology, and a mistress to teach geography, at the Medway Technical College, Day Technical School for Girls, Chatham—The District Education Officer, 15, New Road Avenue, Chatham. A valve physicist and designer at the Murphy Radio Laboratories, Welwyn Garden City, Herts.

Reviews

Mary Kingsley

The Life of Mary Kingsley. By Stephen Gwynn.

Pp. viii + 272 + 2 plates. (London: Macmillan and Co., Ltd., 1932.) 12s. 6d. net.

IN the last eight years of her too-short life, Mary Kingsley crowded many experiences. Until the age of thirty she lived a life of domestic seclusion, fifteen years being devoted to the care of an invalid mother and a delicate brother, while at the same time she assisted her father in the preparation of a work, never completed, on native law and religion. When in 1892 the death of her father and mother within a few weeks of one another left her free to follow her own bent, she set out on her travels, her choice of West Africa being determined largely by a desire to collect first-hand information for the continuation of the work upon which she had been engaged with her father. It is a testimony to the strength of her character, also, perhaps, to its peculiar quality, that notwithstanding her previous sheltered existence, she could adapt herself to West Coast society of the 'nineties—a society of traders and ships' captains which held itself aloof from the official element—and was proud to be of its fellowship, and could steel herself to the dangers of travel in the forest, alone, unescorted and unarmed, with members of cannibal tribes for her guides and carriers, among villages in which the chances were much less than even that she and her party would meet with a friendly welcome.

Mr. Stephen Gwynn's "Life", save for a few deft touches from personal recollection, leaves the sketching of Mary Kingsley's character in the main to herself. By a skilful selection from her "Travels", lectures and letters—many of the letters, unfortunately, have vanished—there emerges a detailed portrait of a remarkable personality; a personality which combined the zest for adventure and the spirit of a sixteenth century English seaman-explorer with a passion for justice and honour in dealings between governors and governed, whether the latter were the traders, who, as she saw it, were doing a great work for England and, given favourable conditions, might do more, or

the natives of Britain's dependencies and protectorates. But with all her sympathetic understanding of those on whose behalf she fought, she was no sentimentalist. Both trader and native she saw as they were, and without illusion, even as, on the other side, she was always ready to do justice to the merits of her opponents; and next to this passion for justice, in the picture as Mr. Gwynn composes it, comes her genius for humour, impish and unconventional, with which she so often veiled her seriousness of purpose and almost missionary zeal.

When Mary Kingsley left England for South Africa, where she died in 1900 while nursing Boer prisoners of war, she carried with her a sense of defeat. In 1898 her projected third journey to West Africa was abandoned, as it proved for ever, in order to carry on a campaign on behalf of what she held to be the interests of both England and West Africa. In this she felt that she had failed, even though she had been consulted privately by Mr. Joseph Chamberlain, then in charge of the Colonial Office.

On the publication of her "Travels in West Africa" Mary Kingsley had involved herself in replies to critics of her views on native customs and beliefs, on missionaries and on the supply of intoxicating liquor to natives; but the development of international affairs in Africa, in which the future of the Niger Company with Sir Charles Goldie at its head was implicated, and the serious unrest among the natives which arose as a result of the imposition of the Sierra Leone hut-tax, raised issues which to her were even more vital.

Mr. Gwynn briefly, but adequately, sketches the course of relations between England and France in West Africa at this time in so far as they affected Mary Kingsley's hopes for British expansion and the development of British commercial interests in tropical Africa; but this is a matter of history. What is still a vital issue, although thanks to Lord Lugard its recognition has been won in West Africa, is the principle upon which she took her stand in the native question, namely, that native institutions should be

recognised in the relations between the administration and the native. She pointed out that the imposition of the hut-tax was a violation of treaty rights because it conflicted with native ideas of ownership of property which had not been affected by the treaties. On the general question she stated her position quite clearly. In her "West African Studies" she said (pp. 331-2):—"I hold that one of the most awful crimes one nation can commit on another is destroying the image of justice, which in an institution is represented more truly to the people by whom the institution has been developed than in any alien institution of Justice; it is a thing adapted to its environment. This form of murder by a nation I see being done in the destruction of what is good in the laws and institutions of native races."

On the other hand, she was equally clear in her recognition of the right or duty of the governing race to suppress, if necessary by force, practices which were repugnant to the more advanced conception of civilisation.

Mary Kingsley had a distrust of theoretical anthropologists, just as she had of stay-at-home administrators and philanthropists; but it is evident that she appreciated anthropological work in the field in its bearing on the problems of government as providing a basis of understanding of native institutions and of the native attitude of mind towards administrative action affecting those institutions. It would be a mistake to exaggerate the part played by her; but the interval of thirty years which has elapsed since her death has given perspective. Her work by no means failed so completely in its effect as she feared. This she would have recognised had she known that within a few years of her death, the Government of Southern Nigeria was to appoint experimentally a government ethnologist, paving the way to the work of such officials as Rattray, Talbot, Meek and others in preparation for, or as a concomitant of, a system of administration in which native institutions and native rulers play a recognised part. But progress is slow and acceptance of the principle is not even yet general.

What generations of anthropologists have urged upon the governments of their day, what individual administrators, not only in Mary Kingsley's time but also before, had realised as the result of their experience, it has taken the driving force of a Lord Lugard in West Africa and a Sir Hubert Murray in Papua to bring into actual operation. Incredible as it may seem, in some areas it is still

possible for those responsible for administration—and this applies also to mission work—to say in all seriousness that their subordinates "have not the time" to study and observe the natives in their charge.

The Human Factor in Industry

Ten Years of Industrial Psychology: an Account of the First Decade of the National Institute of Industrial Psychology. By Henry J. Welch and Charles S. Myers. Pp. ix + 146 + 9 plates. (London: Sir Isaac Pitman and Sons, Ltd., 1932.) 6s. net.

ONE of the difficulties which besets the investigator of the human factor in industry is the relative length of time which is frequently necessary before sound deductions can be drawn from his experimental investigations and observations. The application of scientific methods to investigation of industrial problems in which the human element is a principal factor is a departure in Great Britain which is almost if not exclusively confined to the post-War decade. In this field the formation in 1920 of the National Institute of Industrial Psychology is an outstanding feature, and this very readable account of its activities during its first decade contributed by H. J. Welch, chairman and honorary treasurer of the Institute and Dr. C. S. Myers, its principal, contains abundant material for justifying the initiation of this important experiment. The Institute has already become a living and growing organisation rich in experience and fruitful in services rendered, to which we can look with confidence for assistance in the solution of many serious problems in our industrial and social life.

The Institute was formed specifically for the determination and application of psychological and physiological principles and methods in the solution of the human problems of industry and commerce, and from the outset it was stressed that its work should be scientific and not for profit. The investigation and improvement of actual working conditions and methods in factories, offices, etc.; the study of personnel organisation, including methods of selecting staff, training, promotion, incentives, etc.; and the giving of vocational guidance based on the physiological and psychological study of abilities and of temperamental qualities, were methods adopted by the Institute from the start, and within its first two years all the main lines of its present activities

were being actively developed, including its important educational work, courses of lectures, etc.

The survey of ten years' work as presented in the volume under review, affords sufficient material for enabling some reasoned judgment to be formed of the value of the contribution of science in this field and the developments to be expected. Certain aspects of the Institute's work have indeed earned high praise in many quarters but this summary of its activities demonstrates very clearly how closely many of them are related. Vocational guidance and selection are two aspects of one problem and in turn are closely related to problems of industrial safety and efficiency, while the wide practice of vocational guidance and selection is in turn dependent upon the success of the Institute's educational activities.

The Institute has already become the acknowledged headquarters of research in vocational guidance and selection, and despite the increased difficulty of work in this field due to the magnitude of the unemployment problem to-day, there is no sphere of its work which is of wider importance. In the difficulty of finding posts for boys or girls leaving school, the importance of finding the right post is liable to be overlooked. The experience already gained by the Institute has demonstrated not only the extent to which misfits are a source of inefficiency and accidents in industry but also the positive contribution which vocational guidance and selection can make from the point of view of both employer and employee. On one hand, it enables the employer to secure the type of worker best fitted for the positions he has to fill. On the other hand, it tends to prevent that drifting from one unsuitable position to another which has so demoralising an influence on the adolescent and tends to aggravate that gravest aspect of our unemployment problem to-day, the creation of unemployables. It is clear that the study of these problems in a scientific spirit is of vital importance, and if at the present time it is not always possible to direct the boy or girl leaving school into the ideal occupations for individual talents, the risk of a serious and demoralising misfit can be greatly minimised.

The Institute has as yet only been able to touch the fringe of this problem. Its results need application on a far greater scale and its methods and investigations need extending to all parts of the country and to all classes of occupations, including in these days of educational economy, the selection for higher education of those best

fitted to profit by it. The absence of adequate vocational guidance is lamentably plain and the contrast between the careers of those entering industry unguided and those whose selection of a career is based on scientific guidance is so significant that, even in these days of stringent economy, the nation cannot afford indefinitely to incur this unnecessary waste, or to ignore the risk that anxiety at the present moment to secure any position may result in a succession of demoralising misfits and an increase in the unemployables.

The work of the Institute in this field is typical of the preventive as contrasted with remedial methods which characterise the penetration of science into any field of human endeavour. This aspect, far more than the mere raising of industrial efficiency, is the most impressive, and the better health, less fatigue and greater capacity of the worker to enjoy his leisure hours which have resulted from the Institute's industrial and commercial investigations, should be sufficient answer to those who at the present time might have objected to the simultaneous raising of the efficiency of industrial processes or operations as liable to increase unemployment. Investigations on fatigue, lighting, ventilation, noise, physiology of work, and numerous applications of psychology have demonstrated that the elimination of waste of effort, and the reduction of needless physical and mental strain which scientific thought can thus effect, hold benefits even more important to the community than are the financial benefits to industry. This contribution has hitherto been limited largely to the production side of industry. Its extension to the distributive side of industry and commerce, and indeed to all sides of government and municipal life, as well as to the home conditions which so largely shape the health and happiness of the worker, is urgently required. The present volume should assist in rousing the wider interest and fuller support required for such expansion of the Institute's invaluable work.

R.B.

Exploring New Guinea

Across New Guinea from the Fly to the Sēpik. By Ivan F. Champion. Pp. xix + 267 + 24 plates. (London: Constable and Co. Ltd., 1932.) 15s. net.

THIS book is the simple record of a very remarkable achievement—the first crossing of New Guinea from south to north in its widest

part. From the latest maps it was evident that the sources of the greatest rivers in that island, the Fly and the Sēpik, were not far apart, but that particular area was unexplored, as are many parts of the interior. A certain amount of information about the upper waters of the Fly was available, thanks to the work of Leo Austen and other officers of the Papuan Government, but there was a blank space on the map, and as Sir Hubert Murray, the Lieutenant-Governor of Papua, says in his introduction to Mr. Champion's work, "The crossing must be done some day, and it was unthinkable that it should be done by any but officers of the Papuan service." The ordinary routine work of that service often necessitates difficult and risky journeys into the interior, so that many of the officers have performed notable explorations which have greatly added to geographical and ethnographical knowledge, but whose exploits are for the most part unknown except to those who delve into the annual reports. Thus it is not surprising that, given the opportunity, two thoroughly efficient officers should be found to attempt the adventure here narrated with slender means and without preliminary publicity.

The leadership was entrusted to Mr. C. H. Karius, and Mr. Ivan F. Champion, who was born in Papua, was appointed his colleague. The first expedition started in December 1926 and arrived at its camp, No. 10, 615 miles up the Fly on March 31, 1927, having traversed on foot nearly a thousand miles. This was where its real work was to begin, but the carriers were by then thoroughly tired of the trip. They had carried 40lb. loads, and having carried a load they had to go back over the same track more than once and get another, with rice as practically their sole diet. Before them were ramparts of sharp brittle limestone with neither water nor soil, over which they painfully attempted to crawl, but they were forced to return. Another track over a limestone ridge was more promising, but these and other attempts of the two explorers, who tried different routes, proved abortive. An alarming feature in one district was the crashing down of mountain sides.

At Mount Blücher the party divided. Karius went north-east and reached the head of a valley that led northwards to the Sēpik, but lack of supplies forced him to return and he followed a river that turned out to be the Strickland. Champion went north-west and traced the Luap or Palmer River to its source, and passed down the

Bol to the village of Bolivip where, though the natives had never seen a white man, they were royally entertained. He then made a trip to near the source of a mysterious river, the Feneng, which afterwards proved to be the Fly, and heard of another to the north, the Takin, which Champion conjectured could be no other than the Sēpik. The carriers were worn out and the food all but exhausted so he had to return to Mount Blücher. There, at Camp 10, they made rafts by means of which they travelled 500 miles down the Fly after many exciting adventures. In the estuary of the Fly the two parties were reunited on July 12 and they reached Port Moresby on July 17.

On September 17 the explorers left Port Moresby for a second attempt, this time taking with them 32 carriers from the d'Entrecasteaux, sturdy, hardy men, accustomed to climbing mountains, unlike the former carriers, who came from the estuary of the Fly; there were also 14 armed native constables and 26 prisoners. In due course they reached Bolivip; the natives were friendly but were greatly depressed because owing to a lean season they could not provide their visitors with an ample supply of food. After some difficulty, they persuaded the chief, Tamsimara, to conduct them to the Takin, for the Bolivip people occasionally crossed the divide to join in feasts at Feramin. They went up the Amil affluent of the Bol, and soon came to limestone walls that were most difficult to climb. Everything was saturated with moisture and the icy blasts froze the carriers; at an altitude of 8900 ft. the rain had diminished somewhat but it was still blowing and bitterly cold. The limestone country became worse and worse, rocks with razor-like edges to clamber over, chasms to cross by rotten tree trunks, they descended into large pot-holes varying from 50 yd. to 100 yd. in diameter and from 30 ft. to 100 ft. deep and had to clamber out of them. There was no water and no level ground. The highest camp was at 8300 ft.

In due time the expedition reached the divide at a height of 9000 ft., when the track began to go down, but they were enshrouded in mist and rain and no compass bearing could be made. There were still dangerous chasms to be crossed, but at last they were on a small grass plateau at a height of 7000 ft. in bright sunlight with a magnificent panorama in front of them. On a projecting rock stood Tamsimara calling out "Wok Takin!" They saw where the Takin started its flow in a narrow ravine to the east formed by two spurs of the

Victor Emanuel Range. The last days' march had been too much for the carriers, whose spirits had dropped to zero, but the leaders and the police were jubilant. "Little did they know, as we did, that it was but the commencement of our trials and tribulations." Tamsimara, who was really a remarkable person, introduced the travellers to the people of the village of Feramin, before he made a dramatic farewell. The Feramin received them kindly but had very little food to sell.

The next part of the journey was also difficult and owing to an accident Champion had a bad knee and had to be carried in a stretcher for several days, which greatly impeded their progress. They had only 11 days reduced rations left and were still in the mountains. Karius as usual remained undaunted: "he could take defeat in the matter-of-fact manner with which he met success". They had now arrived at a point where it was possible to identify features marked on German maps of the Sëpik and at times were able to obtain sweet potatoes and sugar cane from the natives, who were friendly but had to be handled with care.

For eleven days Champion had practically lived on the stretcher, and though lame he made up his mind to attempt to walk, and managed to hobble along. There was now food only for five days and the mouth of the river was 600 miles away. Difficult mountain land had still to be traversed and rivers crossed, but on December 23, 1927, they looked upon the great inland plain and an hour later the mountain journey had ended. In a forest glade Karius came suddenly upon a village, the men rushed out fully armed with bows and arrows and drew up in a line three men deep; the quiet courage of Karius saved the situation and shouts of defiance changed into calls of welcome. Here they were able to buy 160 lb. of sago.

They had to leave the Sëpik and travel into the hilly hinterland and were now in Netherlands New Guinea. They crossed the Hoffnungs River and came to another which proved to be the Holländer; here they made rafts but these were wrecked and lives were nearly lost. The police lost their rifles: "It hurt them more than anything could do. They accepted hunger, fatigue, and even death as a part of their work, but to return to Port Moresby without their rifles was too much." Food ran out and Karius and Champion were down with diarrhoea and fever; fortunately they were able to make sago, but a carrier, who had collapsed in

the swamps, died—the only death on the expedition. Rafts were again made and they soon shot into the main river. On January 19, 1928, 500 miles up the Sëpik they saw the *Elevala*, which had been sent from Port Moresby to meet them. "The silence was broken by the sobs and hysterical laughter of the police and carriers who madly clutched at one another, and who then, with triumphant shouts, reached for the oars." Thus ends the book.

Mr. Champion has given us a fascinating, though restrained, record of a most memorable expedition into the unknown. Travelling in the interior of New Guinea is exceptionally difficult and dangerous; food has to be carried and it must be remembered that "a carrier himself will, in a month, eat the load of rice he starts off with", so sufficient stores had to be carried inland to the point from which the final dash was to be made. Travelling in the limestone mountains was a nightmare; besides lack of food and the lurking of diseases and accidents, there were unknown natives to be placated. The Papuan service affords good training for all these emergencies and its fine tradition of dealing with natives enabled the explorers to make friends with suspicious savages even when their attitude was aggressive. The behaviour of the native police was, as usual, efficient and cheerful, and the carriers and prisoners, almost without exception, worked hard and with loyalty. Mr. Karius has well deserved the gold medal awarded to him by the Royal Geographical Society.

A. C. HADDON.

Dwarf Succulents

Mesembryanthema: *Descriptions, with Chapters on Cultivation and General Ecology*. By Dr. N. E. Brown, Dr. A. Tischer and M. C. Karsten. Pp. xxvi + 323. (Ashford: L. Reeve and Co. Ltd., 1931.) 36s. net.

THE group of plants known as mesembryanthemums is almost exclusively of South African origin and contains a great diversity of growth forms. In the work under notice, attention is confined to the 'dwarf', 'stone' or 'sphaeroid' types. These are the peculiar forms localised in the Karroo and Namaqualand, where the rainfall averages 5–10 in. a year. Light intensity and day temperatures are high and the conditions generally are extremely severe. It is owing to these factors that some plants have developed the small succulent habit to such a high degree of efficiency.

