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## Scientific Books and Libraries.

WHEN the Goths overran Greece, so Montaigne relates, "the only thing that preserved all the libraries from the fire was, that someone possessed them with an opinion that they were to leave this kind of furniture entire to the enemy, as being most proper to divert them from the exercise of arms and to fix them to a lazy and sedentary life". Although an author and a 'bookworm', Montaigne himself confessed that he preferred the stimulus of conversation and debate to the "languishing and feeble motion" of the study of books, of which incidentally he too had seen examples "made of things that were never either studied or understood". One wonders how the Goths would have behaved, or what classical tag the French essayist would have quoted, had either been invited to catalogue, arrange, and house, if never to use, only that portion of the scientific literature of the nineteen-twenties that is generally admitted to be of permanent value. It is, however, idle to prophesy, for has not Mr. Belloc told us that a prophecy (when it is scientific) is always and invariably absolutely and totally wrong ?

In any event, scientific authors do not write books with the intention of pleasing or amusing, although both results have been known to follow their efforts, but with that of recording, of instructing, of stimulating inquiry by the offer of new bases, fresh views, or even the galvanism of polemics. In other words, scientific books and journals are intended to be the servants of the multitude rather than the friends of the few.

Desirable as they might individually be, a rabble of undisciplined servants would be of little use ; informative as they might separately be, a motley collection of ill-arranged, ill-catalogued, and ill-indexed books or inadequate abstract journals would do little more than represent a considerable waste of money and effort. The subject of the training of librarians for special libraries was discussed by Mr. A. F. Ridley, of the British Non-Ferrous Metals Research Association, at the recent conference at Cambridge of the Association of Special Libraries and Information Bureaux (ASLIB). When it is remembered that a chemical library, for example, has to accommodate and classify journals containing original records of research, dissertations, patent specifications, treatises and handbooks, abstracts, reviews, indexes, bibliographies, dictionaries and encyclopædias, tables and catalogues, some of broad outlook and others of narrow scope, and that the

custodian of the books is also the mentor of their readers, the specialised yet comprehensive character of his charge becomes apparent. There are said now to be appearing more than twelve hundred journals which publish at least an occasional paper of chemical interest; when to this total are added publications other than of the journal class, and the whole is then extended to include other sciences, the dimensions of modern scientific literature can be appreciated.

In every section leaders of the scientific army help us to digest the mass by summaries and criticism; abstract journals and indexes help us to follow closely the course of development in a particular direction; reports summarise the abstracts; monographs engrave the milestones and label the route; books and articles portray its attractions; some of us run in the race and others are clerks of the course, whilst many contrive successfully, often brilliantly, to combine the two rôles.

So hot has the pursuit become, so rapidly are records made and broken, that sooner or later the cry of standardisation had to be raised. Scientific men, individualists as they are in many ways, are at pains to introduce uniformity into their methods and their observations, but the librarian finds insufficient uniformity in the presentation of their published records. From the utilitarian aspect, from the point of view of the research worker or the teacher, no less than from that of the custodian, this lack of uniformity is a disadvantage which is worth analysis and some measure of co-operative agreement.

This matter also was dealt with at the Cambridge conference of ASLIB. Dr. Wilfrid Bonser discussed the ideal form in which, from the librarian's point of view, a journal should be produced. Dr. Bonser would be the first to agree that the importance lies not so much in the convenience of the library staff, although this is by no means to be overlooked, as in the fact that what the librarian can arrange correctly and catalogue accurately can be the more quickly and completely rediscovered by the user. He indicated, for example, the difficulties which an unfortunately selected title, an inconsistent size, or an inappropriate division of articles may cause. He referred to inconvenience arising from certain practices involving title-pages, contents, and index, and mentioned absurdities which irregularities in the time of appearance may produce. The price of journals is also of general concern. So far as it affects scientific periodicals collectively, the matter has reached a somewhat acute stage.

It has long been impossible for more than the fortunate few to maintain a scientific library with any pretence to adequacy, and it has now become necessary for most important libraries to allow financial considerations a measure of precedence over scientific requirements. Scientific workers, although usually securing for themselves little material profit from their investigations, generally finance on some co-operative plan the publication of their own work, so that the results of their studies may freely serve as the starting-point for the work of others; moreover, they generally find it necessary to purchase in addition reports of the work of other groups, as well as to subscribe to journals and other serial publications of ordinary business enterprise. Thus both the individual worker and the librarian, budgeting within definite, although widely different, limits, dislike violent fluctuations in price and—having for a few years subscribed to a new journal at a moderate price—particularly resent the demand for ever-increasing subscriptions for parts issued at irregular and always more frequent intervals. It is fair to add that the object of Dr. Bonser's criticism is not a British publisher.

Another paper which was read at the same conference, by Mr. H. Rottenburg, was concerned with the indexing and classification of 'one-man' collections of data. The object of the discussion was not, of course, to attempt to lay down rules, for in his methods of acquiring and preserving information perhaps more than in many other characteristics one man differs from another. The paper did, however, disclose methods which, in various hands, have proved advantageous and made suggestions which will doubtless prove acceptable. The hints which Mr. Rottenburg offered ranged from types of bookcases and the vagaries of loose-leaf binders to the use of the decimal classification.

Both the Association of Special Libraries and Information Bureaux and the Library Association have found it necessary to direct attention to the serious deterioration of documents and printed matter in public record offices and libraries, and it is satisfactory to know that steps are being taken with the view of securing the permanence of such records in the future. A committee has been appointed to consider the formation of a panel of expert translators, and the possibility of procuring greater uniformity in the size of journals is being canvassed. The report on the year's work of the Association included reference to the inquiry bureau, to the bulletin and directory, and to plans for the publication of a catalogue of the London borough libraries and the Guildhall library.

## Letters to the Editor.

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### Australoid Element in the Korannas.

IN a short paper which I published six years ago on the craniology of the yellow-skinned races of South Africa, I pointed out that the Hottentots and Korannas seemed to me to be very distinct from the Bushmen. The former have dolichocephalic skulls and are well-built men, often of tall stature : the latter are a small race with skulls that are nearly brachycephalic. The Hottentots of south-west Africa, and the Korannas of the Vaal River valley, while apparently branches of the same race, have certain distinguishing characters. The typical Hottentots are not improbably the primitive race contaminated by a considerable Bushman admixture ; while the Korannas are apparently nearer to the primitive type, but with a considerable Australoid element.

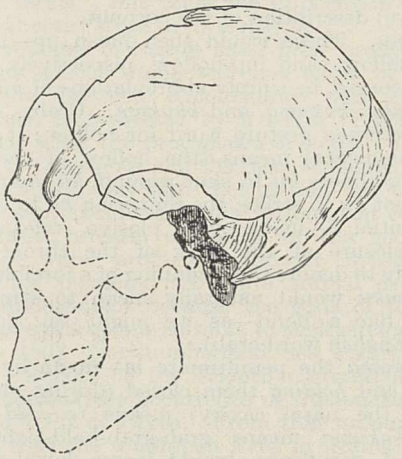

FIG. 1.—Orthoprojection of Australoid skull from Barkly West, South Africa. One quarter natural size.

A few months ago, the discovery of the Springbok skull revealed to us the fact that many thousands of years ago there lived in South Africa a large-brained powerfully built race which was neither Bushman nor Bantu, and a race which in all essentials resembles the living Korannas so closely as to leave little doubt that the Korannas are the descendants, somewhat degenerate and somewhat mixed with another race. In my paper I suggested the possibility of contamination by *Homo rhodesiensis*. Whether later discoveries will confirm this suggestion there can now be little doubt that a race has lived in South Africa with a skull which with a low brow and well-marked supraorbital ridges recalls in many ways the Neanderthaloids and the Rhodesian man.

A skull has just been discovered by Mr. G. J. van Alphen, magistrate at Barkly West, near Kimberley, which though very imperfect seems well worthy of description. The fragments of the skull were got in a deep alluvial bank at Canteen Kopje. The fragments obtained are the practically complete occiput, most of the left parietal, much of the left frontal, parts of both temporals and fragments of the right parietal, and some fragments of limb bones. As no jaws or teeth were found, it seems unlikely that the remains are from a grave. The bones are much mineralised and certainly old, but there is no satisfactory evidence to decide how old. Most probably they are much more recent than either the Boskop skull or the Springbok skull.

Fortunately, the fragments of the left side of the skull enable us to make a complete restoration of the brain case. The occiput is very long and moderately flat, and the parietals exceptionally large. As a result, the part of the skull behind the plane of the ear is unusually large. The frontal, on the other hand, is low and relatively narrow and there is a very large but thin and flat supraorbital ridge. The antero-posterior measurement of the skull is 205 mm., and the greatest breadth about 140 mm. ; the basi-trigmatic height is estimated to be also about 140 mm. The greater part of the temporal is preserved on one side or the other, so that it can be restored with confidence. The mastoid process is exceptionally well developed.

The face is entirely lost except for the upper margin of the left orbit, but as the position of the auditory meatus is certain, the face can be restored with some probability.

When the whole skull is restored it is seen to be very unlike that of the Bushman or Bantu, and only a little like that of the typical Koranna. Most probably it is the skull of a representative of the early Australoid race of South Africa, or possibly a Koranna in which the Australoid characters are unusually prominent.

In the absence of the face, it is scarcely safe to discuss the affinities further, but this skull, when added to the other early types already known—the Rhodesian, the Boskop, and the Springbok—shows that our craniological problem is by no means a simple one.

R. BROOM.

### The Original Home and Mode of Dispersal of the Coconut.

ALMOST simultaneously with the publication of my article under this title in NATURE of July 27, Dr. John K. Small, head curator of the Museums, New York Botanical Garden, published an article on "The Early History of the Coconut Palm" in the *Journal of the New York Botanical Garden* for July (vol. 30, p. 153), which reached Kew on Aug. 9.

The early history given by Dr. Small is adapted from a letter received from the late Dr. William E. Safford, a well-known authority, and it is of interest to find that he considered there seems to be no evidence pointing to the probability of its American origin.

Beccari has pointed out, as I have indicated, that the American species of *Cocos* are not nearly related to *Cocos nucifera* and that it is more closely allied to *Jubœopsis Caffra* of South Africa than to any of the so-called *Cocos* of South America. In his interesting paper, "The Origin and Dispersal of *Cocos nucifera*" (*Philip. Jour. Sci.*, **12**, Bot. pp. 27-43 ; 1917), to which I regret I did not refer in my article, he brings forward very conclusive facts against the suggested American origin of the coconut. Beccari also, from the evidence afforded by the Palmyra Islands, Cocos-Keeling, and Krakatau, produces convincing proofs that the coconut can germinate when washed ashore on coral atolls or sea beaches without human aid.

The historical points referred to by Dr. Safford, which are published by Dr. Small, seem to be worthy of wider attention, so I have extracted those of most importance.

"The supposed *Cocos* from northern South America observed by Cieza de Léon (born 1518), which through an incorrect translation was considered to be *C. nucifera*, must have been a genus of palms closely

related to *Attalea*. No early writer, so far as can be ascertained, regarded the coconut as native of America. Piso (born 1596) expressly says it is exotic, while Aublet (born 1729) states it was introduced into Guiana by missionaries. Père Breton (born 1609), a French missionary in the Antilles, planted a coconut in his garden and called it 'Palm', saying it had no other name in the West Indies, for it was an introduced species, and Hans Sloane (born 1660) said the same.

"Hernandez (born 1514), who was sent on a mission to Mexico in 1575, speaks of the coconut as growing on the west coast of tropical Mexico; and instead of enumerating its uses in Mexico he speaks of its various applications in the Philippines. Dr. Safford saw it growing at Acapulco, Mexico, the port from which the early Spanish galleons sailed to the Philippines and to which they returned with Philippine products, none of which were easier to transport than coconuts. At this port the natives now slice off the tips of flowering branches and let the sap flow into receptacles through tubes of bamboo, exactly as is done in the Philippines. More than this, 'tuba', the name given to the fermented sap by the Mexicans, is the name used for it in the Philippines and in Guam.

"Acosta (born about 1539), in his Natural History of the Indies, 1590, says that he saw a coconut growing in Porto Rico; but he does not pretend to say that it was indigenous there. Indeed we know well that Columbus and his companions, who were quite eager to find East Indian products in the Antilles, did not observe the coconut growing there. On the other hand, throughout the islands of Polynesia the coconut is called 'niu', a name identical with the 'niug', or 'niyog', of Guam and the Philippines. The Polynesian name can be traced, together with the nut, directly to the Malay Archipelago, the cradle of the Polynesian race.

"On the Polynesian Islands and in the Malay Archipelago there are a great many varieties known by distinct names, differing from one another in the forms of the nuts and in the uses to which they are applied. No such diversity of forms and uses is to be found in America, where indeed there is not a single distinctive name for the species. In pre-Columbian times it was referred to by Marco Polo (born about 1254), and by other travellers, not as *coconut* but as *nux indica*, a fact to which many authors who have discussed the coconut do not refer."

Ludovico di Varthema, who travelled in the East, between the years 1503 and 1508 (Hakluyt Soc., p. 163), enumerates ten useful things yielded by the tree "Tenga" (the coconut), and mentions with regard to the fermented juice that "it will affect a man's head by merely smelling it, to say nothing of drinking it!" His account clearly indicates the antiquity of the coconut in Calicut.

With regard to Dr. Safford's suggestion that coconuts were probably carried to America in the Spanish galleons which made regular voyages to Acapulco, this would seem to have been most likely, since the coconut would certainly have been taken as an article for food on the voyage.

As Merrill has pointed out (*Philippine Jour. Sci.*, **7**, No. 3, p. 198; 1912), the introduction of many plants of economic importance, both to America from the Philippines and in the reverse direction, can be definitely traced to these galleons, and it seems reasonable to assume that coconuts so brought over were planted by the Spaniards, and their advent in America may be traced both to this means of transport as well possibly as to ocean currents.