For nearly two centuries, mesembryanthemums have attracted the attention of horticulturists, but owing to the specialised conditions required for successful growth, their cultivation was somewhat restricted until comparatively recently. Latterly, however, mesembryanthemums, American cacti and other dwarf succulents have been adopted by the general public, particularly on the Continent, to decorate window boxes. Miniature gardens in bowls and various other designs have also gained great popularity.

While general interest was at its height, Dr. N. E. Brown, after many years of intensive study, decided that the Linnean genus *Mesembryanthemum* should be divided into a number of smaller genera, and in 1925 commenced the publication of his views. Not long after, Dr. Schwantes, in Germany, and Mrs. L. Bolus, in South Africa, followed a similar course, and since then many articles have been published containing new genera and species. It need scarcely be added that much of the work of these authors has overlapped and considerably more than a hundred new genera have been described and the synonymy increased unnecessarily. To give examples from the work under review: *Conophytum pellucidum*, Schwant.; syn.: *C. elegans*, N. E. Br.; *Lithops Marlothii*, N. E. Br.; *Ophthalmophyllum Marlothii*, Schwant.; and another, *Bijlia cana*, N. E. Br.; syn.: *Mesembryanthemum canum*, Haw.; *M. Tugwelliae*, L. Bol. *Juttadinteria Tugwelliae*, Swant.; *Hereroa Tugwelliae*, L. Bol. *Bolusanthemum Tugwelliae*, Schwant.

The necessity for such an authoritative publication on these plants requires no further emphasis, and coming as it does at a time of wide public interest in its subject, there is no doubt it will meet a real demand. In order to make it a work of wider reference, the editor, E. J. Labarre, decided to have the text printed in English, German and Dutch. Dr. Tischer is responsible for the opening chapter on cultivation, which is followed by a chapter on ecology by Miss Karsten. To these two authors fell the task of translating the main body of the work by Brown, consisting of short descriptions of a large number of species, accompanied by excellent illustrations. Brown's care and exceptional knowledge of the group is a guarantee of accurate and useful information. The photographs, by various authors, and two coloured plates by N. E. Brown are of outstanding merit.

In the chapter on general ecology, a large number of examples of mimicry in plants is given, where the plants resemble in colour and shape the

stones amongst which they grow, and the inference is that the plants have directed their evolutionary progress; but the section concludes with the very necessary warning that this aspect may not be of such importance as hitherto imagined; and that the environment, for example, light, temperature, humidity, soil, etc., working as a whole, is the directive force, is the generally accepted view of modern thought. Prominence is given to the ravages of beasts and birds, particularly of ostriches, but since the ostrich feather has fallen from women's favour, the menace has largely disappeared. On the other hand, the more recent popularity of succulents throughout the world has resulted in collectors taking even greater toll of the wild plants for commercial purposes. This brings one to the consideration of propagation and regeneration. Dr. Tischer gives a host of valuable hints on these points. The reviewer would emphasise the success which attends propagation from seed and cuttings, and if these means are more fully developed, the demand for fresh supplies from the native haunts will be lessened, and this is greatly to be desired.

"Mesembryanthema", although not claiming to be an exhaustive treatise on dwarf species, is an important work of reference, and every serious cultivator of these plants will find it indispensable.

Animal Picture Books

- (1) *Seen by the Camera: Beauty in Animals*. Pp. xvi + 64 plates. (London: George Routledge and Sons, Ltd., n.d.) 2s. 6d. net.
- (2) *Monsters of Primeval Days*. With Foreword and Descriptive Notes by Dr. W. E. Swinton. Pp. 38 + 24 plates. (London: Figurehead, 1931.) 2s. net; paper, 1s. net.
- (3) *Nature by Night*. By Arthur R. Thompson. Pp. xiii + 144 + 44 plates. (London: Ivor Nicholson and Watson, Ltd., 1931.) 12s. 6d. net.
- (4) *The Life Story of Beasts*. By Eric Fitch Daghish. Pp. x + 223 + 21 plates. (London and Toronto: J. M. Dent and Sons, Ltd., 1931.) 6s. net.
- (5) *Fishes*. By E. G. Boulenger. Pp. 174 + 8 plates. (London: Chapman and Hall, Ltd., 1931.) 7s. 6d. net.

(1) "**B**EAUTY in Animals" is introduced by Friedrich Schnack and consists of sixty-four photographs, mostly by Hedda Walther. The series of pictures of mammals and birds, "is the means to assist us to find the way to a higher view,

and to sharpen our understanding for it". Many of the pictures are of parts of animals and in most of the rest the animal fills up the greater part of the picture. We have never found a series of stuffed animals to excite the emotions and we are sure that these pictures will seldom do so. Why not let the publishers try again and show the animals alive in characteristic attitudes, or better, in their natural environment as Mr. Swinton has done in his "Monsters", mostly giants of earlier days (2). Here there are accurate reproductions of models representing the animals in natural motion, set in appropriate environments so as to form pictures. They look to us like superposed photographs, in other words, ancient beasts with modern plants. We do not object to this, for the gain is great, but we think a little more attention to composition and printing would make many of the pictures less confused. The text might be made still more popular, and why give specific names to most reptiles and to no mammals?

(3) "Nature by Night" is in a higher category both of art and science, dealing with animals that have their maximum activity in the hours of darkness. The numerous pictures of living animals are beautiful. Those by flashlight have a certain absence of colour values, but are peculiarly valuable as indicating nocturnal conditions. To the badger and the rabbit they must be nearly the same and the reader should examine and compare the photographs of these two at night and in the daytime. We ask for pictures of the stoat and weasel. The whole is illuminated by an admirable text with little introduction of matter not within the author's own knowledge. Every naturalist will find this book delightful reading, well worthy of a place in his library; teachers will feel that it greatly helps them. Its production is a credit to its publishers and its price is moderate.

(4) To the more sophisticated and modern, which few naturalists are, Mr. Daglish's book should appeal for its woodcut illustrations. Those which close the chapters are delightful. Of the full page illustrations some are anatomical, such as the whale and mole, but many suggest a vigorous existence with the beast using its environment intelligently and itself well adapted to it. The text is admirable throughout and singularly free from technical terms. The arrangement into chapters dealing with the food, homes, courtship, intelligence and other characters of beasts is good. This is an excellent little book.

(5) We wonder whether we shall be criticised

for classifying "Fishes" as a picture book, but we think L. E. Brightwell had great fun in making line drawings from fish in the Zoological Society's Aquarium. We like the drawings, for the fish are alive, their salient features well shown and unnecessary detail omitted. The sawfish is a partial failure, and the copies of earlier figures of the young of the eel scarcely suggest this little transparent person. The tiny male of the angler fish, fused as a parasite to the body of the female, is of peculiar interest. The weaver's poison spine is an efficient defence even against man, for it is as good eating as the sole. The text is admirable, but few people will recognise the sail-finned and reed fishes as *Polypterus* and *Calamoichthys* of African freshwaters; the latter is not even put in the index. Otherwise it is a simple account of the very diverse forms and habits of fish. We recommend this book to all readers and trust that its next edition will be published at an even lower price so as to command the widest public.

A Subantarctic Island

South Georgia, the British Empire's Subantarctic Outpost: a Synopsis of the History of the Island.
By L. Harrison Matthews. Pp. xii + 163 + 26 plates. (Bristol: John Wright and Sons, Ltd.; London: Simpkin Marshall, Ltd., 1931.) 15s. net.

IN view of the importance which South Georgia has assumed during the present century as one of the centres of the whaling industry, it is strange that no book on the island has hitherto been published. The account which Mr. Matthews gives is thus welcome, the more so since it is based on close personal acquaintance with the island and its industries.

The description of the island, with which the book opens, contains a good general account of the topography and notes on the climate and on the flora. The section on the fauna is the longest and it is here that the reader gains most from the author's first-hand knowledge. The account of the birds, seals and whales is excellently done, and even fuller treatment, especially of the courting ceremonies of the albatross, might have been given. The section on geology is less adequate, and the author is apparently unacquainted with Høltedahl's recent work.

The book, however, as the sub-title indicates, is mainly devoted to the history of the island, and

three of its six chapters deal successively with the early navigators, the sealers, and nineteenth century voyages. These chapters, which must have involved protracted research, are valuable in bringing together information from many widely scattered sources, and one feels there is little need for the apology that the author offers for the numerous quotations. Mr. Matthews has some new suggestions to make regarding the courses taken by la Rochè and Guyot, and though the sealers who followed in the track of eighteenth century exploration were reticent folk, more anxious to conceal than to advertise their movements, the collected information presents a good picture of their activities and of the ruthless methods which resulted in the virtual extermination of the fur seal.

The book concludes with an account of present-day conditions and some speculations as to future prospects. The history of modern antarctic whaling is traced from its beginnings in 1904, and the methods adopted in whaling and in taking elephant seal (South Georgia's only industries) are described. Much useful information is conveyed in an attractive form; for it is blended with local anecdote, and while making good reading, succeeds in giving a vivid impression of life in the island. It is unfortunate that the author should quote, with evident approval, Gordon Hayes's criticisms of British territorial claims in this sector of the antarctic. Those unable to resist the temptation to decry the actions of their own government should first assure themselves that their facts are correct, and the passage quoted from Hayes contains an inexcusable error.

There are many illustrations, but the omission of references to them in the text is inconvenient: a bibliography is given and a good index. For a comparatively short book the price seems high.

Photoelectricity

Photoelectric Phenomena. By Prof. A. L. Hughes and Prof. L. A. DuBridge. (International Series in Physics.) Pp. xii + 531. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1932.) 30s. net.

PROGRESS in the subject of photoelectricity has been so great during the past ten years that there was real need for an authoritative account of recent investigations. This need has now been supplied by the admirable volume by

Prof. A. L. Hughes and L. A. DuBridge, whose book provides a concise yet comprehensive survey of this interesting field. After a short introduction, four chapters are devoted to the experimental results as to the emission of electrons from metal surfaces illuminated by visible or ultra-violet light. Chap. iii on "The Photoelectric Threshold" includes data for the work functions of the metals which should be of considerable use.

Chap. vi deals with theories of photoelectric emission, and though the authors modestly disclaim any special qualifications for dealing with theoretical problems, they have been very successful in giving an outline of this aspect of the subject. "The photoelectric effect, which has long been one of the cornerstones of the quantum theory of radiation, now finds itself closely intertwined with recent advances in quantum mechanics and the newer electron theory of metals." This chapter is divided into two main sections, the first dealing with the classical theory and the second with the Sommerfeld electron theory which has been developed by Fowler and Nordheim, Wentzel, and others. The transmission of electrons through potential barriers is one of the fundamental concepts of the new theory.

Two chapters follow, on the volume photoelectric effect, including the ionisation of gases and vapours by ultra-violet light and also photoconductivity in crystals, in partial conductors and in liquids. These contain a large amount of information not previously available in English. Photovoltaic effects and photoelectric effects in liquids and insulators are also treated.

Chaps. xii and xiii may be specially commended and should be studied by experimental physicists and by those who are concerned with the now numerous applications of photoelectricity. The former chapter is concerned with photoelectric technique and the latter with applications to photometry and to the transmission of pictures and of sound. One very striking illustration of the sensitiveness of the photoelectric method is afforded by the work of Rajewsky. Using a Geiger-Müller tube lined with a metal sensitive to the ultra-violet, the emission of single photoelectrons could be detected. Connecting the tube to an amplifier with a loud-speaker at the output end, it was possible to 'hear' the emission of each electron. The book is written in a very attractive style and is well produced.

H. S. ALLEN.

Short Reviews

Anthropology

At Home with the Savage. By J. H. Driberg. Pp. x+267+16 plates. (London: George Routledge and Sons, Ltd., 1932.) 7s. 6d. net.

MR. DRIBERG'S "At Home with the Savage" is a remarkable book. It has an attractive title, it is popular in aim, and it contains nothing that the person of average intelligence should not be able to understand. Yet it is a book which has a very real significance from the point of view of science. Although the author expressly denies it the character of a textbook, it does, as a matter of fact, restate the subject matter of social anthropology from the point of view of the group of workers who study the activities of man as a member of a society in accordance with principles and methods which have come to be known as 'functional' anthropology.

A new orientation is given to the study of the peoples of the simpler cultures in which attention is diverted from questions of the origin or form of institutions and directed to consideration of how they actually work and what is their meaning and significance in a given environment. This concentration of anthropological studies on function was the subject of Prof. Radcliffe Brown's presidential address to the Anthropological Section of the British Association at its meeting last year, and has been demonstrated by Prof. Malinowski in a number of special studies; but Mr. Driberg's book is the first systematic statement of it as a whole on popular lines.

Its concrete treatment of the subject by the citation of a wealth of instances should convince the public for whom it is intended of the practical value of anthropological studies in the administration of the affairs of the native peoples of our dependencies. For this is a moral which the author never fails to point by pushing home the lesson of how difficulties may arise in these matters through the conflict of ideas as between ruler and ruled, and how they have, or might have, been avoided by a knowledge of anthropology.

It would perhaps be out of place in this notice to quarrel with Mr. Driberg for dismissing summarily branches of anthropology and methods of study other than those of his own school; yet perhaps even in support of his own point of view there might be something to say on the other side.

Tribes of the Niger Delta: their Religions and Customs. By Dr. P. Amaury Talbot. Pp. xi + 350 + 40 plates. (London: The Sheldon Press; New York and Toronto: The Macmillan Co., 1932.) 18s.

IN this volume Dr. Talbot describes the peoples of the Degama Division of Nigeria, who, broadly, fall into two groups—the Ibo people of the north, representing the southern-most extension of that

great race, and the Ijaw, who occupy the swampy area intersected by innumerable streams along practically the whole coastal fringe, over a range of 250 miles. According to tradition, which Dr. Talbot apparently sees no reason to set aside, the whole of the latter area is sinking.

Be that as it may, the character of the environment has impressed itself very strongly on the culture of the Ijaw, which in many respects is of a markedly primitive character. One branch lives entirely by fishing and trading. These are the Kalabari, who at one time attained domination over the whole area owing to their proximity to the European slaver settlements. They now have practically a monopoly in the provision of dried fish, virtually a necessity in the dietary of the tribes. Another direction in which the influence of the environment is to be seen in a marked degree is the prominence of the water spirits in the religion of the Ijaw. The contrast with the culture of the Ibo is marked, though it is evident that there has been borrowing on the part of the latter. In his description of the customs and beliefs of the two groups, Dr. Talbot so far as possible has made use of evidence given by his native informants in practically their own words. Frequently it has been derived from his court records. This gives it an added value, especially in its revelation of the working of the native mind.

The photographs, as is usual in Dr. Talbot's books, are numerous and excellent, the subjects being chosen with a wise discrimination.

Biology

Handbuch der Pflanzenanalyse. Herausgegeben von G. Klein. Band 1: *Allgemeine Methoden der Pflanzenanalyse.* Bearbeitet von R. Brieger, F. Feigl, P. Hirsch, E. Keyssner, G. Klein, H. Kleinmann, G. Kögel, H. Lieb, H. Linsler, J. Matula, L. Michaelis, C. Weygand. Pp. xii + 627. (Wien und Berlin: Julius Springer, 1931.) 69 gold marks.

THE principal distinctive feature of this work is its breadth of outlook. While books on biochemical method normally give in detail the methods required for the estimation of particular substances in a plant tissue, this, while not neglecting such details, is principally concerned with the general analysis of a plant tissue or a substance, and more particularly with the principles governing the choice of methods and the principles involved in their application. Even a person moderately well acquainted with biochemistry will receive something of a shock on realising from a book of this type the extraordinary range of methods now available as aids in analysis of one form or another. Ultra-filtration and ultra-microscopy may give valuable information; fluorescence and photochemistry are also called upon for assistance and there are useful chapters on micro-methods and

histological chemical methods which should appeal especially to the general biologist.

The more familiar methods are treated in up-to-date manner and there are interesting chapters on extraction and preparation of material for analysis. A valuable feature of the book is, however, the inspiration which will come from the range of methods discussed.

Regeneration und Transplantation. Von Prof. Dr. E. Korschelt. Band 2: *Transplantation unter Berücksichtigung der Explantation, Pflanzenpflanzung und Parabiose.* Teil 1. Pp. xx + 695. (Berlin: Gebrüder Borntraeger, 1931.) 63 gold marks.

THIS is the second part of the enlarged edition of Prof. Korschelt's well-known book and deals exhaustively with the phenomena accompanying transplantation of parts or organs in plants and animals. It is an exhaustive survey of the known facts and brings together a great wealth of material from a widely scattered literature, and therefore forms an important source for all specialists.

Little or no attempt is made to deal with the philosophical significance of the experimental facts—possibly this is reserved for a later volume—but the book would have been of greater value as a textbook had points of theoretical significance been stressed at greater length at the expense of some of the descriptive data. The text and the figures are beautifully clear, and no biological library can afford to dispense with such a scholarly compilation of important work.

The phenomena of transplantation and regeneration are clearly of fundamental importance and, as in other aspects of experimental biology, new facts accumulate rapidly. It is, however, important that the literature of science should not become burdensome to students or to research workers. Whilst one hesitates to criticise the work of a distinguished author, at the same time, one cannot resist a feeling of regret that the field which Prof. Korschelt covers has been expanded so far beyond the modest dimensions of the first edition. Is it too much to hope that he will give us an abridged account of this interesting field—an account which will appeal to biologists generally and not primarily to specialists?

Elements of Water Bacteriology: with Special Reference to Sanitary Water Analysis. By Prof. S. C. Prescott and Prof. C. E. A. Winslow. Fifth edition, revised. Pp. ix + 219. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 12s. 6d. net.