ARTHUR W. HILL.

DR. ARTHUR W. HILL has suggested to me that the following notes on the native names mentioned in his article in NATURE of July 27 will be of interest.

(1) *Niur*. Coconut. The gestures of tongue and lip which produce this word are:

*N*. Tongue tip elevated to close against the palate, and held closed during phonation through the nasal cavity.

*I*. Tongue tip slightly dropped to the high and forward vowel posture of *I* (as in eat or ? it) so as to produce a *small* front cavity between tongue and lips.

*U*. Lips protruded, lip opening reduced, tongue lowered and humped towards the back of the throat, so as to form an elongated hollow mouth cavity.

*R*. Tongue tip raised and curved back (the edges of the tongue-tip being in contact with the palate).

If this series of gestures be considered as an unconscious mouth-pantomime, originally associated with a general bodily pantomime which described the idea to be conveyed, then:

*Niur* would appear to mean: Up (or high, or touching the top)—little (or high)—hollow (or elongated hollow)—curved (or bent back). A "high up—little (or high)—rounded-hollow" would be a fair (primitive) description of the coconut.

*Niu*, *nu*. These would then mean up—little (or high)—hollow, and up-hollow respectively. They may, of course, be simply abbreviations of *niur*.

(2) *Kuku*, *kukuma*, and *khukum*. Crab. *Ku*, like *u*, is a common gesture word for hollow; it also (in many languages) means (the hollow of the) hand. Thus: Cantonese *ku* to shut around, *kü* to grasp, the Aryan root *ku* to strike, the Sumerian *ku* to throw.

The initial *k*—made by a 'plosive' release of the tongue closure at the back of the throat—seems commonly to denote the beginning of a forcible action. Hence *kuku* would naturally mean to stretch out forcibly like a hand—as we might say grab-grab (cf. the English word crab).

In *kukuma* the penultimate *m*—made by closing the lips and *holding* them closed (during phonation through the nasal cavity) means to *hold* closed. Hence *kukuma* means grab-grab-hold-tight; the final *a*, if significant, would mean down, that is, grab-grab-hold-tight-down.

(3) *Kelapa*, *kelambir*, *kaluku*. Coconut. *Kel* and *kal* have the forcible release *k* followed by the tongue-lifting gesture of *el* or *al* which very commonly denotes up. Compare Polynesian *ala* rise, Indonesian *al* sun, Hoka *al* sun, Doric Greek ἄλιος sun, Latin *altus*. Also *al* in native names for mountains; for example, *Al*ps, Ur*al*, Hima*l*aya—and various names for God, heaven, etc. (meaning on high), in many unrelated languages. *Ap*, *amb*, and *ku* are all gestures of closing or seizing; the terminal *a* of *kelapa* may, as before, mean down.

Hence *kelapa* may mean forcibly-up-seize-down. *Kelambir* would mean forcibly-up-hold-tight—high (or little)—bend-back (or curve). *Kaluku* would mean forcibly-up-hollow-hold.

It will be seen that all these three words are appropriate to the gestures of going up to take the coconuts.

(4) *Kukur*. Claw. *Kuku* means grab-grab, the terminal *r* means back or bent back, the word then means grab-grab-bent-back.

It is evident that if the mouth gesture of *ku* may signify either hollow or grab, there is no need to postulate a direct connexion between *ku* in words for coconut and *ku* in words for crab.

In conclusion I am tempted to refer, on my own account, to a native name for a vegetable product mentioned in NATURE of Sept. 7, namely, *copal*, the Mexican word for resin.

*Cop* (*kop*) is another gesture word meaning hollow

or enclose. Compare English *cup*, *cob* (corn, or nut), *coop*, *coomb*, *cap*, *cape*, *keep*; Latin *copia*, *caput*, *cum*, *capio*; the Semitic roots *H-p-n*, *g-'H-p*, and *K-m* meaning handful, take, quantity; Sumerian *kam* earthen jar, *gab* breast; Cantonese *kap* imbibe, *káp* jaws, *kam* grasp, *kòp* a measure; Bantu *-k'apo* sack; Polynesian *kapu* cup; Indonesian *kabo-k* goblet; Hoka (North American) *kupo* basket; Arawak (South America) *kabo* hand, *komiki* bowl.

*Al*, as we have seen, means up, on high; *copal* therefore naturally would mean cup-up, that is, the vessel fastened *up* the tree to collect the resin.

R. A. S. PAGET.

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Sept. 8.

### Adaptation.

THE present-day attitude with respect to adaptations is peculiar and to my thinking unscientific. Adaptation implies duality, an interaction between the organism and the environment. The descriptions of outstanding examples of the relationship are made in dual terms. But there the implication ends, for biological creed steps in to forbid it.

The younger biologists have been brought up in a genetic school which will not allow of such an interaction between circumstance and life. The protoplasm is possessed by a series of gods which determine what the protoplasm is to do. Variations are due to these gods and the relative degree of power they are able to develop. Let us take two examples. A blind and colourless animal is found in conditions of darkness because a section of the gods in its ancestors were producing inferior eyesight and diminishing pigment. A white animal chooses an Arctic environment because the gods of the germ-plasm gave it a colour suitable to such circumstances.

(1) In 1903 (Northumberland Sea Fisheries Committee. Report on the Scientific Investigations, p. 51) I described the occurrence of *Gammarus duebeni* in the Mill Pit at Blyth. From that account it will be seen that the amphipod lives in drains near the pit head and is liable to be carried into the pit when flooding takes place. The pit was flooded in 1887 and in 1899. The gammarids were first observed in 1893 (and were called by the men 'pit fish') in the landward workings, but they were carried by the drainage water into the second drift. The fact of time and the circumstance of a large increase in numbers about 1898 when the drainage water was dammed back for the use of the stables, show that they breed in the new environment.

The examples I obtained in 1901–2 had a dull transparent white colour, and the three red spots were absent. They were apparently blind so far as simple tests could testify. The colour was gradually regained under laboratory conditions, the degree of restoration depending upon the intensity of the light and successive ecdyses. The first exuviated cuticle was white and the second yellow to light brown in colour. The red spots appeared also and, at first very faint, gradually increased in strength of colour.

The variation therefore is reversible. But it is in this respect of importance. If, during the life of an individual still able to undergo ecdysis the stimulus of light is capable of restoring the pigment and probably the function of the eyes, it is evident that the original change was also direct and affected all the individuals successfully introduced to the conditions. In neither case is the germ plasm involved. The life in a state of darkness and the subsequent exposure to light produce results which are due simply to stimuli and the cessation of stimuli on protoplasm. After the first event of breeding of similar variants, the first generation would be exposed to the conditions of darkness from the egg-stage and the effects would be intensified. The next generation would arise from parents still more completely colourless and blind. The pit is liable to receive fresh contributions from the surface which would tend to delay the change; but even so it is evident that it would progress to a stage when restoration would be more difficult, when, instead of a succession of ecdyses, one or more generations would be required.

This is not the only case of the kind. More than sixty years ago Thomas Atthey sent to my predecessor examples of a copepod which were obtained from the damp roof of the pit workings of a colliery at Cramlington. Brady described it originally as a new species, but later identified it with Sars' *Canthocamptus pygmæus*. The references will be found in Brady's Ray Society monograph under the name *Attheyella pygmæa*. Brady said nothing about the pigment, but the queried 'eyes wanting' is significant.

It may be urged, and rightly, that the effects of the one and the other environment are just what would be expected. The variations result from the nervous capacity of protoplasm and are not inherited. They depend upon the sustained condition of the cause. But this consideration gives rise to a feeling of misgiving as to what is meant by heredity. It is plainly difficult to say where non-inheritance ends and inheritance begins. If the circumstances confine the reproduction to a section of the population, the members of which are all similar variants, then a direct inheritance results without the germ plasm being called upon to do more than start a history which is affected in similar degree in every generation. This is what might be called a conditioned or passive sexual selection. But it must be remembered that an active sexual selection is generally exhibited and has been in operation since conjugation was instituted.

Whether the change is to be inherited depends upon circumstance. An annual ring is not inherited. This brings us to the other example, the Arctic animals.

(2) It is already obvious that a similar explanation can be given in the case of northern terrestrial animals. They are affected by the seasonal alternations of heat and cold, the degree of the modification depending on temperature. The whitest of them all, the polar bear, becomes more yellow in summer and progressively white in winter. No one now seriously believes that the origin of the change had anything to do with colour protection. A physiological explanation of the change is apparent, and inheritance is assured, for all the members of the species exposed to the conditions would be similarly affected.

I beg to submit, therefore, the proposition that all adaptive variations are psychogenetic and that they are directly inherited under asexual conditions of reproduction and by the action of sexual selection in the sexual state.

A. MEEK.

Aug. 29.

### Distribution of Potential Temperature in the First 25 Kilometres over the Northern Hemisphere.

IN his communication in NATURE of June 15, p. 906, Sir Napier Shaw has emphasised the fundamental importance of a knowledge of the distribution of entropy in the atmosphere for an understanding of the physics of the general circulation.

In Fig. 1 is drawn a smoothed diagram (similar to Sir Napier Shaw's diagram on p. 116 of his "Manual of Meteorology", vol. 2) showing the latitudinal distribution of potential temperature in summer and winter of the northern hemisphere. The potential temperatures plotted (in degrees absolute) are

temperatures which the air at any place would assume if compressed or expanded adiabatically to 1000 mb. The temperature data used in the calculation are the same as those employed in preparing the diagram of temperature distribution over the earth (see NATURE, June 1, p. 834), and the monthly mean surface pressure data at the places of sounding balloon observations are taken from the isobaric maps given in pp. 218-241 of the book quoted above. The values obtained from the results of a few sounding balloon ascents over Poona (lat. 18° N.) during the winter of 1928–29 have also been used. As is well known, lines of equal potential temperature are also lines of equal entropy.

It is possible that potential temperatures over north India during the summer are exceptionally high and that the trough near Lat. 25° N. will be less marked if more data from similar latitudes in other parts of the world are available.

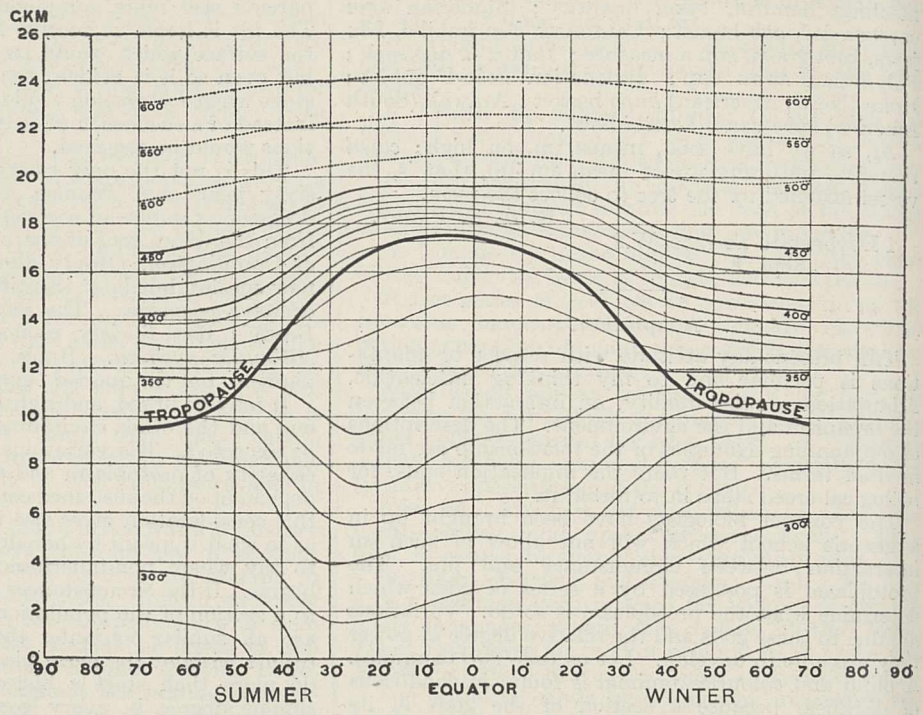


FIG. 1.—Upper air potential temperatures over the northern hemisphere.

Two interesting features (also partially shown in Sir Napier Shaw's diagram) may be pointed out:

1. The dip in the isentropics over the tropics and sub-tropics below about 12 gkm., their elevation between 12 gkm. and 20 gkm., and their pronounced concentration between 17 gkm. and 20 gkm., especially during the summer, suggest that these features are causally connected.

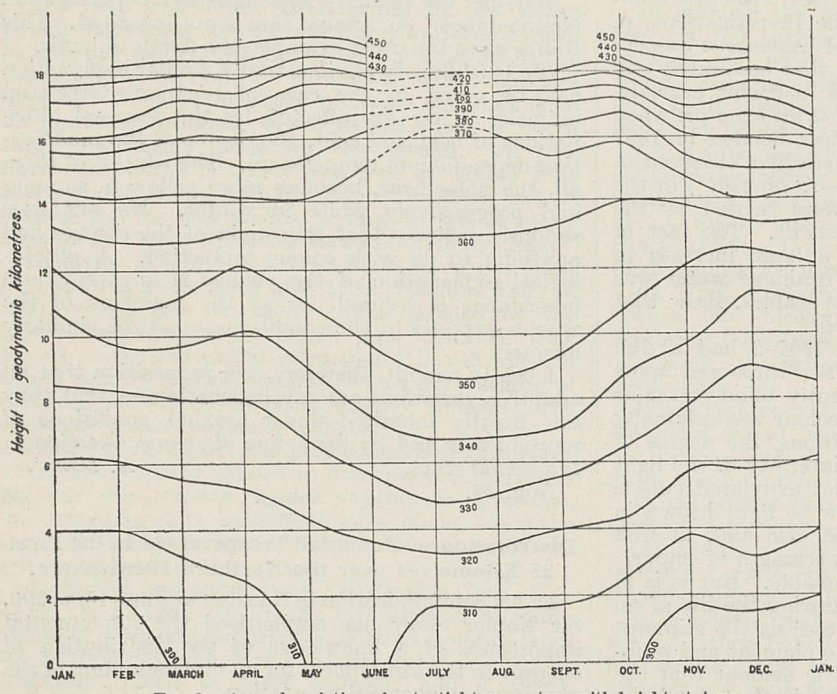


FIG. 2.—Annual variation of potential temperature with height at Agra.