THE authors, in this latest edition, give a valuable and comprehensive survey of the methods which can be used for the bacteriological analysis of water, with special reference to American practice. Their desire for the unification and simplification of these methods is a reasonable one, though the difficulty of fixing an arbitrary standard, as they themselves point out, is that each sample of water

must be judged individually upon the correlative evidence as well as upon the bacteriological findings. The importance they attach to the distinction between *B. aerogenes* and *B. coli* would appear to be minimised by this fact, but, where the distinction is necessary, some recent work by Taylor and Goyle in India seems to show that Eijkman's method of incubating the primary cultures at 46°C. provides a sufficiently reliable demarcation between the saprophytic and intestinal strains of coliform bacilli without lengthening the routine examination.

The authors consider, justly, that averaging results of the bacteriological examination of a series of samples taken from the same water supply over a long period, is open to criticism, since this tends to obscure any temporary, and possibly dangerous, pollution of such a supply.

The book has a useful bibliography, but there are some misprints in the bacteriological table on p. 59 which might be confusing to the inexperienced worker.

The Biochemistry of Muscle. By Dr. Dorothy Moyle Needham. (Methuen's Monographs on Biological Subjects.) Pp. viii + 166. (London: Methuen and Co., Ltd., 1932.) 5s. net.

THE author of this monograph has clearly been handicapped by the extent of the published work that she has had to survey. To achieve this adequately she has been compelled to do nothing more than very curtly define the highly specialised terminology of the branch of biochemistry discussed, and this makes the book difficult to read for all those not actually engaged in the field. This unavoidable defect is, however, far more than balanced by the comprehensive nature of the treatment in an astonishingly short space. To have reviewed in 140 pages the voluminous researches of Hill, Embden, Meyerhof and their colleagues, with a bibliography of three hundred references, and an index, and to have reviewed it critically and comprehensively, is something for which many biochemists will be profoundly grateful, and to have given them this cause for gratitude at so low a price is a credit to the publishers.

Chemistry

Recent Advances in Analytical Chemistry. Vol. 2: *Inorganic Chemistry.* Editor: Dr. C. Ainsworth Mitchell. Contributors: Norman Evers, B. S. Evans, S. G. Clarke, W. R. Schoeller, A. T. Etheridge, Brynmor Jones, A. R. Powell, Janet Warden Brown, J. W. Haigh Johnson. Pp. xiv + 452. (London: J. and A. Churchill, 1931.) 15s.

IN addition to chapters recording recent work on the analytical chemistry of the elements, the volume includes chapters on the determination of hydrogen ion concentration and on potentiometric titrations, on microchemistry and on water and sewage analysis.

On the ground of economy of space, working details of new methods of analysis of the commoner elements are not given; these chapters are written on a plan very similar to that adopted in the Chemical Society's Annual Reports. This procedure has a defect: it does not afford the reader much guidance for selecting a method best adapted to particular circumstances. On the other hand, the chapters on the rarer elements, particularly those on selenium, tellurium and the acid earths, give adequate descriptions of the newest methods of their separation and determination. Space has been found for short but useful chapters describing the determination of gases in steel and the examination of graphites and carbon blacks.

The first chapter in the volume gives a good survey of modern methods of the determination of hydrogen ion concentration and of potentiometric titrations and includes a description of the glass electrode, which has been found to be so useful industrially. Microchemical methods are described in some detail with references to the use of coloured and impregnated threads and to 'spot' tests. Nephelometry receives less space than is due to its importance in biochemistry. There is a general discussion on the difficulties encountered in the problem of the determination of pollution in waters, and the shortcomings of the existing methods of analysis are indicated.

The book is well printed and assembled, free from errors, and has a good index. It should be on the shelves of all chemical libraries.

Lunge and Keane's Technical Methods of Chemical Analysis. Second edition. Edited by Dr. Charles A. Keane and Dr. P. C. L. Thorne. Vol. 3. Pp. xx + 678. (London and Edinburgh: Gurney and Jackson, 1931.) 63s. net.

THIS volume is a collection of treatises by well-known authors on clays, glass, cement, water, sewage and effluents, fertilisers, feeding stuffs, soils and air. Since the date of the publication of the previous edition (1908), so many improvements have been made in technical methods of analysis that the subject matter of the earlier volume has been much increased and largely rewritten. In the present volume the examination of clays is divided into two parts, chemical and physical, each with a separate author, an arrangement which reflects the increasing importance attached to their physical characters.

The methods of analysis described are representative of modern analytical procedure and, generally, little criticism is necessary. Among the methods used for the colorimetric determination of iron, no mention is made of the thioglycollic acid method, which is both delicate and independent of the state of oxidation of the iron. But it is gratifying to note that the very convenient method of titration of iron by means of titanous chloride is advocated.

Included in the section on air are the results of recent research on the gaseous impurities of the

atmosphere of towns, including carbon monoxide, oxides of nitrogen and the acid oxides of sulphur. Subsequent work on the Government Laboratory method for the determination of the acid oxides of sulphur (p. 628) has shown that with a suitable indicator the method affords a reliable measure of these oxides in the air; in the absence of fog they have been found to be composed almost entirely of sulphur dioxide.

A. G. F.

Handbook of Chemical Microscopy. By Prof. E. M. Chamot and Prof. C. W. Mason. Vol. 2: *Chemical Methods and Inorganic Qualitative Analysis.* Pp. ix + 411. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 22s. 6d. net.

THIS volume describes the manipulative methods of chemical microscopy; it is a compilation of reliable tests for inorganic cations and anions. In Chapters i and ii general and special manipulations are given in detail and special apparatus is illustrated. It may be noted that some of the apparatus needed for the manipulation of gases and volatile liquids shows a general resemblance to that used by Faraday in his 'minute' chemistry.

The next nine chapters contain detailed tests for the detection of the elements arranged in the groups of the periodic table and also for many inorganic anions. The reactions are well chosen and in many cases have stood the test of time, being those of Behrens, to whom the authors acknowledge their indebtedness. Many beautiful reproductions of photomicrographs of crystals are given and these increase the usefulness of the work; the authors, however, are careful to state that the illustrations must not take the place of the direct study of the tests.

Chapter xii describes the use of some special reagents and the separation of metals based upon their differences of electric potential. A scheme for the qualitative analysis of materials of unknown composition, including alloys, forms the last chapter of the book, which is completed by the addition of an appendix giving details of the preparation of the special reagents, and a good index.

Geology

German-English Geological Terminology: an Introduction to German and English Terms used in Geology, including Mineralogy, Petrology, Mineral Deposits, etc. By Dr. Arnold Cissarz and Dr. William R. Jones. Pp. xvii + 250. (London: Thomas Murby and Co.; Leipzig: Max Weg; New York: D. Van Nostrand Co., 1931.) 12s. 6d. net.

THIS work is intended for those who have already acquired some knowledge of German (or English), but are not familiar with German equivalents of the special terms used in the various branches of geology. The book is arranged on the lines of an elementary textbook and is bilingual. All scientific terms are italicised when first used. Equivalent

portions of the text are arranged on opposite pages, and corresponding paragraphs represent close translations one of the other. Literary style has been subordinated to the necessity for maintaining as nearly literal a relationship as possible between the English and German texts. Four appendices deal with abbreviations used in geological literature, English and German weights and measures, the chemical elements, and mineral names.

As a general criticism it may be suggested that the text is somewhat unbalanced with regard to the amount of space allotted to each of the several branches of geology. Thus, palaeontology is represented solely by a chapter containing formal descriptions of the various groups of invertebrate fossils, while vertebrate palaeontology and palaeobotany are ignored. The principles of stratigraphy are dismissed in a single page. On the other hand, petrology, mineralogy, crystallography and allied subjects receive detailed treatment.

Some terms one would expect to have been included have been omitted, and a few spelling errors were noticed. As a whole the book can be recommended for the use of students. A mastery of its contents should adequately if not completely equip those who wish to read geological literature in the original German. V. A. E.

A Key to Mineral Groups, Species and Varieties.

By Dr. E. S. Simpson. Pp. viii + 84. (London : Chapman and Hall, Ltd., 1932.) 10s. 6d. net.

It has always seemed a matter for regret that so many of the names applied to mineral species, even in recent years, give no indication whatever of the chemical composition or physical properties of the mineral. Instead of attempting to clarify the science by devising a self-explanatory system of nomenclature, mineralogists continue to increase the tax on their memories by attaching to new minerals quite irrational names. This being the case, Dr. Simpson justifiably claims that his tables may be regarded as a *vade mecum* to everyone interested in minerals. He has listed in alphabetical order upwards of 1800 mineral names. Opposite each mineral is stated concisely its chemical composition, specific gravity, crystal system and refractive indices. These data have been collected from the latest and most accurate sources available. In addition, reference is given in every case to a source of detailed information regarding each mineral. The latter item is particularly valuable in the case of the newer mineral species, about which data have, until now, remained scattered through many publications.

The literature of mineralogy is cumbered with a great number of useless names. The list is selective to the extent that the author has omitted names which he regards as obsolescent or which stand only for minute differences in unessential characteristics.

The tables represent a careful compilation by the author of information gathered from many sources over a long period of years. Dr. Simpson is

to be congratulated on having made accessible to the public in such concise form the result of his labours.

The Microscopic Characters of Artificial Inorganic Solid Substances or Artificial Minerals. By Prof. A. N. Winchell. With a Chapter on the Universal Stage, by Prof. R. C. Emmons. Second edition. Pp. xvii + 403. (New York : John Wiley and Sons, Inc. ; London : Chapman and Hall, Ltd., 1931.) 31s. net.

FORMERLY known as "The Optic and Microscopic Characters of Artificial Minerals", the modification in the title of the new edition of this work serves to prevent misapprehension as to its scope. This is, in fact, much wider than would be the case if it dealt only with synthetic *minerals*, using the latter term in its generally accepted sense. The author has attempted to include all inorganic substances the optical constants of which are known.

Many changes have been made since the first edition appeared (NATURE, vol. 122, p. 436, 1928). The book is now cloth bound, and has been greatly enlarged, chiefly through the introduction of a new section on optical principles and the methods of study of crystals under the microscope. This, Part I of the new edition, consists largely of revised selections from the same author's "Elements of Optical Mineralogy", Part I, third edition (see NATURE, vol. 123, p. 158, 1929), and includes a chapter on the universal stage. Numerous alterations and additions have been made in the descriptive section of the book, and the determinative tables have been re-written and re-arranged.

The new section obviates the necessity for reference to other textbooks for those not familiar with the microscopic study of crystals and renders the book to a large extent self-contained. Altogether the new edition is a great improvement on the old.

Mathematical and Physical Science

Dielectric Constant and Molecular Structure. By Prof. C. P. Smyth. (American Chemical Society Monograph Series, No. 55.) Pp. 214. (New York : The Chemical Catalog Co. Inc., 1931.) 4 dollars.

THIS book effectively completes Debye's "Polar Molecules" and Errera's "Polarisation Diélectrique" by a detailed account of the subject in its relation to chemical constitution. Electrically polar molecules, its principal concern, have never been of so much importance in physics as the formally similar magnetic dipoles or as non-polar molecules, but the advent of thermionic valve methods for finding the dielectric constant opened up a wide field for their application in chemistry, development of which is due in no small degree to Prof. Smyth.

The subject matter falls roughly under three heads. The first three chapters are upon the elementary theory and the measurement of the

dielectric constant. The mathematics is not taken very far, but is adequate for the purpose of the monograph, whilst the account of experimental methods gains by Prof. Smyth's personal experience. The second and main section is upon the effect of structure, and includes chapters on the chief types of compounds (principally organic), electric moments and theories of valence, electronic and atomic polarisation, and molecular association. It is evident that much still remains to be done, both in the extension of measurements and in their interpretation, but Prof. Smyth has shown himself sufficiently master of the subject not to minimise difficulties. It would not be surprising if a number of these were found to be connected with quantum resonance, or were resolved in some similar manner in the theory of molecules now coming from Hund, Slater and others. The last section consists of tables of molecular moments.

Debye and Errera have left Prof. Smyth with the least interesting part of the work; he is to be congratulated on having made it readable as well as useful.

A Textbook of Thermodynamics. By F. E. Hoare. Pp. xii+271. (London: Edward Arnold and Co., 1931.) 15s. net.

MR. HOARE has been successful in writing a treatise on thermodynamics which gives a very clear account of the theoretical side of the subject and an unusually detailed description of its applications. The reviewer has had an opportunity of testing some parts of the book in a recent course on thermodynamics of an introductory character and has found the descriptions both accurate and lucid. The author, who holds the diploma of the Imperial College, has evidently been influenced by the teaching of the late Prof. Callendar, and excellent use is made of the latter's work on the properties of steam. Experimental results are frequently quoted, and some numerical examples are included in the text. For the benefit of the student who finds difficulty in applying thermodynamic principles in practical cases, we should like to see numerical exercises added in a second edition. The work can be recommended to students who are taking an honours degree in physics.

We note that Mr. Hoare does not adopt the terms 'enthalpy' or 'free energy'. It may be suggested that the time has come when some decision should be sought by international agreement as to the nomenclature and notation to be used in the practical and theoretical aspects of the subject of heat. H. S. A.

The Nature of a Gas. By Prof. Leonard B. Loeb. Pp. x+153. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 12s. 6d. net.

THIS monograph is published under the auspices of the National Research Council of America and is the first of a series related to electrical insulation.

Gases are utilised as insulators and also occur in insulating materials, and knowledge of their properties is of importance to those responsible for the design and construction of electrical apparatus of all descriptions. The book contains three chapters, the first an introduction describing modern theories of the electrical constitution of atoms and molecules, the second giving an account of the kinetic picture of a gas, and the third dealing with ionisation phenomena.

The first two chapters are concerned mainly with researches already familiar to the physicist, and many readers will turn with special interest to the third chapter in which Prof. Loeb's own work rightly finds a place. Much useful information is here incorporated, but we must confess to some measure of disappointment with the result. This is due in a large measure to the many problems still unsolved in this branch of physics, but in part to the use of terms, such as 'elastic' and 'inelastic' collisions, which are not adequately defined. As the author points out, too much of the 'how' of the processes described can scarcely be looked for, and we must content ourselves at present with the bare facts.

Vector Analysis: with Applications to Physics.

By Prof. Richard Gans. Authorised translation from the sixth German edition by Winifred M. Deans. Pp. ix+163. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1932.) 12s. 6d. net.

THE special features of this book are the emphasis laid upon the applications of the subject and the forty-four examples with their full solutions (occupying fourteen pages) in an appendix. The first chapter deals with scalar and vector products and their applications, chiefly to electric circuits. The second introduces differential operations; after defining gradient, divergence and curl we are given many applications to mechanics and physics. An interesting historical note points out that the symbol like an inverted delta was first introduced by Hamilton, who called it "nabla", after a Hebrew stringed instrument. The third chapter deals with orthogonal curvilinear co-ordinates, with applications to Laplace's equation, wave motion, and rigid dynamics. The fourth chapter, headed "Tensors", is disappointing. It opens well by following the historical development of the subject, which is connected with elasticity, but it is misleading to state that "A tensor is determined by six numbers", and the whole of the chapter seems spoilt by the implicit assumption that all tensors are necessarily of the second order and in three dimensions. The fifth and last chapter deals with applications to hydrodynamics and electrodynamics. Except for the tensor chapter, the book appears likely to be useful to students of applied mathematics and physics.

Leçons sur la géométrie projective complexe. Par Prof. E. Cartan. D'après des notes recueillies et rédigées par F. Marty. (Cahiers scientifiques, Fascicule 10.) Pp. vii+325. (Paris: Gauthier-Villars et Cie, 1931.) 80 francs.

IMAGINARY elements in geometry were for a long time considered solely as an auxiliary to the study of real points. Projective complex geometry, considered as an independent branch of mathematics, owes its origin to von Staudt (1858) who introduced the notion of a chain, and it was greatly developed by Juel (1885) and Segre (1889). The latter showed the importance of *antiprojective* transformations, *anti-involutions* and *antipolarities*. Prof. Cartan treats complex projective geometry from a higher point of view, linking it with non-Euclidean geometry of three dimensions, following the example of Poincaré, who linked real projective geometry with non-Euclidean geometry of the plane.

The first part of the book is restricted to the projective geometry of the complex line and its relations with the geometry of Lobatchewsky. The second part deals with the complex projective geometry of three dimensions. The last chapter treats of the harmonic polynomials of complex projective space and their applications to the representation of this space, or rather of Hermitian elliptic space, by real algebraic varieties without singularities contained in a Euclidean space of a suitable number of dimensions. The writing is clear and attractive, and the book is a useful exposition of one of the less-known branches of geometry.

H. T. H. P.

Miscellany

This World First. By J. H. Curle. Pp. v + 212. (London: Methuen and Co. Ltd., 1932.) 6s. net.

MR. CURLE is like the road-mender who, when accused of pessimism, said "I ain't no pessimist; I thinks badly o' most things and most people—that's all." Mr. Curle declares himself to be no pessimist; but he sees the world as a series of problems or riddles. Thus: Nature, on one hand a thing of beauty and perfection, on the other is "a spectacle of overwhelming cruelty and horror", which makes "the idea of a Living, Personal God" behind it "a nightmare" and unthinkable; Christianity is dying after nearly two thousand years; Western civilisation is nearly at an end; and science "deeply enheartening when we think of genetics, psychology, bio-chemistry, and medicine; deeply disconcerting when we think of aspects of relativity, of physics, of bacteriology, of poison gas, of weapons of war". We need pursue the list no further. The problems are such as present themselves to all who are not content with a blind acceptance of things as they are, and a familiar symptom of the questioning spirit, which for our good, if not for our comfort, has been all pervasive since the War.

Mr. Curle has travelled widely and pondered his many and varied experiences. As the result he

sees a way of escape from pessimism on the line he has suggested in the title of his book: "This World First". If we may no longer look for the intervention of a personal God in the arena of the struggle between good and evil, which we call the world, man must take up the cudgels on his own behalf. Holding fast to the beauty of the world, he must co-operate with law and order in Nature against cruelty and oppression; he must fight on the side of science for the betterment of mankind in the war against degeneracy and disease. Mr. Curle thus sees the solution of his problems in the form of a duty of us all to make secure and hold the good against the encroachment of evil. If this does not help us "to grasp the sorry scheme of things entire", it is at least a sound enough practical philosophy for a work-a-day world which is content to leave the riddle of the universe to solve itself while it "gets on with the job".