2. Within the tropics during summer the isentropic lines have a downward slope towards the north practically throughout the troposphere, while between 30° N. and 50° N. they have an upward slope to about 12 gkm. Tropical storms and depressions occur mostly in the neighbourhood of this V-shaped trough in the isentropics and move from an easterly direction in the region where the isentropics fall towards the north and from a westerly direction in the region where they rise.

In connexion with Fig. 1, it may be interesting to point out the close analogy which the distribution of potential temperature in Fig. 1 bears to the seasonal variation of its distribution over Agra (Fig. 2). The influence of the high value of entropy below 12 gkm. in raising the tropopause and increasing the inversion above it is clear in both cases.

K. R. RAMANATHAN.

Meteorological Office,
Poona, 5,
India, Aug. 2.

## Effect of Atmospheric Pressure on the Frequency of a Tuning-fork.

DUE to the necessity of obtaining accurate values of high frequencies in radio communication, the establishment of a frequency standard of high order of accuracy has already been undertaken in various countries. The usual method is a single frequency standard system. It naturally requires an ideal

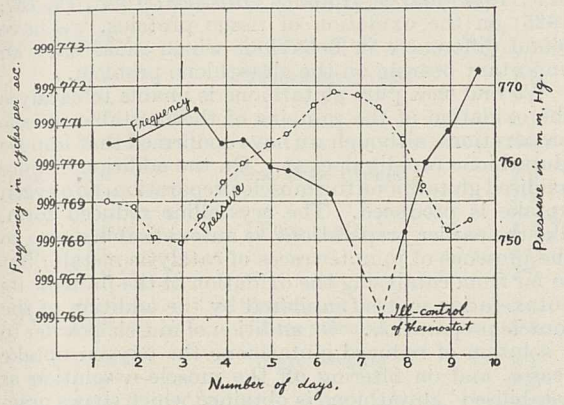


FIG. 1.

vibrator of extremely high order in constancy. A valve-maintained tuning-fork, according to Eccles, has been widely employed.

For the same purpose, one of the valve-maintained tuning-forks of 1 kc./s., made of elinvar steel, has

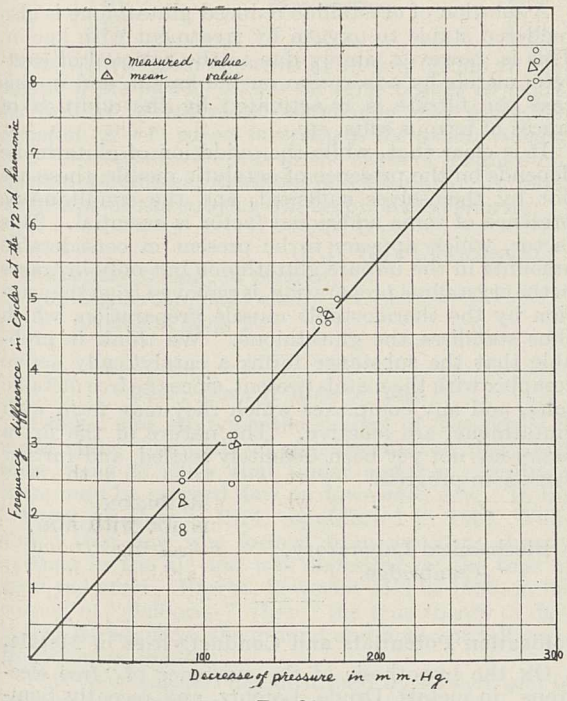


FIG. 2.

been maintained at this Laboratory since 1928. All the possible sources of frequency variation have been examined and reduced as much as possible; namely, effects due to temperature, electrical sources, output load, humidity, and surrounding conditions. The results of frequency measurement which are accurate to within one part in a million have shown that the effect of atmospheric pressure should not be neglected.

One example is shown in Fig. 1, which represents the result obtained from observations carried out over a period of ten days, and it clearly shows the effect. It also shows that the fork does appreciable acoustic work when it is in vibration, and the air-loading varies the damping of the fork, which in turn changes its frequency, as indicated by A. B. Wood (*Jour. Scientific Instruments*, vol. 1, No. 11, p. 330; 1924). Wood, referring to forks of low frequency, states in his paper that the direct effect of damping on frequency is quite negligible compared with that due to other causes, but when other factors are sufficiently reduced the effect will be predominant.

With the view of verifying this fact, the fork was tested in the pressure chamber, and the results are shown in Fig. 2, which gives the relation of the frequency difference in cycles at the seventy-second harmonic to the decrease of pressure in millimetres of mercury. It indicates that the relation is linear within the accuracy concerned, and the sense of the variation justifies my theoretical reasoning. The pressure-coefficient of frequency of the fork in air was $-(2{\cdot}7_7 \pm 0{\cdot}05) \times 10^{-7}$ cycle per mm. of mercury change of pressure.

Y. NAMBA.

Electrotechnical Laboratory,
Ministry of Communications,
Tokyo, Japan, July 15.

## Raman Effect from Powdered Crystals.

RECENTLY it was desired to obtain by Raman observations, information as to the effect of solution on the infra-red vibration-frequencies of groups in crystals. But so far, observations on solids have had to be restricted to such substances as can be obtained in large clear crystals.

An attempt was made to obviate this difficulty by immersing crystals in a liquid of the same refractive index. This was found to be made difficult by the optical anisotropy of the crystals and by the differing dispersions of the solid and of the surrounding liquid.

It was then thought worth while to try if repeated reflection from the crystal surfaces would give rise to Raman radiations. Light from a quartz mercury vapour lamp was sent into some coarsely-powdered potassium nitrate crystals contained in a small (100 c.c.) flask, and the light which issued from the side of the flask was observed with a Hilger *C.D.* glass spectrograph (suitably screened from the source). Thus the spectrum was obtained of the light which had been reflected many times from the surfaces of the crystals (and doubtless transmitted through crystals as well).

In the spectrum, the lines of mercury were very strong, but two new lines appeared having frequencies 23651 cm.$^{-1}$ and 21885 cm.$^{-1}$. These two new lines were extremely sharp. Treated as shifts, they correspond to shifts to the red of 1053 cm.$^{-1}$ and 1052 cm.$^{-1}$ from exciting frequencies 24704 and 22937 respectively.

In order to confirm that these new lines were really due to the potassium nitrate crystals, another exposure was made with conditions unaltered except that crystals of potassium bromide were now used, of a similar degree of coarseness. The lines were absent, as would be expected, since potassium bromide will not have Raman radiations in this region at all.