Astronomische Paradoxa. Von Dr. Georg Alter. Pp. 72. (Prag: J. G. Calve'schen Universitäts-Buchhandlung, 1932.) 25 Kč.

THIS work is a series of short essays explaining a number of points that often cause perplexity to students of astronomy. The earlier ones are elementary; why the sun is not on the meridian at 12 o'clock; why the moon's orbit is concave to the sun, though it revolves round the earth; why it is winter when the earth is nearest to the sun. The following ones are more difficult; why the crest of the tidal wave lags behind the moon; the effect of the earth's rotation on the motion of projectiles, etc.

Chap. viii explains why the effect of a resisting medium is to shorten the time of revolution, although it reduces the initial speed of the body. Chap. ix deals with the Einstein bending of light by the sun, and explains why the star's image is pushed outwards though the light rays are bent inwards. The final chapter explains why the variation oval of the moon is pushed inwards at full and new moon, though these are the points where the outward perturbing forces are strongest; this is a cause of perplexity to many. The author's explanation would not be clear to the 'man in the street', as it needs a considerable knowledge of dynamics.

Some of the problems dealt with are explained in nearly all astronomical primers; but the explanations in this book are fuller and more rigorous than those often given. The mere fact of a result seeming bizarre and unexpected often attracts the attention of earnest students.

A. C. D. C.

Fractures. By Meurice Sinclair. (Modern Surgical Monographs.) Pp. xxxiv + 550. (London: Constable and Co. Ltd., 1931.) 24s. net.

THE exceptionally vast and various experience of the treatment of fractured bones provided by the War was responsible for bringing this, like many other departments of applied science, to a

high pitch of efficiency. The author of the treatise under notice, who gives a comprehensive and lucid account of what was learned during those years of strict discipline, complains that in spite of the ever-increasing incidence of traffic and road accidents, there is a widespread tendency to relax the thoroughness of remedial measures, which the War taught surgeons to regard as vital and essential in this department of treatment, so vastly important not only from an æsthetic point of view

but also even more so for its economic and utilitarian bearings.

Hence Mr. Sinclair has written this excellent book as an appeal for increased efficiency and care in treating fractures and as a guide for surgeons to the methods that are essential for attaining the best results in practice. It is illustrated with 337 X-ray photographs and diagrams and should become the means of instructing every medical student how to deal with fractured bones.

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Anthropology and Archæology

Cambridge University Press.—The Andaman Islanders: a Study in Social Anthropology, A. R. Brown. *Macmillan and Co., Ltd.*—On Ancient Central-Asian Tracks, Sir Aurel Stein. *Methuen and Co., Ltd.*—Studies in Sociology, Prof. Morris Ginsberg; The County Archæologies: Yorkshire, F. and H. W. Elgee; Greek Coins: a History of Metallic Currency and Coinage down to the Fall of the Hellenistic Kingdoms, Charles Seltman. *Oxford University Press.*—Caravan Cities, M. Rostovtzeff; Myth and Ritual: Essays on the Myth and Ritual of the Hebrews in Relation to the Culture Pattern of the Ancient East, edited by S. H. Hooke; The Caste System of Northern India, with Special Reference to the United Provinces of Agra and Oudh, E. A. H. Blunt; Reservation Indians, Margaret Mead; Mediterranean Studies, George Hempf; The Sealand of Ancient Arabia, R. P. Dougherty; The Eskimos: a Study of Adaptation to Environment and the Folk-ways of the Eskimos, E. M. Weyer. *Kegan Paul and Co., Ltd.*—Nomads of the European Steppe, G. F. Hudson. *G. Routledge and Sons, Ltd.*—The Pagan Tribes of the Nilotic Sudan, Prof. C. G. Seligman and B. Z. Seligman.

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Miscellany

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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.]

An Egyptian Axe Head of Great Antiquity

IN NATURE of April 18, 1931, I described the investigation of an Egyptian axe head of date 1800 B.C., supplied to me by Mr. Guy Brunton, and showed how it was possible to reproduce it by the ordinary laboratory methods of to-day. Recently, at his request, I have examined an axe head which is many years older. It was found by Mr. Brunton last winter during his excavations at El Matmar south of Assiut in middle Egypt. He informs me that it can be well dated to what is known as the middle Pre-Dynastic period and early in that; that is, roughly about 4000 B.C. He adds: "I know of no other copper implements anything like as early as this with the exception of small pins and such-

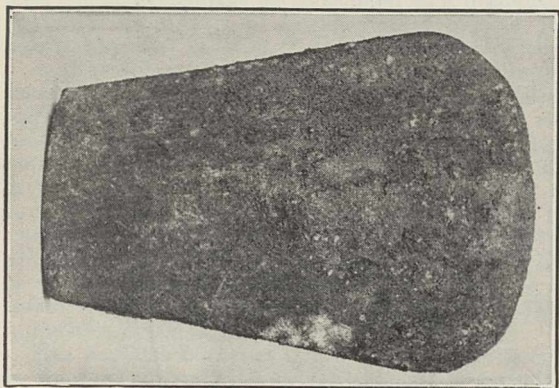


FIG. 1. Middle Pre-Dynastic axe head from Middle Egypt. Reduced by $\frac{3}{8}$.

like; consequently it has a very considerable importance."

The axe weighed 3 lb. 7 oz. One side of it, reduced by three-fifths, is shown in Fig. 1. It was coated with a thick patina of malachite and azurite with some patches of sandy material adhering to it. Part of one side of the axe was ground and polished; the area so treated is outlined in the top right-hand corner of Fig. 6. Under the coating of carbonate was a layer of cuprite, beneath which was the original copper-coloured metal, apparently sound. When the exposed metal had been polished and examined with the microscope it was found to be differentially corroded, the corrosion product (cuprite) forming a dendritic structure which suggested at once that the metal was a cast alloy with a 'cored' structure. This was confirmed by etching the surface with ammonia and hydrogen peroxide. The structure developed in this way is shown in Fig. 2 at 100 diameters, in which the black corrosion product is seen to coincide with the dark 'cores'.

To reveal the structure of the metal more clearly, the surface was ground to the depth of about one-tenth of an inch, which was sufficient to remove the superficial layer of partly corroded metal. The microstructure of the metal at a point corresponding to A in Fig. 6, is shown in Fig. 3 at a magnification

of 100 diameters. As is mentioned above, its 'cored' structure indicates that it is a casting of high copper content. Superimposed on the 'coring', however, is a granular twinned structure which shows that the alloy has recrystallised under the influence of strain and heat. This structure could be produced either by hammering the casting cold and then annealing it at a moderately high temperature—the persistence of the coring indicates that the annealing temperature

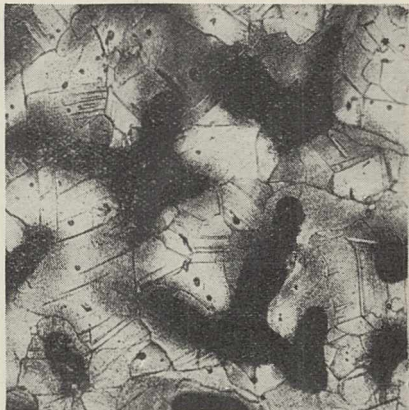


FIG. 2. Microstructure of metal beneath corrosion products. $\times 100$.

could not have been above, say, 800° C., or by hammering the metal hot. Some of the grains in this micrograph contain striations which show that the axe has been cold worked after the recrystallisation occurred. The effect of this mechanical treatment is shown more clearly at a magnification of 200 diameters in Fig. 4 which reveals, in addition to the strain markings, considerable distortion of the twin bands. Near the cutting edge of the axe, the distortion of the metal was much more pronounced



FIG. 3. Microstructure below superficial layer. $\times 100$.

than elsewhere, as is shown by a comparison of Fig. 5 at 100 diameters, which represents the structure at point B in Fig. 6, with Fig. 3. This indicates that the axe had been more heavily worked at the edge and suggests that the purpose of the final cold working was to harden the metal.

Drillings for analysis were taken from one of the side edges of the axe head. The main constituents found and their percentages were as follows: copper, 97.35 per cent, nickel 1.28 per cent and

arsenic 0.49 per cent. Metals present in smaller quantities were, lead 0.17 per cent, iron 0.15 per cent and manganese 0.06 per cent. In addition traces of tin and antimony were detected. There remains about 0.5 per cent to account for. This consisted almost entirely of the oxygen present in the corroded products, of which cuprite was the principal. The fact that tin is present only in traces need cause no surprise and is, indeed, to be expected from the great age of the axe head, for as Sebelien



FIG. 4. Microstructure below superficial layer. $\times 200$.

has shown, the Egyptians had not learned how to make bronze until the later dynasties. It is unlikely that any of the elements present in the copper were added intentionally for the purpose of hardening the metal. Almost certainly they were derived from the ores from which the copper was smelted.

Brinell hardness measurements were made at various points on the polished surface of the axe using a 1 mm. ball. The results, which are shown in Fig. 6, were rather irregular, varying from 63 to



FIG. 5. Microstructure at axe edge. $\times 100$.

73 on the flat and increasing considerably near the cutting edge to a maximum figure of 85. The Brinell hardness of an alloy of this composition in the cast or annealed state would be about 50, so it is clear that the axe has been work hardened, no doubt by cold hammering. All the data lead to the conclusion that it was cast roughly to shape and then either cold-hammered and annealed or hammered when hot. After this treatment, which was perhaps a shaping operation, the axe was hardened by hammer-

ing it cold, most severely near the edge. In spite of its great antiquity—it is nearly six thousand years old—this axe head has retained a considerable amount of the hardening artificially conferred by work. In this respect it confirms the results of my previous investigation of an axe head about 3,700 years old. The maximum hardness figure is lower, namely, 85, as compared with 112, but the alloys have different compositions and the older axe head is probably rather softer in the annealed state. The Brinell hardness would probably be about 50 as compared with 54. The retention of cold work in alloys of this type may thus be regarded as sufficiently established. Accepting Mr. Brunton's date, it is clear that six thousand years ago, the Egyptians were casting, heat-treating and cold-working copper alloys of these types.

I acknowledge with pleasure the assistance of

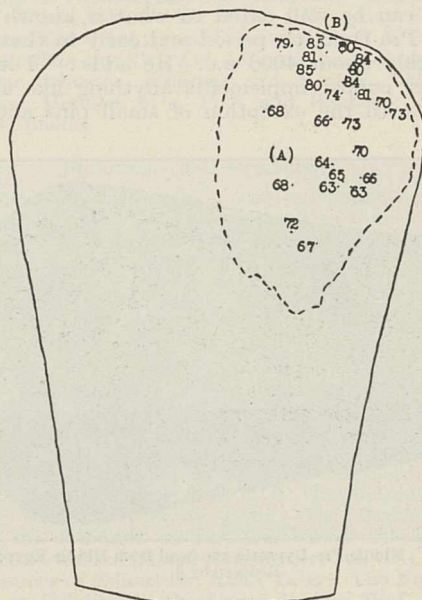


FIG. 6. Outline of axe head and Brinell hardness numbers. The scale of the diagram is one half.

two members of my staff, Mr. C. W. Dannatt and Dr. M. S. Fisher, in the above investigation.

H. C. H. CARPENTER.

Royal School of Mines,
South Kensington, S.W.7,
Sept. 20.

Possible Existence of Multiply Charged Particles of Mass One

THEORETICAL arguments justify the assumption that, while nuclear electrons elude every dynamical treatment, the dynamics of the particles of proton mass in the nuclei is in accord with the general quantum-kinematical scheme.¹ The forces of interaction, however, seem to exceed ordinary Coulomb forces considerably. The binding energy E per particle, for example of a system of two particles of proton mass M in its lowest quantum state, should be for attractive Coulomb forces between the particles:

$$E \sim \frac{Me^4}{8h^2} \sim 6000 \text{ electron volts.}$$

that is, about a thousand times less than the actually

observed binding energy per proton in the α -particle.

On the other hand, the remarkable phenomenon of the anomalous scattering of hard γ -rays cannot be ascribed either to nuclear electrons, because it is known from experimental results concerning the statistical properties of nuclei, that the electrons do not exist in the nucleus as dynamical units, or to proton dipoles, because it is known that the application of the ordinary formula for the scattering coefficient σ :

$$\sigma \sim \frac{8\pi}{3} \left[\frac{e^2}{Mc^2} \frac{v^2}{v_0^2 - v^2} \right]^2$$

(where v, v_0 are the frequencies of the scattered light and of the proton oscillator) leads to intensities of the scattered radiation which are about a thousand times smaller than the observed ones.² It should be noted, that in both these cases, where we observe gross and roughly equal departure from simple theoretical formulæ, the formulæ contain the charge in the fourth power.

We know that the constancy of the charge of the particles of mass one is not unlimited: transitions from charge e to zero must occur (proton and neutron). The neutron must not be considered as a diminutive hydrogen atom, but as an elementary particle just like the proton, because of its statistical properties.

Applying this view to the above-mentioned experimental fact, I suggest the following generalising hypothetical assumption: *the particle of mass 1 may have arbitrary, positive and negative (but perhaps only integral) values of its charge.* The stability of a given charge value against β -decay or against its reverse process depends on the quantum state of the particle. In particular it is assumed that a free particle is stable with charge e or zero, an α -particle is stable with charges of about $+6e$ and $-5e$ (in order to explain discrepancies of the order of 1000 in quantities depending on e^4 .)

This explains both the strong forces which prevail in the nucleus, and the strong anomalous scattering of hard γ -rays. Virtual forces due to exchange of charge or similar ones can be dispensed with.

The question arises, whether particles in a state of higher charge, if suddenly set free by hard collisions, are sufficiently stable to be observed. With all necessary reserve (because of the uncertainty of the experimental data) I suggest that two phenomena may be interpreted on these grounds:

1. Hoffmann, Steinke and Schindler have observed the production by cosmic rays of secondary particles of high ionising power and kinetic energies certainly greater than 10^8 volts, that is, energies which are great compared with the binding energies of the elementary particles in the nucleus. They suggest that these particles should be complex nuclear fragments. It is, however, necessary to consider, that the nuclear binding forces are negligible compared with the forces which effect such enormous transfers of kinetic energy. In that case only elementary particles can be ejected. I suggest that in these cases particles of mass 1 and of high charge are set free and take some time before arriving at their stable charge value (e or zero). The majority of the rays reported by Steinke and Schindler (those giving 3×10^6 ion pairs) can be ascribed to particles of mass 1 and charge between $5e$ and $6e$.³

2. The outstanding difficulty in the interpretation of the experiments on cosmic rays is the fact, that the particles, the distribution of which is only slightly

affected by the earth's magnetic field, seem to be absorbed largely in the earth's atmosphere. (The ionisation at 28 km. height is about sixty times bigger than at sea level; in particular, there appears to be absorption already in the first two metres of water-equivalent.) I suggest that the decrease in ionisation in passing downwards from the upper layer of the atmosphere may be due not to a decrease in the number of ionising particles but to a decrease in ionising power, and this in turn to a decrease in the charge. The particles of mass 1 and high positive charge may in the interstellar space find no chance to collect electrons for compensating their charge and enter the earth atmosphere in the state into which they were originally dissociated. This assumption could easily be tested by measuring the number of particles up to great heights and comparing the results with the variation of ionisation. Only the latter has been measured so far.

M. DELBRÜCK.

Wills Physical Laboratory,
University of Bristol,
Sept. 1.

¹ Cf. N. Bohr, Address to the Rome Congress on Nuclear Physics, 1931.

² Cf. Gamow, "Constitution of Atomic Nuclei and Radioactivity," Oxford, 1931.

³ Cf. Bethe, *Z. Phys.*, **76**, p. 293, 1932.

Atmospheric Conditions and the Kennelly-Heaviside Layer

SINCE 1925, I have made observations upon the signal strength of KDKA in Pittsburgh. The observing station at Morgantown, West Virginia, is sixty miles due south of KDKA. My results are in complete agreement with the discoveries of Prof. Ivo Ranzi¹, provided I assume that the 309-metre wave from KDKA behaves like a 100-metre wave in so far as the E layer is concerned.

The following quotations from my published articles should be compared with the statements of Prof. Ranzi: "The night signal may be equal to, greater than or less than the day signal. A rising curve (stronger signal) after nightfall indicates cloudy or stormy weather, while a falling curve (weak signal) is likely to be followed by clearing weather".² "Weather conditions have a decided effect upon the signals from KDKA. So much so that it is even possible to foretell the weather one day ahead by the form of the fading curve".³ "When a high pressure area covers both Pittsburgh and Morgantown, the day signal from KDKA is stronger than the night signal; while for a low pressure area, the night signal is stronger. If the storm centre passes to the south of the observing station, the fading curve from a station to the north is no longer reliable."⁴

Apparently these variations depend upon the changes in the E layer. During the day the received signal is made up of two parts: the ground wave and a weak sky wave reflected from the E stratum of the Kennelly-Heaviside layer. If there is a low pressure area to the north of Morgantown, the sky wave increases at night and so the night intensity is greater than that by day; if, on the other hand, a high pressure area lies to the north, the E layer disappears rapidly after nightfall and the night signal drops below the day signal. The changing intensity acts like a barometer in indicating the presence of cyclonic and anticyclonic conditions and so has considerable value in weather forecasting.

With this method of fading curves, our weather

prognostications were about ninety per cent correct for the periods in 1927, 1928, 1929 and 1930 during which it was used. The results in February and March of each year averaged only eighty-five per cent. These observations have been discontinued temporarily on account of a prolonged drouth in this section of the United States.

R. C. COLWELL.

Department of Physics,
West Virginia University,
Sept. 21.

¹ NATURE, 130, 368, Sept. 3, 1932.

² Proc. West Virginia Acad. Sci. 1929, p. 234.

³ Proc. Inst. Radio Eng., vol. 17, No. 1, January 1929, p. 143.

⁴ Phys. Rev. Ser. 2, vol. 37, 1932, p. 464, No. 33.

Post Office Reform

ALL who realise the weaknesses of the present system of 'secretariat' control as practised in the great departments of State will endorse the view expressed in the leading article on Post Office reform in NATURE of October 15, p. 557, where it is stated that the Bridgeman Committee has rendered an important public service by the emphasis it places upon the need for bringing the engineers in the Post Office more effectively into the consideration of matters of policy. As is rightly pointed out, the principles of organisation which the Bridgeman Committee recommends should be applied to the Post Office, call for a wider application; and, for the reasons indicated below, the most valuable result of the Committee's recommendations may ultimately prove to be not so much in the reform of the Post Office as in the reactions on the whole structure of administrative control in the public departments.

There is a feeling in some quarters that the Committee's recommendations, if carried out, will dispose of all legitimate complaints on the part of the technical men in the Post Office. The Engineer-in-Chief (and other heads of departments) would, for the first time, be brought into discussions on matters of policy, as of right and in open council; and the possession of technical knowledge and experience would no longer, in practice, debar the engineers from advancement to purely administrative posts. Actually, however, as is hinted in the article in NATURE, acute controversy is certain to arise on the application in the provinces of the Committee's recommendations. It is indeed not unlikely that the position of the now autonomous engineering staff outside headquarters may be positively worsened if the Report is put into effect as it stands; for it is an integral part of the Committee's proposals that executive responsibility should be taken away from the Secretariat and placed upon 'regional directors'. Post Office and Civil Service tradition being what it is, these posts will naturally fall, in the main, to the senior members of the Post Office staff in the provinces, namely, the so-called 'surveyors', whose vestigial title is of itself sufficient evidence of the course of Post Office evolution as an essentially mail-carrying organisation. By its rejection of the almost time-honoured proposal for separating the administration of the telephones from that of the mails, and by its specific recommendation that the post of 'surveyor' should be re-labelled 'regional director', the Committee has rendered it an almost foregone conclusion that the regional directors will be the surveyors 'writ large'.

It must be remembered that the surveyors as a

class have taken little or no part in local telephone administration, which has in practice been left to the superintending engineers and the district managers. The result of applying the Committee's policy of a unified administration for all Post Office services would appear to be, inevitably, that, for perhaps a generation, the provincial control of the telephone service will pass into the hands of those who, however gifted in the administration of the mails, were described by the Select Committee on Telephones of 1922 as "a fifth wheel to the coach" in regard to telephone administration. In short, what the Post Office engineers may gain at headquarters and in occasional admission to the sacred preserves of the Secretariat is likely to be lost in the provinces by their submergence, in company with other telephone staff, in an organisation nurtured in the mails tradition.

For the Bridgeman Committee's reforms to have their full effect in promoting administrative elasticity and rapid development in the telephone service, it would seem to be essential for the telephones to be separated from the mails in accordance with the views expressed by (among others) the Select Committee on the Telephones of 1922, the Chambers of Commerce, and the engineers themselves in the evidence submitted to the Bridgeman Committee through the Institution of Professional Civil Servants. Such a separation, under whatever form of public control, would result in the administration of the telephones by telephone men, technical and non-technical. The Committee, while agreeing that theoretically separation would be the ideal solution, recommends against the proposal in view of the manner in which the mails, telegraphs, and telephones have become interwoven in Post Office administration. It cannot be denied that the difficulties of segregation during the transitional period would be considerable; but, on the other hand, it cannot be questioned that the ultimate advantages accruing from such a policy would be so great that it would be well worth while to face any temporary difficulties that might arise.

F. A. A. MENZLER.

15 Adam St., W.I.

Absence of Mitosis in Tissue Culture and Regeneration in *Helix aspersa*

IN recent work on regeneration in the mantle cavity wall of *Helix aspersa* and on the metamorphoses of pieces of the wall kept in blood,¹ no mitosis has been found. Such cell divisions as occur are amitotic. These can be watched *in vitro*, in the hanging drop preparations.

In *Janella*, L. Plate² describes the regeneration of cells lining the breathing tubes as occurring exclusively by amitosis.

Normal mitosis takes place, of course, in the hermaphrodite gland, but so far as I know, in the half-grown and adult snail, amitosis is the only method of cell division in somatic tissues I have examined. Possibly some of the readers of NATURE have a series of *Helix* embryos, and it would be interesting to know whether they can find normal mitosis in the somatic tissues, and up to what age.

J. BRONTE GATENBY.

Zoology Dept., Trinity College,
Dublin, Sept. 29.

¹ NATURE, 128, 1002, Dec. 12, 1931.

² Arch. mikr. Anat., 51, 1898.

Occurrence of a Paired Parietal Bone in a Snake

A GENERAL conception of zoologists is that the parietal bones are always fused into a large unpaired bone in Ophidia. During our recent investigation of the skeletal systems of different reptiles we found from an alizarine preparation of transparency that

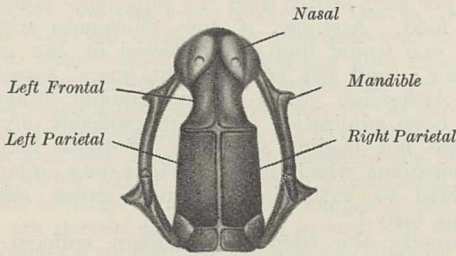


FIG. 1. Dorsal view of the skull of *Typhlops braminus* showing the paired parietal.

Typhlops braminus has a distinct paired parietal bone (Fig. 1). Perhaps their occurrence as such escaped the notice of the former investigators, the size of the skull being very small and alizarine preparation of transparency being unknown to them. The details of the skeletal system will be published elsewhere.

HIMADRI KUMAR MOOKERJEE.
GOPI MOHAN DAS.

University College of Science
and Technology,
Calcutta, Aug. 18.

Prof. P. E. Richards and NATURE

THE letters of the late Prof. Philip Ernest Richards (died June 4, 1920) recently published under the title "Indian Dust" (Allen and Unwin) contain a most interesting reference to the jubilee number of NATURE.

Richards was appointed in 1911 professor of English literature to the Dyal Singh College at Lahore, transferring in 1914 to Islamia College in the same town. The letter in question is dated Jan. 23, 1920, and is addressed to his mother :

"The jubilee number of NATURE has fallen into my hands. It presents a portrait of Norman Lockyer, the founder and editor. Here is the man who found something in the sun before it had been found on the earth. Surely a wonderful fellow—far more wonderful than he looks. But I think he looks wonderful. Many articles in the paper review the progress of science in many different branches during the last fifty years. I do not understand one eighth of any article, but I have read them all, and derived a deep sense of satisfaction—joy, I might say. Here are men who have something to live for, and who have much to show for what they have been doing. They are the best sort of men in the world, and the world ought to belong to them, and not to Prussians and Bolsheviks or Indian extremists. But poor humanity is far behind its leaders. Nevertheless, the world is worth living in for the sake of Science—and Literature—and all the other Arts."

T. LL. HUMBERSTONE.

15 Gower Street,
London, W.C.1,
Aug. 25.

No. 3286, VOL. 130]

Radiographs of Insects

IN a letter to NATURE of Sept. 17, 1932, Dr. Hugo Fricke and Irwin Sizer state, in an account of their own radiographs of insects, that they could not find previous records of such radiographs. We made and published such radiographs five years ago^{1, 2, 3}, chiefly with *Deilephila euphorbiæ* pupæ, when carrying out research work on metabolism during metamorphosis of insects. Particulars of the methods used, the results, and about seventy radiographs, can be found in the papers referred to below.

The radiographic method was afterwards found useful in economic entomology, and we have made radiographs of insects for the Department of Sylviculture. The distribution of parasitic hosts in populations of hundreds of pupæ can be shown in one single radiograph without injury, and further development can be observed by the same method.

J. HELLER.
E. MEISELS.

Department of Medical Chemistry,
University of Lwów, Poland.
Sept. 26.

¹ J. Heller und E. Meisels, "Untersuchungen über die Metamorphose der Insekten. VI. Röntgenographische Untersuchungen über den Entwicklungsvorgang." *Biol. Zentralblatt*, 47. 257-264; 1927.
² E. Meisels und J. Heller, "Ueber die röntgenologische Beobachtung der Metamorphose bei Insekten." *Fortschr. a.d. Gebiete der Röntgenstrahlen*, 36. 104-109; 1927.
³ J. Heller, "Badania nad przeobrażeniem owadów." *Acta Biol. Exper.*, 2. 225-315; 1928.

Colonisation of the Sea by Insects

THE letter from Dr. Hem Singh Pruthi on this subject¹ is of much interest, but one feels doubtful whether the comparative absence of insects from the oceans can be accounted for simply on the ground of calcium deficiency. Even supposing that the remarkable instance of the *Claeon* larva, which he cites, is to be connected with the unusually high concentration of calcium in the waters of the Salt Range, there remains the fact that many species of Coleoptera (Dytiscidæ, Hydrophilidæ), as well as Hemiptera (Corixidæ) and Diptera, have been recorded from waters of a salinity equal to or greater than that of the sea, but in which the proportion of calcium was no higher.

Several species of insects which I myself have recorded^{2, 3} from saline waters, both on the south coast of England and in the desert regions of California, are listed in the accompanying table.

Insect.	Range of Specific Gravity to which exposed.	Locality.
Hemiptera <i>Corixa selecta</i>	1.009-1.035	Sussex, England
Coleoptera <i>Octhebius marinus</i>	1.014-1.035	Sussex, England
<i>Octhebius rectus</i>	1.024	Death Valley, California
<i>Philhydrus maritimus</i>	1.009-1.035	Sussex, England
Diptera <i>Culicoides nubeculosus</i>	1.022 (circa)	Somerset, England
<i>Ephydra hians</i>	1.024	Death Valley, California
<i>Ephydra riparia</i>	1.026-1.035	Sussex, England
<i>Nemotelus uliginosus</i>	1.000 (?) - 1.035	Sussex, England

In each case, although the specific gravity of the water to which the insects were exposed was almost

as great if not greater than that of the sea, analysis showed the proportion of calcium to be definitely lower. In the case of the Californian locality, the amounts of calcium and sodium were 84 and 9010 parts per million respectively, whereas in sea water the amounts in parts per million are approximately 420 and 10,700 for calcium and sodium respectively. Therefore the inability of these and allied forms to colonise the sea itself can scarcely be explained on grounds of calcium deficiency.

Secondly, the Caspian Sea may be cited as an example of a type of lake which, while of a lower total salinity than the ocean, has a much higher proportion of calcium and magnesium salts. Yet insects do not appear to have been strikingly more successful in adapting themselves to saline conditions here than elsewhere.

W. H. THORPE.

Zoological Laboratory,
Cambridge,
Aug. 29.

¹ NATURE, 130, 312, Aug. 27, 1932.

² Thorpe, W. H., 1927: "The Fauna of Brackish Pools of the Sussex Coast", *Trans. S.E. Union of Scientific Societies*, 1927, pp. 27-34.

³ Thorpe, W. H., 1931: "Miscellaneous Records of Insects Inhabiting the Saline Waters of the Californian Desert Regions", *Pan-Pacific Entomologist*, 7, 145-153.

Susceptibility of English *Culex pipiens* L. to Infection with Bird Malaria

IN a recent letter¹ we described a method of inducing females of *Culex pipiens* to gorge on canaries. We have utilised this method for experiments on the infection and transmission of bird malaria by English *C. pipiens*. In the course of our experiments 393 mosquitoes gorged on birds heavily infected with malaria (*Plasmodium relictum*, Grassi and Feletti). 131 of the mosquitoes were dissected and 72 (55 per cent) were found to be infected. On dissection many of the mosquitoes showed more than twenty cysts on the stomach and the salivary glands were heavily infected with sporozoites. The infected mosquitoes readily transmitted the malaria parasite to healthy canaries.

So far as we know, there is no published record of the transmission of bird malaria by *Culex pipiens* in England. It is interesting that, once the experimental difficulties of breeding and feeding the English *Culex pipiens* are overcome, it behaves as a normal vector of bird malaria.

P. TATE.
M. VINCENT.

The Molteno Institute,
University of Cambridge,
Sept. 29.

¹ NATURE, 130, 366, Sept. 3, 1932.

The Vitamin Factor in Dental Caries

Is there not a possibility that the vitamin factor in the production of dental caries is unduly emphasised? That malnutrition may precipitate and intensify decay of the teeth is beyond question, but exception may surely be taken to the inference that if the proper vitamins are present in food all will be well with the teeth. Australian experience is strongly against such an assumption. Here the incidence of caries is admittedly high, but Australia is a land flowing with milk and vitamins; cows are exposed to sunlight throughout the year, whilst fruit

and vegetables are abundant, of good quality and cheap.

A distinguished English biochemist, to whom I referred the argument, suggested that the low phosphate content of Australian soils might be the causative factor, but this is easily ruled out, for deficiency in phosphate lowers the yield of food stuff per acre rather than the phosphate content of such food. Anyhow, if low phosphate were its cause one would find this reflected in the growth of bone; and yet twenty-eight years' association with Australian youth has continually aroused in me a deep admiration for his magnificent physique. Are we not dealing with one of those biological degenerations which may overtake any organ and will lead to extinction of such unless selection is kept busy?

Formerly the edentulous human suffered from grave malnutrition, and the girl with pronounced caries was not only physically unattractive but also repellent. The modern excellence of the dentist's art has stopped both forms of selection and so may we not expect human teeth to go the way of the snake's legs?

W. A. OSBORNE.

University of Melbourne.
Sept. 6.

Further Doublets of As V

WHILE examining the spectra obtained by passing varying discharges through the vapour of pure metallic arsenic contained in capillary tubes, certain lines were found to be even more strongly enhanced than those due to the trebly-ionised atom, with increase in the intensity of excitation. A strong doublet at $\lambda\lambda$ 2902, 2785 which was completely suppressed by the introduction of the slightest inductance in the circuit was therefore ascribed to the quadruply-ionised atom of arsenic.

Sawyer and Humphreys¹ reported the identification of four pairs forming the first members of the doublet series of As V. The above pair is found to be the combination $5s \ ^2S_1 - 5p \ ^2P_{1,2}$ and is in perfect agreement with the corresponding pairs in the sequence Cu I, Zn II, Ga III, and Ge IV. The value of the term $5s \ ^2S_1$ found by Sawyer and Humphreys ($\nu = 241540 \text{ cm.}^{-1}$) led to the values $\nu = 207096$ and 205648 cm.^{-1} for the $5p \ ^2P_1$ and the $5p \ ^2P_2$ respectively with the difference $5p \ ^2P_1 - 5p \ ^2P_2 = 1448 \text{ cm.}^{-1}$. This identification is further supported by the detection, in exactly the calculated position, of the inverted group $4d \ ^2D - 5p \ ^2P$.

Classification	λ (Int.)	ν (vac.)	$\delta\nu$	ν (calc.)
$5s \ ^2S_1 - 5p \ ^2P_2$	2785.35 (10)	35891.6	1447.2	
$5s \ ^2S_1 - 5p \ ^2P_1$	2902.38 (8)	34444.4		
$4d^2 \ D_2 - 5p \ ^2P_1$	1635.45 (6)	61145		61143
$4d^2 \ D_2 - 5p \ ^2P_2$	1609.16 (6)	62144	1448	62146
$4d^2 \ D_2 - 5p \ ^2P_2$	1597.61 (5)	62593	449	62591

The occurrence of these pairs of As V in a simple discharge tube leads one to think, that, as a method of excitation of spectra, this simple source affords a very wide range of ionisation of the atom, for example, As I to As V.

A. S. RAO.

Science College, Andhra University,
Waltair, India,
Sept. 15.

¹ *Phys. Rev.*, 32, 580; 1928.

Research Items

Buffalo Sacrifice.—The sacrifice of a buffalo at an annual festival in honour of one of the two chief village deities of Manakaddu, Salem City, Madras Presidency, is described by Mr. F. J. Richards in the *Indian Antiquary* for August. The festival is held in February or March in each year and usually lasts for some weeks. The sacrifice here described took place on March 7–8, the seventeenth day of the festival, which had begun on February 19. In the evening the processional images of the two deities, Mâri-amman and Selli-amman, are brought to the temple of Kâli, with whom Selli-amman is identified, and after the sacrifice of a sheep the images of the goddesses are carried in procession around the village, Selli-amman's vehicle being a lion and that of Mâri a horse. In front walks the pariah whose privilege it is to slay the buffalo, carrying the sacrificial knife on his shoulder. His torch-bearer is also a pariah, whose office is hereditary. The goddesses are then carried clockwise around the temple. A plaintive hymn is sung while two men rock the images of each goddess. After the singing of the hymn all females must go home. The buffalo victim is then led to the edge of a pit 50 yards in front of the temple. It must be male. After offerings have been made to the victim by the priest and it has been garlanded and sprinkled with red-ochre, sandal and saffron on the forehead, the pariah awaits the signal that the goddess accepts the victim. This is signified by the shivering of the beast. The victim is held by the people and the pariah severs the neck with two or three blows. The attendant then mixes the blood with boiled rice, which he hands to the executioner, who conveys it to his mouth and then rushes like a madman around the village, at each corner throwing a few grains of blood-sodden rice into the air. The pariahs at the graveside throw the body into the pit, and it must be completely buried before the pariah returns from his circuit of the village. The pariah returns in front of the temple and after a few ecstatic screams, the spirit of the goddess leaves him. The festival closes with the sacrifice of sheep and a general feast on the 8th or 16th day after.