It is concluded that the shift 1052 cm.$^{-1}$ is due to the inactive fundamental of the $NO_3$ group, especially as the inactive fundamentals appear with great intensity in the Raman effect. The wave-length corresponding to the shift is 9·52 $\mu$, and this is of the right order.

Thus it is clear that Raman spectra can be obtained

using powdered crystals, so that a large field of observation is opened up.

I propose to explore this field, determining first the best arrangement of apparatus, and then making observations on different salts in powder form. It is hoped that even opaque powders can be dealt with in this way. A. C. MENZIES.

University College,
Leicester, Sept. 23.

### Fossil Laterite from Southern Queensland.

IN view of the diverse opinions held by pedologists as to the occurrence of laterites in extra-tropical regions, I wish to direct attention to what I regard as a true laterite in Southern Queensland.

Some authorities, of whom one need mention only Glinka, appear to hold that true laterites are confined to tropical regions of heavy rainfall and that laterites reported from extra-tropical regions are either (i.) not true laterites, (ii.) are developed where climatic conditions closely resembling those of the humid tropics exist, or (iii.) are fossil soils which were originally developed under tropical conditions. In the case under discussion the laterite appears to be true to type, but the climatic conditions are far removed from those considered by Glinka as necessary for the formation of laterites, so that the most reasonable explanation would seem to be to consider the soil a fossil laterite.

At many places about Brisbane there occur deep red soils to which the somewhat comprehensive adjective 'lateritic' may be safely applied, but the occurrence to which I wish to direct attention is at Scarborough, a seaside resort twenty miles north of Brisbane and in Lat. 27° 15′ S. The average annual rainfall of the locality is 47·5 inches, of which 32·5 inches falls in the summer between Nov. 1 and April 30. The highest monthly average is February with 6·64 inches, and the lowest August with 1·57 inches. No temperature records are available for the spot, but those of Brisbane should be close enough to give a general indication of conditions at Scarborough. The Brisbane figures are: Mean annual shade temperature, 68·9°. The highest monthly mean is 77·0° (January), and the lowest, 58·5° (July). The natural vegetation at present growing on the laterite is open savannah forest characterised by eucalypts with a ground covering of grasses and herbaceous plants.

A typical section of the soil at Scarborough gave the following profile:

| | |
|---|---|
| Red-brown soil, with definite crumb structure | 2 ft. 6 in. |
| Brick-red soil with crumb structure | 3 ft. 6 in. |
| Red soil thickly studded with rounded black ferruginous concretions ⅛ in. to ½ in. in diameter | 2 ft. 3 in. |
| Red and white mottled horizon with larger less regular ferruginous concretions | 3 ft. 6 in. |
| Red-brown and purple reticulate and cellular ironstone in parts mottled with white clay | 3 ft. + |

The uppermost horizon is the least lateritic. May this indicate a tendency of the soil towards a condition more nearly in equilibrium with the present climatic conditions?

A more detailed account of this occurrence is at present in preparation as a contribution to the *Proceedings* of the Royal Society of Queensland.

W. H. BRYAN.

The University of Queensland,
Department of Geology,
Brisbane, July 25.

### A Crystalline Tripeptid from Living Cells.

THE sulphur-containing tripeptid glutathione was originally obtained by Hopkins (*Biochem. Jour.*, **15**, 286; 1921) as a slightly impure non-crystalline powder. Hopkins has now succeeded in obtaining the substance in a pure crystalline form (NATURE, Sept. 21, p. 445). On repeating with this pure glutathione the experiments of Hopkins and Dixon (*Jour. Biol. Chem.*, **54**, 527; 1922) and of Hopkins (*Biochem. Jour.*, **19**, 787; 1925) on the oxidation of tissue proteins, we have found differences in behaviour which must have an important bearing on the glutathione problem.

We find that pure glutathione is unable to catalyse the oxidation of the proteins of thermostable muscle preparations, although we have confirmed that impure glutathione rapidly does so. On the addition of pure oxidised glutathione to a muscle preparation, no oxygen uptake is produced. The crystalline reduced form, like the earlier preparations, is autoxidisable owing to the presence of minute traces of catalytic metals; but so far from catalysing the oxidation of the proteins its autoxidation is itself inhibited by the addition of the muscle preparation. On addition of muscle powder to a solution of reduced glutathione the oxygen uptake ceases, and on filtering off the muscle a solution of 'stabilised' glutathione is obtained which shows practically no oxygen uptake. This effect is not due to removal of catalytic metals by the muscle, for the stabilised glutathione solution is not rendered autoxidisable by the addition of iron or copper salts or hæmatin, even in considerable amount. It is, however, re-activated by the addition of a small amount of impure glutathione.

A solution of crystalline reduced glutathione is also rendered stable to oxygen by treatment with kaolin. This is, however, simply due to the removal of catalytic metals by adsorption on the kaolin, and in this case the filtrate is re-activated by the addition of traces of ferrous salts, etc.

It is clear that, while the oxidation of glutathione depends on the presence of catalytic metals, these are not by themselves sufficient, and the simultaneous presence of some additional factor is essential. This factor, which appears to be present in considerable amounts in the impure glutathione but only in traces in the crystalline preparation, is removed from the solution by the thermostable muscle preparation, which thus stabilises the glutathione. We think it probable that the substance forms a catalytically active complex with the metals present, since the free metallic salts, and any complexes which they may form with glutathione, are inactive. The nature of the extra factor has not yet been definitely settled, and further work is in progress.

M. DIXON.
N. U. MELDRUM.

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Cambridge.

### Ionisation Potentials and Conductivities of Metals.

ON the hypothesis of the existence of 'free electrons' in metals, Drude, Lorentz, and recently Sommerfeld have explained the Wiedemann and Franz law, namely, that the ratio of the thermal and electrical conductivity is the same for all metals, and is proportional to the absolute temperature. In a paper by Mukherjee and Ray, to appear shortly, the authors, in order to explain the conductivity of metals, have pictured the 'valency shells' of the neighbouring atoms as touching each other, and thus forming a large equipotential surface in the metal crystal. Electrons in this surface travel freely without

doing any work, and in this restricted sense they are termed 'free'.

Now if these 'free electrons' are really responsible for electrical and thermal conductivity, it is only natural to expect a relationship between the ionisation potential and electrical (or thermal) conductivity of any metal atom. The following table shows the relationship, where $N$ represents the atomic number, $K$ the electrical conductivity, and $I$ the ionisation potential. The values of $K$ are taken at 0° C.

| Group. | Element. | Structure of Crystal. | $\frac{1}{KNI} \times 10^8$. |
|---|---|---|---|
| I. | Na | Body centred cube | 7·8 |
| | K | ,, | 8·0 |
| | Rb | ,, | 8·1 |
| | Cs | ,, | 8·5 |
| II. | Zn | Hex. close packed | 2·0 |
| | Cd | ,, | 1·8 |
| III. | Al | Face centred | 3·3 |
| | In | ,, | 3·0 |
| | Tl | ,, | 3·5 |
| IV. | Sn | Tetragonal cube | 3·5 |
| | Pb | Face centred | 3·3 |
| V. | As | Body centred | 9·2 |
| | Sb | ,, | 9·0 |
| | Bi | (?) | 18·0(?) |
| VI. | Cr | Body centred | 1·6 |
| | Mo | ,, | 1·4 |
| VIII. | Fe | Body or face centred | 4·7 |
| | Ru | Hex. close packed | 4·3 |
| | Co | Face centred or hex. close packed | 4·24 |
| | Rh | Face centred | 1·34(?) |
| | Ni | Face centred | 2·74 |
| | Pd | ,, | 2·70 |

The above table shows that in any group of elements, *if the metals possess the same crystal structure, the product of electrical conductivity and ionisation potential* ($K \times I$) *varies inversely as the atomic number* ($N$). Discrepancies occur in the cases of magnesium, calcium, strontium, rhodium, and bismuth. A fuller treatment of the subject will be published shortly.

B. B. RAY.
D. P. ROY CHAUDHURI.

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Calcutta, Aug. 22.

## Dew: Does it Rise or Fall?

WHEN I was studying the subject of dew-ponds, I made many hundreds of experiments on dew, and these went to show that under suitable conditions there may be upward dew or downward dew. In his "Essay on Dew", 1814, republished in 1866, Wells stated that dew was formed from moisture already existing in the air and was deposited on the tops of good radiators. Blythe, however, said in 1836, in his edition of "Selborne", that "the true theory of dew is that it rises from the ground and does not fall, as is the common opinion".

This view was also demonstrated by Aitken, and in certain circumstances I found that it is true. On some nights an inverted tray was found to be bedewed only on the underside, and the undersides of stones were also moist with dew. This dew must have been formed from the moisture which had arisen from the soil with radiant heat after nightfall. But the fact remains that most of the dew is found on the upper-sides of radiating materials, and it seems to follow that it 'falls', although the distance through which it falls cannot be great. It is where there is the greatest radiation of heat that it is deposited, and this is as a rule on the uppermost sides of grass, stones, feathers, or cotton wool, etc.

It seems to stand to reason that the moisture already in the atmosphere near the soil will be the first to fall below dew-point, although this may be difficult of proof. My point in writing is to suggest that according to the conditions prevailing either theory is correct.

EDWARD A. MARTIN.

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S.E.25.

## The Translator of Newton's "System of the World".

NEWTON'S book, the "System of the World", has laboured under two uncertainties, the first as to its authorship, the second as to the translator of it into English. The first uncertainty, raised by De Morgan in his "Budget of Paradoxes" (1872, p. 83), has been removed, but the second still prevails, according to G. J. Gray's "Bibliography of the Works of Sir Isaac Newton", second edition, 1907, p. 20. I wish to prove that it was translated by Andrew Motte, the translator of the "Principia". This follows conclusively from a comparison of the translation of a practically identical passage of about 850 words in the "Principia" and in the "System of the World". No two independent translators could use language so very nearly identical. Consider, in particular, a critical phrase in that passage ("Principia", Bk. 3, Prop. 41, Example; "System of the World", Paragraph 67): "Nam quod dicitur Fixas ab Aegyptiis comatas nonnunquam visas fuisse". The translation of "comatas" caused trouble and was rendered in both books by the use of three words, "coma or capillitium", the whole phrase being translated, "For as to what is alleged that the fixed stars have been sometimes seen by the Egyptians, environed with a coma or capillitium". Such singular coincidence in a free translation makes it certain that both books are rendered into English by the same translator.

FLORIAN CAJORI.

University of California.

## Structure of Trebly Ionised Chlorine.

WHILE investigating the nature of spectra given by halogens in their different states of ionisation, I came across certain lines of chlorine which I found as arising from its trebly ionised state, due to the transition $M_2(N_1 - N_2)$. The fundamental transition has been investigated by Bowen and the differences are taken from his paper (*Phy. Rev.*, **31**, 36; 1928). The differences are ${}^3P_0 - {}^3P_1 = 362$; ${}^3P_0 - {}^3P_2 = 1434$. The chief lines of the group $M_2(N_1 - N_2)$ have been thus located: ${}^3P_2{}^3D_3$ at $\nu = 34918$; ${}^3P_2{}^3P_2$ at $\nu = 37227$; and ${}^3P_2{}^3S_1$ at $\nu = 38554$. The singlet system and the intercombinations have also been obtained: thus ${}^1P_1{}^1P_1$ at $\nu = 38088$. The difference ${}^3P_0{}^1P_1 = 1643$.

SURESH CHANDRA DEB.

Physical Laboratory,
University of Allahabad,
July 25.

## *Conocephalum conicum.*

I HAVE just come across a rather fine quantity of this interesting hepatic in the fruiting condition. The plant is well established in that particular place, and I shall be delighted to forward the material to anyone who is engaged in the working out of the cytology, etc., of the fructifications.

A. G. LOWNDES.

Marlborough College,
Wilts.

## The Species Problem in the Light of Genetics.[1]

By J. B. S. HALDANE.

DARWIN held that the differences between species were due to the accumulation of such smaller differences as distinguish varieties within a species. Since the rediscovery of Mendel's papers, a vast amount of work has been done on the genetical basis of intra-specific varieties, and a smaller, but still considerable amount, on the genetics of specific differences.

Intra-specific differences, so far as they are hereditary, can be classified as due to one of the following causes :

1. Extra-nuclear 'factors', or plasmons. These are inherited entirely or almost entirely through the mother. They cause many of the differences in chloroplasts between different plant varieties, the plastids being handed on maternally as more or less independent units. They may also interact with nuclear factors to alter such characters as the development of the anthers. They are not certainly known in animals.

2. Single intra-nuclear factors, or genes. An enormous number of varietal differences, in both wild and domesticated organisms, have been shown to be due to one, or a small number of genes.

3. Multiple genes. Quantitative differences are often due to the action of a number of genes. In some cases an apparently continuous varying character can be shown by careful analysis of individuals to be determined in this way. Moreover, Fisher has shown that the correlations found for human stature between relatives by Pearson and his pupils are in quantitative agreement with expectation on the hypothesis that they are due to multiple genes.

4. Differences in the arrangement of genes within a chromosome. Sturtevant has shown that different geographical races of *Drosophila melanogaster* differ in the order of the genes in a chromosome, as determined by linkage experiments. A section of a chromosome of one race appears to have been reversed in the other. Similar results have been produced by Muller with X-rays.

5. Differences in chromosome attachment. A chromosome of one variety may be represented by two smaller bodies in another, as in *Zea Mays*, or a fragment may be attached to different larger chromosomes in different varieties, as in *Drosophila melanogaster*.