Puebloan Decorative Designs.—The Elden Pueblo, $6\frac{1}{2}$ miles from Flagstaff, Arizona, when excavated by Dr. Walter J. Fewkes in 1926, yielded a variety of pottery, of which the decorative designs have been studied by Dr. Walter Hough (*Smithsonian Misc. Collect.* vol. 87, art. 7). Elden Pueblo is classed as a gray-ware site dating from the 'Great Period' of Kidder and is one of the many of northern type settlements penetrating the Little Colorado area. Band designs and parallel striping are applied in agreement with the structure of the ware, that is, on the corded junctions. Bands did not disappear with the coming of the quadrant art, which is also old and was introduced from the north. Allied to the band are all-over designs made up of a network of interlocking stripes. The quadrant designs seem to mark a profound change in Pueblo cosmogony, which probably began at Elden in Pueblo III. The Elden red-ware takes on the variety of paste and design of the polychrome area of the Little Colorado valley. The whole decorative field of the Elden pottery is elaborated from the bird motive. In its early form it is not realistic, but two engaged spirals

generally arising each from a triangular or wedge-shaped base are taken to be the body of the bird. No other symbol is so wide spread in time and space as that derived from the bird. At Elden it occurs in various stages of convention. As a rule two birds are represented in apposition. The most ancient form is curvilinear, expressing motion. The body is sometimes shown as a triangle, sometimes supplied with a head and a tail. The list of small units is not long. Hachuring passed out of use with the discontinuance of gray-ware, about A.D. 1250.

Mammals of Central and South-eastern Asia.—The Kelley-Roosevelt Asiatic Expedition of the Field Museum, Chicago, in a relatively short period in 1928-29, was able to cover a wide extent of territory in central and south-eastern Asia. This was due to the division of the expedition into three sections, each of which touched faunal areas not reached by the others, and the result was a collection of mammals of unusual size, variety and interest. Species are represented from very different regions so that in the systematic account, by Wilfred H. Osgood, which has just been published (*Field Mus. Nat. Hist., Zoo. Series*, vol. 18, No. 10, 1932), inhabitants of the tropical coast of Cochin China rub shoulders with alpine forms from the highlands of western Szechwan near the Tibetan border. The accounts, however, show that in spite of its temperate climate western China possesses a mammalian fauna many elements of which extend into French Indo-China. To some extent the area covered overlaps that from which the late Oldfield Thomas obtained collections, and the author pays a warm tribute to the co-operation of the scientific staff at the British Museum, in which are housed the type specimens of new forms collected by the French ornithologist, Jean Delacour, whose mammal collections also are described in the Field Museum memoir.

Innervation of the Crustacean Heart.—J. S. Alexandrowicz (*Quart. J. Micr. Sci.*, vol. 75, Pt. 2, pp. 181–249, 3 pls., 1932) gives an account of the innervation of the heart of decapod Crustacea. Three systems of nervous elements can be distinguished: (1) a local system of neurones in the heart itself; (2) nerve fibres connecting the heart with the central nervous system; (3) nerves supplying the valves of the arteries which issue from the heart. The first system consists of a nerve trunk in the dorsal wall of the heart from which branches pass to the muscle-fibres of the heart. The cells in this nerve trunk are of two kinds—large and small—and their number was found to be constant; in *Cancer pagurus*, *Maia squinado* and *Homarus vulgaris*, five large and four small cells were present, but in *Potamobius astacus* there were eight large and eight or may be nine or ten small cells. The cells are multipolar and their long processes (the axons) after sending out short branches (regarded as dendrites) give off long branches to all the muscles of the heart including those of the ostia. The fibres which connect the heart with the central nervous system arise from the subesophageal ganglion, travel in the nerves which run on the thoracic muscles to the dorsal side of the heart, where they pierce the wall and reach the local system. The thicker fibres, possibly inhibitory, break

up into richly arborising branches forming a neuropile which is the field of conjunction of these fibres with each other and with the neurones of the local system. The nerves of the third system, forming four pairs, arise from the thoracic nerves and innervate the valves of the arteries, except the ophthalmic artery which has a separate nerve from the stomatogastric system. The local system is an autonomic nervous apparatus from which the muscles of the heart receive impulses necessary for their regular contractions; the nerves to the valves bring about contraction of the muscle fibres of the valves during the diastolic period.

Alcohol and Inheritance in Guinea-Pigs.—An extensive experimental investigation of the effects of alcohol on guinea-pigs, made by Miss P. M. Durham and Miss H. M. Woods, has been issued by the Medical Research Council as Special Report No. 168 (London: H.M. Stationery Office, 1932). Prof. Stockard found that treatment of guinea-pigs with alcohol by inhalation led to the appearance of abnormalities which were inherited, also to reduced fertility and higher mortality records. Repetition of these experiments with careful controls leads to negative results, and it is suggested that a smaller amount of green food may have caused a deficiency of vitamins and so produced some of the abnormal offspring in Stockard's experiments. In the present work four successive generations of guinea-pigs were treated with alcohol by inhalation from a half-saturated atmosphere. Ten abnormalities occurred among 6,309 alcoholic stock and one among 674 control stock. There was no evidence that fertility was affected by the alcohol, or that males were more affected than females. A certain decrease in fertility occurred, which is ascribed to genetic qualities in the stock and the effects of inbreeding, but the controls were not extensive enough to prove this point. Some deterioration in weight also occurred, but this, too, may be due to inbreeding. The general conclusion is reached that there is no evidence that alcohol has had a deleterious effect on the genetic behaviour of guinea-pigs, and this is in accord with the results of most other workers.

Management of Race-horse Paddocks.—Prof. J. A. Hanley gives an account of management of race-horse paddocks in the *Student's Gazette* of the Royal Agricultural College, Cirencester, for 1932 (vol. 19, new series, part 1). The type of grass required differs in many respects from that which the farmer wishes to obtain and the methods of management in the two cases must in consequence be different. Paddocks used for exercise, for example, should have a soft springy turf or 'mat', a condition which a farmer would regard as indicating a serious state of deterioration. Owing to the great value of race-horses, oats and bran are fed without stint, and too little attention is often paid to the value of paddocks for grazing. Further, hand feed is apt to be deficient in lime, a danger for which fresh grass is the best natural corrector. To meet the varying needs of the yearlings, breeding mares and foals, and to provide leafy herbage for grazing throughout the greater part of the year, it is evident that a number of paddocks to be used in rotation are needed, and a scheme of management, including manuring, is outlined to show how this may be done. Horses are notably selective in their grazing, so that it is essential to

include some other stock (preferably polled bullocks) in the scheme if the grazing is to be of the best quality, and there seems no doubt that the performance of a horse depends in no small degree on the management of the paddocks at the stud where it was reared.

Liquid Inclusions in Minerals.—Most of the known data on the composition and concentration of primary fluid inclusions in minerals is assembled in a paper by W. H. Newhouse in *Economic Geology* for August. Sodium chloride appears to be one of the most abundant and widespread of the constituents present, especially in or adjacent to sulphide ore deposits. It is suggested that the sulphides are carried in solution with sodium chloride and probably at higher temperatures with potassium chloride. The concentration in solutions found in galena and zinc blende from the Mississippi valley ores excludes the possibility of formation by descending meteoric waters. Similar solutions were found in galena from localities where the ores are related to visible igneous rocks (Leadville, Freiberg, etc.), and it is concluded on this evidence that the only known available sources for such concentrated solutions (apart from saline deposits) are magmatic or possibly the first artesian flow from newly tapped beds containing connate waters.

The Elastic Limit of Metals.—Dr. G. Cook describes in the September *Proceedings of the Royal Society* experiments designed to test several rival hypotheses about the stresses necessary to produce elastic breakdown in a metal. The hypotheses which have been suggested include (1) definite shear stress at yielding, (2) definite total strain energy, and (3) definite energy of shear strain. The second hypothesis requires that failure may be produced by superposing a sufficiently large hydrostatic pressure on a constant shear stress which is itself insufficient to cause breakdown, and a direct test led to the rejection of the hypothesis. In the main experiments a triaxial stress, the three components of which could be varied separately, was used instead of the simplified stress systems which have usually been used in work on elastic breakdown. The triaxial stress was obtained by using a hollow steel cylinder exposed to combined axial tension and internal pressure. A large number of samples were tested and analysis of the stresses at breakdown agrees with the assumption that failure takes place when the shearing stress reaches a certain value which agrees rather closely with the limiting stress in simple torsion. A comparison of the limiting stress in simple tension experiments shows some discrepancy, and the author concludes that, while the maximum shear stress is the principal condition of failure, the mode of distribution of the stress has some influence on the yield conditions.

Intensity Distribution in a Band Spectrum.—It is a characteristic of modern spectroscopic theory that it concerns itself with the probabilities of spectral transitions and hence with intensities in spectra. Condon in 1926 gave a theory to explain the general features of the intensity distribution in band systems, but little accurate photometric work has yet been done on band spectra. R. C. Johnson and N. R. Tawde (*Proc. Roy. Soc.*, Sept.) publish a photometric study of the Swan bands of carbon (C_2 molecule). Photometric work over a large range of optical frequencies is very difficult. The method

adopted in the present work is the use of the photographic plate and microphotometer to compare the intensities at the intensity maxima of the (unresolved) bands with the intensity distribution of a calibrated tungsten lamp. The points of technique discussed in the paper are fairly well known to workers in this field. From the observed intensity distribution the transition probabilities are calculated and they agree in a general way with the Condon predictions of the most probable transitions. The experiments with different methods of excitation (bunsen flame, oxy-coal gas flame, argon discharge, and spark under glycerine) show that the populations of the different states do not agree with thermodynamic equilibrium at the temperature of the source.

Water Transport in Electrolysis.—A well-known method for determining the hydration of ions consists in adding to the solution of the electrolyte an indifferent substance such as urea, from the changes in concentration of which around the electrodes it is possible to calculate the amount of water transported by the ions. Experiments by Miss Taylor and Sawyer

in 1929 showed that in the electrolysis of sodium chloride, water is transported from the anode to the cathode, the transference per faraday being greater the lower the concentration of the solution. A further investigation by Davies, Hassid and Taylor (*J. Chem. Soc.*, Sept.) extends the results, and it is shown that the transference of water increases with dilution at a rate which is too great to be accounted for by change in the transport number of the ions. It also increases with decrease in temperature, whereas the transport number of the cation decreases with fall in temperature. The calculation of the absolute hydrations of the ions on the assumption that the hydration is independent of the concentration and that the decrease in water transport with concentration depends on the change in transport number, gives impossible values of 240 and 145 molecules of water for the sodium and chlorine ions, respectively. It is concluded that, since activity considerations point to a total ionic hydration which is independent of concentration, the results obtained must be interpreted as indicating that the ions during migration transport a considerable quantity of water with which they are not chemically combined.

Astronomical Topics

Eta Aquilæ and the Cepheid Problem.—Vol. 4, No. 8 of the Publications of Michigan University Observatory contains a study of the spectrum of Eta Aquilæ by Dr. D. W. Lee. The star has been known as a variable since 1784, its period being about 7.2 days. It was soon recognised that the eclipse explanation did not fit this case and many other theories were tried in turn, the one usually accepted at present being Prof. Shapley's pulsation theory. The present paper supports this theory, but with the modification that the pulsations are to a large extent in the star's atmosphere. The spectro-heliograph has enabled us to study the behaviour of gases at different heights in the sun's atmosphere, and the experience gained there may be extended to stellar spectra. D. Lee notes that if the pulsation arises from a central impulse, there would be a lag in the phases of the outer layers as compared with the inner ones; his observations confirm this, and indicate the presence of a compressional wave which is traced through four of the lower layers of the atmosphere. A companion paper by W. Carl Rufus in No. 7 of the same publication contains a diagram of the mean velocity curve for all levels. This shows a marked pause in the middle of the ascending portion of the velocity curve. The curves from hydrogen and strontium lines have a secondary maximum at this point. The light-curve has a similar pause, which is supposed to indicate a stage of comparative rest in the atmosphere.

The light maximum follows maximum compression of the body of the star by about one quarter of the period; but the maximum compression of the atmosphere would be later than that of the body, owing to the lag in the outer layers. It is concluded that the atmospheric compression plays a large part in the increase of light.

The Place of the Moon derived from Occultations.—Prof. E. W. Brown succeeded in his attempt to interest a large number of astronomers in the

observation of occultations of stars by the moon. The observers are so widely scattered that the risk of bad weather is largely obviated, and a sufficient number of results is obtained every year to give a good value of the mean error of the moon in longitude. There is, however, one point that prevents us from taking the result as giving the absolute error of the moon; this is the fact that Prof. Brown rather discourages the observation of re-appearances of stars, so that practically all the observations are made between new and full moon. He gives as a reason that re-appearances are more difficult to time with accuracy than disappearances; but this difficulty can be overcome with sufficient practice; there would necessarily be fewer re-appearances observed, since the majority of them occur after midnight; this would necessitate some weighting of the results, to obtain the mean error of longitude. The present system cannot be relied on to give the true error of the moon in longitude, for errors in the assumed semidiameter and in the assumed coefficients of the variation and the parallactic inequality are not eliminated. However, the errors from these sources should be the same every year, so we can take the results with confidence as showing how the mean error of longitude is changing from year to year. Prof. Brown and Dr. Dirk Brouwer have published (*Astr. J.*, 970) their discussion of the observations of the year 1930, and also give a preliminary result for 1931. The following table gives the values for different years, with their differences:

Year.	Obs. minus Tab. Long.	Diff.
1927	+6.92"	-0.60"
1928	+6.32	-0.36
1929	+5.96	-0.17
1930	+5.79	
1931	+(5.6) provis.	

They conclude, from the run of the differences, that the error of longitude probably passes a minimum in 1931 or 1932, and will then increase again.

The Early History of the Cell Theory

IT is now generally recognised that Schwann was not the first to discover cells in the body of an animal but he is often regarded as the founder of the theory of the conformity in the elementary structure of plants and animals. In a recent number of the *Anatomischer Anzeiger* Prof. F. K. Studnička shows that Schwann was neither the first to make this suggestion, nor did he really prove it. He has studied the work of all the forerunners of Schwann and has attempted systematically to interpret the significance of their work.

In 1823 H. Milne Edwards came to the conclusion that the small granules ('globules') of 1/300 mm. in diameter, which he found in all the tissues he examined, are of varied origin and in great part mere artefacts. Henry Dutrochet (1824) accepted some of H. Milne Edwards's ideas (he had seen the same globules), but he made a great advance by directing attention to cells in the modern sense, as typified for example in the ganglion cells of *Helix* and *Arion* and the cells in the glands of *Helix*. In his opinion, the globules of Milne Edwards develop into small vesicles, that is, cells. He compared these animal cells not with the 'great' plant cells, but with the small 'cells', found in the walls of the latter, which probably are plastids and starch granules. According to Dutrochet, the difference between the cells of animals and those of plants lies in the fact that in plants they develop much farther than in animals and give origin to large vesicular formations, whereas in animals they retain the globular form. Dutrochet was completely mistaken in describing such 'cells' in animals, because the 'cell' (that is, the cell in plants) of those times conformed to the usual meaning of this word in English. It corresponded to what we call the cell membrane. As is well known, such cells are only exceptionally present in the tissues of animals. Rich, who has dealt with Dutrochet's work more recently (1926), takes into consideration only Dutrochet's conclusions, some of which happen to agree with our modern ideas, but he overlooks the fact that these conclusions were not sufficiently proved and were, therefore, mere speculations. Dutrochet foreshadowed the cell theory but he was not the founder of the latter.

Raspail (1827) distinguished small and large 'globules' (erythrocytes, for example) and 'cells' and pointed out that the latter may assume a very elongated form, for example, muscle, nerve.

H. Milne Edwards's observations of globules in the body of animals had some influence upon contemporary literature, but to Dutrochet's and Raspail's theories of the essential identity of the 'cells' of both plants and animals, no special attention was paid. They were regarded, not quite without justification, as unproved.

In 1835, Purkinje's pupil G. Valentin described 'granules' in the body of an embryo, 'globules' in the chorda dorsalis and 'cells' in the cartilage of the larva of the frog. Another pupil of Purkinje, Raschkow, described (1835) cells in the epithelium of the gums and directed attention to the similarity of the latter to the cells of plants. Following on Purkinje's description in 1825 of the vesicula germinativa in the ovum of birds and the discovery by R. Brown, in 1831, of the nucleus in plant cells, these authors also described the existence of the cell nucleus in animal cells, which had not been observed by

Dutrochet and Raspail. In 1836, Johannes Müller rediscovered the cells of the chorda and cartilage.

In 1837, Purkinje communicated to a meeting of the German Men of Science and Physicians in Prague a short note on a theory of the conformity in the microscopic structures of plants and animals and directed attention to the differences between them. This was not a cell theory, and even later Purkinje firmly rejected Schwann's cell theory (1839, 1840). The great advance he made, however, was that he no longer attempted like other workers to discover the plant 'cell' in the body of animals. (We must here bear in mind that the 'cell' of Purkinje's contemporaries corresponded to the cell wall or the cell membrane in the modern sense.) Purkinje did not describe 'cells' in animals, but, more correctly, 'granules' (*Körnchen*), quite different from the 'globules' of H. Milne Edwards, and formed by a special vital substance containing a nucleus. For this vital substance, he was the first to use the term 'protoplasma' and he concluded that this substance and not the outer part, or cell membrane as we would call it to-day, formed the essential constituent of the 'granules'.

Studnička has dealt with Purkinje's work in a special paper: "Purkinjes und seiner Schüler Verdienste um die Zelltheorie"¹. He points out that J. E. Purkinje (professor of physiology in Breslau and from 1851 in Prague) is to be looked upon as one of the founders of experimental physiology and modern histology and microscopical anatomy. He was one of the first to give an account of the methods for the study of the animal tissues and in a series of papers in conjunction with his pupils described in detail the structure of the chief tissues of the animal body. In particular Purkinje and his pupils described the 'granules' in these tissues, which represent the cells of modern histology, and so to this school (of which Valentin was a very prominent member) belongs the distinction of having been the first to recognise the manifold variety of cells in the animal body. The school of Johannes Müller also discovered the cells of the animal tissues independently, but their observations were published later than those of the Purkinje school.

Notwithstanding the advances made by the Purkinje school, Schwann (1838, 1839) in his well-known book (in which he developed his own cellular theory) returned to the views of Wolff, Oken and Dutrochet. For him, the outer part (cell membrane in the modern sense) was the essential constituent of the 'cell' and he attached no special importance to the cell contents. Nevertheless his views came to be widely accepted and quite overshadowed those of Purkinje, the consequence being that his name became associated with that of Schleiden as the joint founder of the cell theory. So far as the completely mistaken theory of cytogenesis which these two writers advocated is concerned, this was no doubt justified; but Schleiden and Schwann are usually regarded as the founders of the cell theory in the modern sense without any qualification. Even Haeckel regarded Schleiden as the first to extend the cell theory to plants but the botanists never paid great attention to Schleiden's erroneous discoveries, and it is, therefore, the more remarkable that to Schleiden alone was attributed such an important part in the history of the histology of animals.

Schwann introduced Schleiden's errors into animal histology, reinforced by one of his own, namely, the idea that new cells originate chiefly between the old cells, not within them. On these mistaken ideas (the wrong definition of the cell and erroneous ideas of cell formation) Schwann built up his theory of the "conformity in the structure and the development

of the cells in animals and plants". It remained for Max Schultze to correct, twenty-two years later (1861), the errors of Schwann's theory in the sense of Purkinje's ideas.

J. FLORIAN.

Anat. Anzeiger, 1927, and *Acta Soc. natur.*, Brno, 1927.

The 'Butterfly' Map Projection

THE problem of reducing the sphere to a plane surface has ever been a difficulty. This realisation has led cartographers to adopt the policy of constructing a map for a specific purpose. The most important features which have to be embodied in maps may be classified in three categories: (1) exactness of shape; (2) exactness of area; (3) exactness of relative position. Whichever of these features will be required is decided by the purpose

a substitute for the globe and on development is a spherical representation and not a reproduction. The cube of the gnomonic projection is replaced by this modified octahedron.

The other unusual figure is the combination of various projections, namely, 1, 2 and 3. This gives rise to a grave defect when one remembers that an essential feature of any map is ease of interpretation. A form of projection frequently employed for statis-

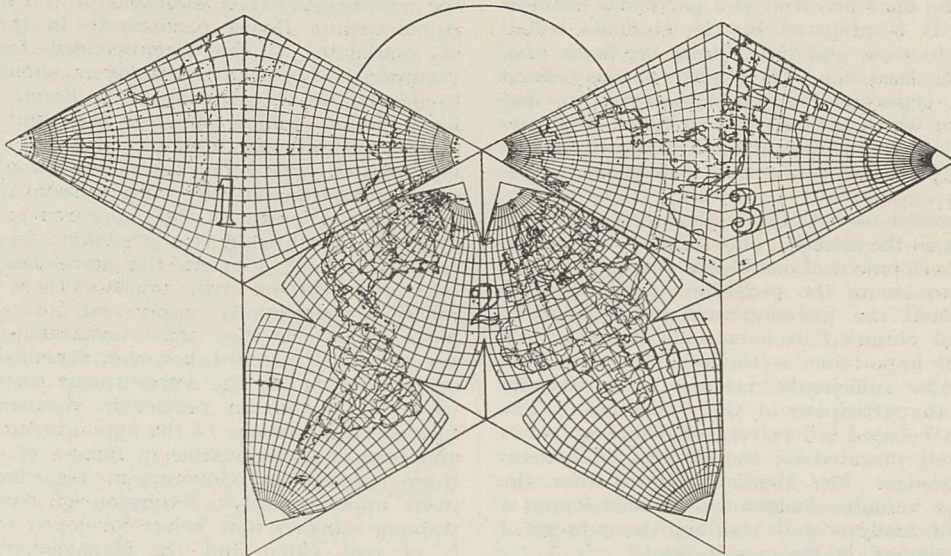


FIG. 1. Butterfly map of the world. The three variants are condensed to one diagram.

of the map, and when this has been decided a map is constructed on an appropriate projection. The required feature is embodied in the map, the others are ignored, with the result that distortion in some respect is usually apparent.

Mr. B. J. S. Cahill, of Oakland, California, has regarded this problem from a fresh angle. Instead of making one purpose dictate the form of the whole map, he has realised that in a world map the land areas may be required for one purpose and the water for another. There is also the uneven distribution of land and water over the globe.

The resultant map, constructed to serve many purposes, has been achieved by incorporating various projections into one final form, and by representing the globe by an octahedron (Fig. 1). Such a figure is capable of being more closely approximated to the sphere by the addition, on either face of the octahedron, of smaller tetrahedrons. Thus the principles of triangulation as applied in plane work are translated to the solid. Such an octahedron with tetrahedral modifications can easily be developed into a plane surface.

It must, however, be noticed that such a figure is

tical purposes is that of Mollweide. This is an equal area of projection and when constructed with the Greenwich meridian in the middle of the map, areas in remoter longitudes assume very distorted shapes. To obviate this difficulty the usual form of the projection is replaced by an interrupted form. Against such forms there has always been the accusation that they are not easy to read.

In the case of the 'butterfly' map this criticism will be made, and strongly asserted, because the continuative feature is missing. The faces numbered 2 do not conform to the original octahedral boundaries, whilst the junctions of the portions 1 with 2, 2 with 3 are not too happily made. Such breaches of continuity as are evidenced in tracing the 5° N. latitude and in north-west India (sheets 2 and 3) will require more than supplementing by simple graphic diagrams.

The use of this modified octahedron instead of a single plane is an advantage, but it cannot give a sphere, whilst the discontinuity due to the unhappy alliance of divers projections will scarcely "help mankind to learn to think planetarily".

J. E. COLECLOUGH.

Education and Training for Management

A DISCUSSION arranged by the Department of Industrial Co-operation of the Section of Economic Science and Statistics at the York meeting of the British Association was devoted to the selection, training and placing of administrative personnel, including the study of the "Case Method" as an instrument in education and training for management. The discussion was opened by Mr. Jules Menken, of the Department of Business Administration at the London School of Economics. Mr. Menken described the Case method which was originally developed by the Harvard Business School in the United States. The method is used in many other American schools of business administration as well as at the Business Preparation Centre of the Paris Chamber of Commerce but is little known in Great Britain. Essentially the method consists of the discussion in class of problems actually drawn from business experience. A business case or problem sets forth the facts involved in a particular business situation. It is prepared by the students before they come to class and then forms the basis of a conference or discussion. The student is thus trained to analyse types of business situations, to find principles on which action must be taken in a particular situation, to formulate a plan of action and to justify his policy and plan in reasoned argument.

The successful use of this method depends upon such factors as the selection and training of teaching staff, the development of confidence among the firms associated to secure the provision of material for the cases, and the planning and presentation of the material obtained in a suitable manner. Of fundamental importance is the use of the method with students sufficiently mature in mind and experience to participate in the discussions. The method can be used inductively or deductively but it is relatively unsuited for the teaching of systematised knowledge. Mr. Menken claimed that the method is a valuable instrument for developing a technique of analysis and training the powers of judgment required in business decisions.

The second paper in the discussion was contributed by the Hon. J. F. A. Browne, who outlined some suggestions for co-operation between the universities and industry in the placing of those

who have qualified not as specialists such as chemists, engineers, etc., but who have taken a general degree and left the university without a specific vocational qualification. After emphasising the futility of specialised training for business management at the universities, Mr. Browne suggested that it is more important for a man to enter business with a wide general education and a keen mind, trained to learn quickly and accurately, to grasp the essential points of a problem and to analyse a difficult situation. The absence of any agreed demand as to what qualifications are necessary in its recruits, indicates how far industry still is from being professionalised, but industry should regard the universities as a field for recruitment and pay much more attention to machinery for careful and systematic selection of candidates. Bad selection in the past has been largely responsible for much prejudice in industry against university men. Much more of the personal touch is desirable in the work of the Appointments Board particularly in the selection of candidates to be recommended for specified vacancies. Prospective employers should be able to depend on the Appointments Board for a perfectly frank opinion about a man and to regard it as an absolutely reliable source of confidential information. By more careful selection of candidates and particularly by warning them from applying for posts for which they appeared to be unsuitable, the Board could render genuine service to its candidates and prevent the development of an inferiority complex in the minds of those who might otherwise continually apply without success for posts for which they were unsuitable. Efficient selection by the Board, however, depends essentially on industry telling the Appointment Boards frankly what it requires in particular vacancies and in furnishing particulars of the appointment, its duties and prospects comparable in fulness of detail with those supplied by Government regarding Government appointments. Extension of the organised training schemes now being developed by industry is of real value and the Management Research Groups might well explore the possibilities of co-operation in this field, particularly in securing a common approach between different firms and the university appointments boards.

The Wren Tercentenary

THE loan exhibition of portraits, architectural drawings, models, manuscripts, and personal relics illustrative of the life and times of Sir Christopher Wren, brought together in the Trophy Room by the Dean and Chapter of St. Paul's Cathedral, is now open to the public view, and will undoubtedly ensure large attendances, for Wren is secure in the nation's affectionate regard. Very suitably the opening of the exhibition was undertaken by Sir Frederick Gowland Hopkins, president of the Royal Society, who delivered a brief address dealing with various aspects of Wren's many-sided career.

The catalogue of the exhibits contains 168 entries of objects; happily it does not err on the score of meagre description. It would, perhaps, have been helpful to have supplied such an important issue as

this—one doubtless destined to circulate all over the world—with a preface embodying the main events of Wren's life, in particular, at least, the series culminating in his great architectural achievement.

Several portraits of Wren at varying ages are shown. These include the small full-length, attributed to Gascar, 1674-80, from Welbeck Abbey, the portrait in the Sheldonian Theatre, Oxford, presumed to be by Sir James Thornhill (about 1675), the St. Paul's modified copy of the Kneller in the National Portrait Gallery (1711), and the Royal Society's portrait, painter uncertain. There is also the Wren death mask, lent by All Souls' College, Oxford. On a sheet of foolscap size appears the following: "I will give one thousand pounds a yeare. Whithall 20 March $\frac{7}{1678}$. Charles R."—

"I will give two hundred pounds a year to begin from Midsommer day last past. July 17, 1678 James."

A wealth of material is illustrative of projects and plans for re-building London, its churches, and public offices, under royal commission. Singular in its interest is the great model and rejected design (in oak and other media, and now in complete repair) submitted to the King for a new St. Paul's. A copy is exhibited of Willis's "Anatomy of the Brain" (1664). Though the plates are unsigned they were the work of Wren, as stated by Willis in the preface. It remains to add to this brief notice of some of the many objects displayed that the unique "heirloom" copy of "Parentalia" (Memoirs of the Family of the Wrens, 1750) is exhibited. This copy descended in the family of Wren, ultimately, by purchase, passing into the ownership of the Royal Institute of British Architects.

From the earliest inception of the Royal Society, and onwards, Wren had been a faithful coadjutor in many ways, a councillor strenuous in effort, prompt in action. On St. Andrew's Day, November 30, 1680, the date of the anniversary meeting (held at Gresham College) for the election of a president and council, it appears that Wren had been re-nominated for membership of council, in company with others. A new incoming member, no other than Robert Boyle, the illustrious philosopher, was chosen as president to follow Sir Joseph Williamson. However, the unexpected happened, for Boyle, in a letter to Robert Hooke, declined office, respectfully desiring the Society to proceed afresh. Whereupon, without any dissentient, Sir Christopher Wren was elected, and he was continued in the post at the anniversary meeting of the year following.

Our existing cordial relations with Sweden are curiously reminiscent of that remote gathering. It is recorded that whilst the lists were being collected, M. Lyenbergh, envoy from the King of Sweden, presented a letter and two books from Dr. Olaus Rudbeck, professor of anatomy at Uppsala, Sweden, for which the president returned the Society's thanks to the envoy. Both communications engaged discussion at a subsequent meeting.

University and Educational Intelligence

CAMBRIDGE.—The professor of physiology has, with the approval of the General Board, appointed G. S. Adair, of King's College, an assistant director of physiological research.

The Cavendish professor of experimental physics gives notice that the Clerk Maxwell Scholarship will be vacant in December 1932. Candidates are requested to send in their applications to Lord Rutherford, at the Cavendish Laboratory, on or before November 1.

At Trinity College Mr. H. Davenport and Mr. G. A. Millikan have been elected into fellowships.

ST. ANDREWS.—An extensive addition has been made to the Bute medical buildings in the form of a new block to house the Departments of Botany and Geology, zoology taking over the accommodation vacated by botany. The new building is of stone and has a dignified appearance, combining harmoniously with its surroundings. The ground floor is occupied by the Botany Department and comprises a lecture room, which will accommodate seventy students, laboratories, research rooms and herbarium. Above are the classrooms of the Geology

Department, together with laboratories for palæontology, mineralogy and petrology. Excellent facilities are available for research both in the building and in the country round St. Andrews.

The work of the Departments of Chemistry and Natural Philosophy was handicapped last session on account of the fire on November 3. Reconstruction and alteration have now been completed, and improvements have been made in the physical and chemical laboratories. A good-sized honours laboratory has been provided at the top of the main staircase for students of physics, and the accommodation for physical chemistry has been much improved. Mr. Donald Mills was the architect for all these buildings.

RESEARCH in higher education is recognised and encouraged by the United States Office of Education as of fundamental importance at the present time and the first of a series of official bulletins on the subject has recently been issued by the Government Printing Office. This reproduces eleven papers read at a conference held last year under the joint auspices of the Office of Education and the University of Oregon. Some years ago this University instituted an elaborate investigation of the methods by which university teaching might be improved. A five-year experimental programme was prepared and a faculty committee proceeded to carry it out. In the papers now published are summarised some of the results grouped under the headings "Instruments of Measurement" (for example, marking systems and types of examination), "Student Personnel Studies" and "Administrative Measures Based on Test Results". Under the second of these are included some interesting accounts of "orientation" and "how-to-study" courses designed as safeguards against the waste of time and discouragement which, in the absence of a tutorial system, are too often experienced by students on passing from school to university, while they are adjusting themselves to the changed conditions of life and study. Such courses, consisting mainly of assigned reading, discussion, some lectures with drill in note-taking, and a large amount of specific drill in approved methods of study and economies in the use of time, have been provided at Oregon since 1927 and their results have been carefully watched and evaluated both subjectively (collecting students' opinions) and objectively—by comparing academic records of students who had participated in the course with those of 'control' groups who had not.

Calendar of Geographical Exploration

Oct. 25, 1616.—West Coast of Australia

Dirk Hartogssoon reached the island still known as Dirk Hartog Island and sailed northward along the west coast of Australia from $26\frac{1}{2}^{\circ}$ to 23° S. In 1696 de Vlamingh, in the course of an important survey of the coast, during which the islands fringing Shark's Bay were discovered, found a pewter plate set up by Hartog on his visit. De Vlamingh also visited the Swan River, so named from its black swans.

Oct. 26, 1776.—South-west United States

Two Franciscan friars, Fathers Escalante and Dominguez, reached the Colorado River on their return from a journey begun in Santa Fé in July. They set out with the aim of opening up an overland route from northern Mexico to the Pacific seaboard.

They failed in this, but their journey was the most important achievement in the south-west of what is now the United States until the beginning of the nineteenth century. From Santa Fé they went north-west, crossing the upper Rio Grande and entering the basin of the Colorado. They reached the head waters of the San Juan, its eastern tributary, crossed the plateau region between it and the upper Colorado and traced part of the course of the Rio Dolores. They visited the Yuta (Utah) Indians and arrived in the territory of the Comanche Indians after crossing the Green River. A difficult mountain traverse brought them to Utah Lake, which discharges northwards into the Great Salt Lake. This journey marks the farthest advance of the Spaniards in the interior of North America; it was not followed up, fur hunters and adventurers from the United States being the first to make their way into the region of the Great Salt Lake. Escalante's narrative gave useful information about the climate, products and peoples of the region.

Oct. 29, 1762.—Niebuhr in Yemen

A party of Danish scientific workers, among whom was Carsten Niebuhr, a mathematician and practical surveyor, arrived at Jidda in a pilgrim ship. There they remained for two months before they could get a barque to take them on to Yemen, and they passed the time in making observations on the country inland. The party broke up at Beit el-Fakih, and between them covered most of the Tehema southwards to Tais and Zebid and the lower mountains. They were able to travel unmolested in a country afterwards noted for its fanaticism until they reached Mokha. Three of them reached Sana in July, 1763, but they were ill, and two had died; they decided to return, two of them dying on the voyage. Niebuhr was in Arabia again in 1765. Sana, his farthest point inland, is less than a hundred miles from the Red Sea coast, and he explored but a small region. Yet the insight he showed and the careful and faithful delineation of what he saw have made his work a classic still valuable to the student and would-be traveller in the Yemen.

Societies and Academies

LONDON

Society of Public Analysts, Oct. 5.—E. Hinks: Third report of the Milk Products Sub-Committee: The analysis of sweetened condensed milk in which the sucrose has altered during storage. The problem was at first thought to be one merely of determining invert sugar, but by the study of 'aged' sweetened condensed milk by various processes, a modified Barfoed process, copper reduction processes, and in particular a combination of the polarimetric and chloramine-T-iodide oxidation, it was found that the usual hydrolysis products of sucrose present, if any, were dextrose, lævulose and levan, the proportion of dextrose being sometimes as high as nine or ten times that of lævulose.—E. B. Hughes: A new copper reagent for sugar determinations. This reagent consists of copper acetate (5 gm.) mixed with triethanolamine (5 gm.) and made up with water to 100 c.c. The reagent has selective reducing properties; its action on dextrose is appreciable; its action on lævulose is very much greater, and it is only negligibly active towards sucrose, lactose and maltose. By modifying the formula (also by purifying

the triethanolamine) the reagent can be made to react strongly with lævulose, but not to oxidise dextrose.—W. G. Moffitt: A colorimetric method for the determination of chloroform. The blue colour reactions given by chloroform with α - or β -naphthol in a strong solution of sodium hydroxide have been made the basis of a rapid colorimetric method of determining chloroform. None of the seven chloro compounds tried (including carbon tetrachloride) was found to have any appreciable influence on the reaction with β -naphthol, although α -naphthol gives a blue coloration with carbon tetrachloride under the conditions of the test.

MELBOURNE

Royal Society of Victoria, Aug. 11.—Leo W. Stach: Victorian Tertiary Polyzoa. (2)—Catenicellidæ. A review of this typically Australian group of the Polyzoa and a suggested new subdivision into three subfamilies, based on the position of the ovicell on the zoarium. This paper discusses the new subfamily Vittaticellinæ and correlates ovicelled zoecia described as distinct species with previously described forms.

ROME

Royal National Academy of the Lincei, May 1.—G. Armellini: The increment of the eccentricity in the problem of two bodies of diminishing mass, with applications to the orbits of binary stars. For a system consisting of a satellite and a principal star, it has been shown that, if the mass of the system is a decreasing function of the time, the mean orbital distance is an increasing function of the time. Some authors consider that, under these conditions, the eccentricity remains virtually constant, but it is now shown that this view is inaccurate.—U. Broggi: Series of factorials and equations to the differences.—R. Caccioppoli: Linear functionals in the field of analytic functions.—A. Mambriani: The summability of Fourier's double series of discontinuous functions.—T. Boggio: A theorem of Siacci for the motion along a curve.—A. Consiglio: A revolving elliptical obstacle invested by an irrotational plane current.—G. Agamennone: The reflection of seismic waves at the antipodes as a cause of earthquake shocks. An attempt was made by Oddone in 1907 to prove that seismic waves, generated by a violent earthquake shock, may be propagated along the earth's diameter to be reflected back along their path and thus give rise to a shock of less intensity than that of the original shock; a second such reflection, giving another shock, was also considered possible. Various difficulties involved in such hypothesis are now discussed.—B. Rossi: Secondary effects of penetrating corpuscular radiation. In traversing matter, the corpuscles of penetrating radiation generate a secondary radiation, probably also corpuscular. The number of such secondary corpuscles generated in iron is only about one-half of the number generated in lead and is less than would correspond with the ratio between the two densities. The penetration in iron is, however, about three times that in lead, so that the number of secondary rays in equilibrium with the penetrating corpuscular radiation should be somewhat greater in iron than in lead.—B. Rossi and B. Crinò: Anomalies in the absorption of penetrating radiation. Measurements of the absorption in thin lead screens have been made to show the influence of secondary radiation in experiments carried out by the coincidence method

and to indicate how such influence depends on the position of the absorbing screens.—F. De Carli: Compounds of urea with alkaline-earth bromides. The solubility isotherms at 11° of the systems, $\text{CaBr}_2\text{—CO(NH}_2)_2\text{—H}_2\text{O}$ and $\text{SrBr}_2\text{—CO(NH}_2)_2\text{—H}_2\text{O}$ reveal the formation of the compounds, $\text{CaBr}_2\cdot 4\text{CO(NH}_2)_2\cdot 2\text{H}_2\text{O}$ and $\text{SrBr}_2\cdot 4\text{CO(NH}_2)_2\cdot 2\text{H}_2\text{O}$, the existence of which in solution is not, however, shown by measurements of the density and fluidity.—D. Marotta and G. Rosanova: The structure of C-substituted derivatives of barbituric acid. The formation of barbituric acid and its C-substituted derivatives by condensation of malonic acid and its derivatives with carbodiamide indicates for these compounds the structure $\text{CH}_2\text{R}_2\text{<CO}\cdot\text{NH}\text{>CO}$.

Observations on the metallic derivatives of the compounds and their behaviour on fusion with potassium hydroxide raise a doubt as to the accuracy of this constitution.—B. Monterosso: Cirripedological studies (7). Euryalinity and anabiosis in *Chthamalus stellatus* Ranzani. When immersed in fresh water, *C. stellatus depressus* survives for four months at the most and undergoes a partial crisis in its motor activity, but there is no arrest in the relative function and no assumption of a hypnic state (Kreps' *Salzschlaf*).—M. Sacchetti: Certain *Zygosaccharomyces*. Copulating yeasts appear to be widely diffused in Nature and a number have been isolated from various Italian products. None of these could be made to sporulate by Hansen's method, but all sporulated on the upper portion of streak cultures on agar or gelatine. To two new species the names *Zygosaccharomyces gracilis italicus* and *Z. felsineus* are given.—Federico Millosevich: Obituary notice of Ferruccio Zambonini.

SYDNEY

Royal Society of New South Wales, July 6.—A. R. Penfold and F. R. Morrison: The occurrence of a number of varieties of *Eucalyptus radiata* (*E. numerosa*) as determined by chemical analysis of the essential oils (1). The several physiological forms of this plant cannot be distinguished on morphological evidence but are readily differentiated by the variation in the chemical composition of the essential oils. The forms can also be separated in the field by crushing the leaves and noting the odours. The chemical evidence in support of the physiological forms is taken from the following data: specific gravity, optical rotation, refractive index at 20° C., composition.—H. G. Raggatt and H. F. Whitworth: The intrusive igneous rocks of the Muswellbrook—Singleton District. (2) The Savoy Sill, with rock analysis by W. A. Greig. This paper describes a large sill-like mass of Tertiary age which intrudes the Greta Coal Measures near Muswellbrook. The intrusion is shown to be a composite sill, the feeding channel of which appears to be partly exposed. The occurrence of two rock types is recognised, one analcrite dolerite, and the other soda syenite. An analysis of each of these two types is given and their relationship to each other discussed both from the point of view of petrology and tectonic geology.—Francis P. Dwyer and David P. Mellor: The crystal structure of indium. While earlier goniometric studies made on electrodeposited crystals of indium have resulted in their assignment to the cubic system, the lines of a powder photograph made with an impure sample of indium have been interpreted as arising from a face-centred tetragonal structure.

In order to check the former observations, powder photographs have been made with carefully purified indium deposited on fine silver wires under different conditions of temperature and current density. In none of the photographs was there any indication of a pattern which could be attributed to a cubic space lattice. The face-centred tetragonal structure of Hull was confirmed. The constants found for the lattice were: $a_0 = 4.587$ (0.002A.), $c_0 = 4.954$ (0.002A.), $a:c = 1.078$.

VIENNA

Academy of Sciences, June 23.—Anton Kailan and Rudolf Raff: Velocities of esterification of alcohols in acetic acid. Velocity constants, and their dependence on the structure of the alcohol, etc., have been determined for the esterification of a number of alcohols by acetic acid.—Guido Machek: Action of gaseous cyanogen on phenols (1): Dicyanogen and the three dihydroxybenzenes. Pyrocatechol yields a cyano-derivative, which may be acetylated, benzoylated and methylated, but resorcinol and quinol yield equimolecular additive compounds with dicyanogen.—Fritz Rieder and Elisabeth Rona: The ranges of the α -rays of actinium products, RdAc, show, besides the main groups with ranges of 4.6 cm. and 4.25 cm., also groups of less intensity with the values 4.5, 4.2, and 4.1 cm. respectively. Ac X shows groups with the ranges 4.0 and 4.55 cm., as well as the principal group (4.2), and Ac C, the two known groups (4.9, 5.39). With Ac Em, the recently discovered subsidiary group (5.2) and a distinct double character of the principal group are noted. Ac A also exhibits signs of complexity (3 groups).—Gerhard Kirsch and Fritz Rieder: The neutron emission of beryllium. Investigation of the excitation of the beryllium nucleus to emit neutrons by the Wilson method shows that this is a resonance process, which can be brought about by α -particles with ranges of 35.4, 30.0, 25.3, and about 15 mm. From consideration of the absorption curves it appears necessary to assume that emission of neutrons occurs preferably in the direction of impact of the α -particles and in the opposite direction.—Marietta Blau and Herta Wambacher: The behaviour of a granule-free emulsion towards α -particles. The blackening of such an emulsion by α -particles follows laws different from those holding for the blackening of ordinary photographic films.—Walter Späth: Spectrographic detection of very small quantities of substance. The smallest quantities (in grams) detectable are, by the spark method: 10^{-10} Cd, 10^{-10} Mn, 10^{-7} As, 10^{-7} Te, 10^{-8} Tl, 10^{-11} Sr and 10^{-9} Li, and by the arc method, 10^{-10} Cd, 10^{-9} Te, 10^{-9} Tl and 10^{-8} Mn.—Roman Lucerna: History of the development of the Matterhorn (4482 metres).—H. K. Barrenscheen and Johannes Pany: The rôle of phosphorylation in the intermediate carbohydrate metabolism of plants (2). Assimilating *Elodea canadensis* yields a hexosemonophosphoric acid which belongs to the levulose series but is different from Neuberg's ester. From germinating wheat a phosphorylated octa-amylose may be isolated and the action of taka-diastase on this also gives a hexosemonophosphoric acid of the levulose series. Partial degradation of an artificially phosphorylated starch by means of taka-diastase results in a phosphorylated octa-amylose identical with that derived from seedlings.—H. K. Barrenscheen, Johannes Pany, and Robert Berger: Glycogenolysis. Post-mortem glycogenolysis of the liver does not proceed linearly but follows a stepped curve, analogous to that of the

scission of inorganic phosphate, the coupling of the two processes being thus indicated. The glycolysis is accompanied by the appearance of a hexosemonophosphoric acid, the amount of which increases most during the period when the liberation of sugar and phosphate is declining. The hexosemonophosphoric acid isolated from rabbit and dog livers is chemically different both from those previously obtained from biological material and from the artificial products.—H. K. Barrenscheen and Béla Vászrhelyi: Glycolysis of the blood (2): Pyrophosphate fraction and glycolysis. Except with pig's blood, the content of pyrophosphate in different bloods increases with the glycolytic power. The whole blood and the erythrocytes, and, to a less extent, the serum and plasma, contain an enzyme which effects the scission of inorganic pyrophosphate and is inhibited by fluoride.—H. K. Barrenscheen and Karl Braun: Glycolysis of the blood (3): Restriction of glycolysis. The pyrophosphate fraction seems to contain an essential part of the co-enzyme effecting glycolysis.—H. K. Barrenscheen, Karl Braun, and Miklos Dreguss: Inhibition of glycolysis and accumulation of methylglyoxal.—H. K. Barrenscheen and Karl Braun: Colour and precipitation reactions of methylglyoxal.—H. K. Barrenscheen and Miklos Dreguss: Colorimetric micro-method for determining methylglyoxal. By separating the bis-hydrazone formed with 2:4-dinitrophenylhydrazine, results accurate to ± 4 per cent are obtainable.—H. K. Barrenscheen, Karl Braun, and Miklos Dreguss: Inhibition of glycolysis and disappearance of methylglyoxal.—H. K. Barrenscheen, Leopold Frey, and Otto Renth: Muscle rigidity and co-enzyme.—H. K. Barrenscheen and Wilhelm Filz: Co-enzyme action (1): Inhibition of glycolysis and liberation of ammonia. The liberation of ammonia appears to be partly responsible for the inactivation of the co-enzyme in glycolysis.—Franz M. Kuen: Oxidation of sugar by atmospheric oxygen and hydrogen peroxide.

Forthcoming Events

TUESDAY, OCT. 25

ROYAL ANTHROPOLOGICAL INSTITUTE.—Dr. P. V. van Stein Callenfels: "Some Early Migrations in the Far East", at 8.30 P.M.

FRIDAY, OCT. 28

INSTITUTION OF CHEMICAL ENGINEERS—(First Hinchley Memorial Lecture).—Mr. H. T. Tizard: "Chemical Engineering and the Aircraft Industry", at 6.30 P.M.

NORTH EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS—(Andrew Laing Memorial Lecture at Bolbec Hall, Newcastle).—Eng. Vice-Admiral Sir Reginald Skelton: "The Work of Andrew Laing", at 7 P.M.

EAST LONDON CHILDREN'S HOSPITAL, SHADWELL.—Sir Buckston Browne: "Lessons to be Learnt from a Study of the Darwin Family", at 8.45 P.M.

Official Publications Received

GREAT BRITAIN AND IRELAND

Proceedings of the Royal Irish Academy. Vol. 41, Section B, No. 4: The Flora of the Turloughs, a Preliminary Note. By R. Lloyd Praeger. Pp. 37-45. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 6d.

Transactions of the Institution of Chemical Engineers. Vol. 9, 1931. Pp. 212. (London.)

Journal of the Society for the Preservation of the Fauna of the Empire. New Series, Part 17. Pp. 62. (Hertford: Stephen Austin and Sons, Ltd.) 2s.

The Royal Technical College, Glasgow. Calendar for the One Hundred and Thirty-seventh Session, 1932-1933. Pp. 449+xxiii. (Glasgow.)

Record of the Royal Institution of Great Britain, 1932. Pp. 176. (London: Wm. Clowes and Sons, Ltd.) 5s.

The Journal of the Royal Anthropological Institute of Great Britain and Ireland. Vol. 62, January to June. Pp. xxvi+192+14 plates. (London: Francis Edwards, Ltd.) 15s. net.

Department of Scientific and Industrial Research. Report of the Building Research Board, with the Report of the Director of Building Research for the Year 1931. Pp. ix+158. (London: H.M. Stationery Office.) 3s. net.

Proceedings of the Royal Society of Edinburgh. Session 1931-1932. Vol. 62, Part 3, No. 19: Filial and Fraternal Correlations in Sex-linked Inheritance. By Prof. Lancelot Hogben. Pp. 331-336. 6d. Vol. 62, Part 3, No. 20: The Diffusion Coefficients of Bromine-Hydrogen, Bromine-Nitrogen, Bromine-Oxygen, and Bromine-Carbon Dioxide. By Dr. John E. Mackenzie and Dr. Harry W. Melville. Pp. 337-344. 9d. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

Philosophical Transactions of the Royal Society of London. Series B, Vol. 221, B476: Experiments on the Development of Chick and Duck Embryos, cultivated *in vitro*. By C. H. Waddington. Pp. 179-230+plates 22-28. (London: Harrison and Sons, Ltd.)

The Strangeways Research Laboratory, Cambridge. Report for 1931. Pp. 18. (Cambridge.)

Hull Museum Publications. No. 174: Record of Additions and Activities. By Thomas Sheppard. Pp. 14. No. 175: Hull Shipping Pictures. By Thomas Sheppard. Pp. 23. No. 176: Mill and Engine Models at the Hull Municipal Museums; being an Account of some Historic Industrial Models. Made by W. Marshall. Pp. 27. No. 177: Ancient and Modern Wedgwood, exhibited in the Mortimer Museum, Carr Lane, Hull, July-August, 1932. Pp. 32. (Hull.)

OTHER COUNTRIES

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 29: The Possibility of the Entomological Control of St. John's Wort in Australia, Progress Report. By G. A. Currie and S. Garthside. Pp. 28. Pamphlet No. 30: The Binomies and Economic Importance of *Thrips imaginis* Bagnall, with Special Reference to its Effect on Apple Production in Australia. By J. W. Evans. Pp. 48+3 plates. (Melbourne: H. J. Green.)

Memoirs of the Punjab Irrigation Research Institute. Vol. 4, No. 1: An Examination of some of the Factors determining the Hydrogen Ion Concentration of Suspensions of Punjab Soils. Part 1: The Effect of Concentration of the Soil Water Suspension. By R. C. Hoon and Dr. E. McKenzie Taylor. Pp. 11. 4 annas; 5d. Vol. 4, No. 2: An Examination of some of the Factors determining the Hydrogen Ion Concentration of Suspensions of Punjab Soils. Part 2: The Variation of the Hydrogen Ion Concentration of the Soil Suspensions with Time. By R. C. Hoon and Dr. E. McKenzie Taylor. Pp. 12. 4 annas; 5d. Vol. 4, No. 3: The Conductometric Method of Analysis as applied to Soil Survey Work. By R. C. Hoon. Pp. 10+2 plates. 6 annas; 7d. (Lahore: Punjab Irrigation Research Institute.)

The Indian Forest Records. Entomology Series, Vol. 17, Part 1: Entomological Investigations on the Spike-Disease of Sandal (*Santalum album* Linn.). Part 1: An Introductory Survey of the Problem. By Cedric Dover. Pp. iii+53. (Calcutta: Government of India Central Publication Branch.) 1 rupee; 1s. 9d.

Indian Institute of Science, Bangalore. Investigations on the Spike-Disease of Sandal. 5: Report of Progress made during the Quarter ending 31st March, 1932. Edited by Dr. V. Subrahmanyan. Pp. ii+18. (Bangalore.)

CATALOGUES

Wild-Barfield Electric Furnaces for Works and Laboratories. Pp. 20. (London: Wild-Barfield Electric Furnaces, Ltd.)

Microscopes and Accessories. Pp. 112. (London: C. Baker.)

Movable, Focusing Self-sustaining Fittings for all Purposes. Pp. 8. (Hazel Grove, near Stockport: John Dugdill and Co., Ltd.)

Automatic Temperature Control. (List No. T.R.2.) Pp. 32. (London: Negretti and Zambra.)

Patent Pyrometer Controller for Temperatures up to 1400°C (2550°F). (List No. T.R.7.) Pp. 8. The Negretti and Zambra Sea Surface Temperature Recorder. Pp. 4. (London: Negretti and Zambra.)

Standard Books and Periodicals: a Reference Catalogue for Librarians, Institutions, Scholars and Collectors. (No. 393.) Pp. 154. (Cambridge: W. Heffer and Sons, Ltd.)

Newton's Epidiascopes: High Intensity Model fitted with Special Diffusion Reflectors. Pp. 6. (London: Newton and Co.)

Steel Frame Cable Hangers for Armoured Cables. Pp. 2. (Aston, Birmingham: The Electric Depot, Ltd.)

X-Ray Camera. (Ron. 33.) Pp. 2. Electrometer Triode. (Trio. 33) Pp. 2. Glass Double Monochromator. (Specmo. 32.) Pp. 4. (Delft: P. J. Kipp and Zonen.)

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