6. Unbalanced differences in the amount of chromatin. One or more chromosomes, or portions of them, may be represented once, thrice, or four or more times in a variety, as compared with twice in the type. This is not only the genetical basis of sex in most organisms, and of intersexuality and other abnormalities in some, but also occurs in varieties of other types. For example, some fatuoid oats, and most cultivated sweet cherries, have one or two chromosomes in addition to the set characteristic of the species. In this condition some genes are represented three or four times, the majority twice. This generally produces a greater effect on the visible character than results from a trebling or quadrupling of the haploid number of all the genes at once.

7. Polyploidy. The number of chromosomes is here two, three or more times as great in one variety as in the other. This generally results in an increase of size, but often the visible effect is very small indeed, far less than that of many single factors or of an unbalanced difference in chromosome number. But it invariably results in a certain degree of physiological isolation. Not only is there often difficulty in crossing a diploid and a tetraploid, but also, if the union is fertile, the hybrid is generally a triploid, and therefore much more sterile than either parent owing to irregularities in meiosis.

Differences of all these types have arisen in animal and plant races under observation, and all but the first have been produced experimentally. So far as I know, there is no clear evidence that any intra-specific hereditary variations are due to causes other than these, though it is possible that the list is not yet complete, and some of the cases ascribed to multiple genes demand much further study.

The assertion is still occasionally made that characters inherited in a Mendelian manner are pathological. This may, I take it, mean one of two things. The character may be supposed to be disadvantageous to its bearer. Much of the variation in shell pattern of wild *Cepea nemoralis* is due to two factors. Diver has shown that the four races produced by the interaction of these factors have been in existence in England since Neolithic times, and although it is conceivable that one race may have some slight advantage in a particular environmental niche, there can be no such advantage in the country as a whole, or selection would have eliminated certain of the types. Naturally, however, most variations from the normal are disadvantageous in a normal environment, and are therefore eliminated by natural selection. Many mutants are definitely shorter lived or less fertile than the type. But Pearl and his pupils have shown that in artificial conditions some of the mutant types of *Drosophila melanogaster* are more fertile than the type, others longer lived. Such mutants cannot be called pathological.

Secondly, it may be meant that a Mendelian character is pathological because it is due to injury. Mutants are produced in large quantities by X-rays, and it may be that much of normal mutation is due to the $\beta$- and $\gamma$-rays from potassium, other radioactive substances, and cosmic radiations. I can see no reason why such mutation should be regarded as more pathological than photosynthesis or sunburn. It is probably a prerequisite of evolution, and its effects are not necessarily harmful either to the individual or the species, though often so to the individual.

[1] Paper read to the Society for Experimental Biology on June 15.

Inter-specific differences are largely due to the same causes as intra-specific. In general, they can only be analysed genetically where the species can be crossed. But this is not always the case. For example, the order of the genes in the chromosomes of different species of *Drosophila* can be shown to be nearly, but not quite, the same. The linkage values of homologous genes are somewhat different in the mouse and rat. Since the yellow *Primula acaulis* and related species differ from the purple *P. Juliae* by the loss of a gene needed for anthocyanin formation, it is very plausible that other yellow Primulas also lack this gene.

Differences in chromosome number and arrangement can, of course, also be observed apart from crossing. A few examples of inter-specific differences will now be given under the same classification as that adopted for intra-specific.

1. In a number of plant species crosses, one of the $F_1$ hybrids is vigorous, while the reciprocal has defective plastids, and is yellow or variegated. Renner regards this as due to the inviability of the maternally inherited plastids in the presence of the hybrid nucleus. A very clear case of a plasmon causing sexual abnormality after species crossing occurs in *Geranium* (unpublished work of the late Mr. Newton). There are probably analogous cases in animals; indeed, wherever adult reciprocal hybrids of the homogametic sex differ, extra-nuclear inheritance may be suspected.

2. Mendelian segregation for some characters in $F_2$ is very common. Apart from cases where varietal characters of one species still behave in a Mendelian manner after the crossing, some of the actual specific characters are so inherited. Sometimes, however, the ratios in $F_2$ diverge markedly from expectation.

In plants the genes by which species differ often cause striking differences. Thus Chittenden showed that the purple *Primula Juliae* had no gene for plastid pigments, the primrose none for anthocyanin. Hence white flowers appeared in $F_2$. On the other hand, the colour genes distinguishing crossable rodent species cause rather smaller changes, and are multiply allelomorphic with genes causing the sharp differences distinguishing domestic varieties. Thus *Cavia porcellus* has a gene for yellow-bellied agouti, *C. rufescens* for agouti-bellied agouti, both allelomorphic with the gene found in the well-known black variety.

3. When species are crossed the $F_1$ is generally uniform, the $F_2$ variable, often differing among themselves more than do the parent species. This fact is, of course, the principal reason why hybridisation is employed in horticulture to obtain striking new forms The phenomena can be exactly paralleled in varietal crosses, and are probably due to multiple gene differences.

4. The order of the genes is slightly different in *Drosophila melanogaster* and *D. simulans*, and probably in other *Drosophila* species which cannot be crossed.

5. There is strong cytological evidence for this when the chromosomes of different species are compared, and fairly good genetical evidence both in *Drosophila* and mammals. Thus the gene the loss of which converts a grey mammal into a yellow is sex-linked in cats but not so in rodents, suggesting that a corresponding gene is carried by the *X*-chromosome in the cat, by another chromosome in rodents.

6. Unbalanced differences of this type between species probably occur in *Viola* and some other genera. They are not, however, quite so well authenticated as types 5 and 7.

7. This type of difference is very common in plants, and extremely rare in animals. For example, in *Rosa*, species with 14, 28, 42, and 56 chromosomes are known, besides species with intermediate numbers, which are probably hybrids.

It is obviously impossible to state that all inter-specific differences can be explained on these lines. It is, however, doubtful whether any differences are known which cannot be so explained. In view of the very great morphological and physiological differences produced by single genes, there is no reason to doubt their capacity for causing inter-specific differences of these kinds, which are often less striking than varietal differences. The stumbling-block in the past has been the failure to find, between varieties, the physiological barrier which often prevents the effective crossing of species. This failure was regarded as a serious but not fatal objection to Darwinism by such men as Huxley and Romanes. It has now been completely overcome. Let us consider, for example, *Primula sinensis* and its tetraploid variety *gigas*. Every plant of these forms in England is descended from the same few seeds brought over from China in 1819–26. The giant tetraploid form has originated on several occasions in cultivation since 1900. Tetraploid pollen on the diploid stigma has never produced a single seed. The reciprocal cross, though very extensively made, has produced about a dozen hybrids. These hybrids are often triploids, and hence have irregular reduction divisions, and are far less fertile than either parent. We have thus a complete analogy to the case of true species, and indeed some geneticists regard such tetraploids as new species. Such tetraploidy can sometimes be produced by injury of the diploid plant. This produces a tetraploid branch, and if this branch is self-fertilised, the seedlings are tetraploids. Incidentally, this is the only case known to me in which a *somatically* acquired character is transmitted by sexual reproduction.

Phenomena similar to those found in the $F_2$ of species crosses may be produced by the action of small numbers of genes. Thus Gonsalez found the following expectations of life in days for *Drosophila melanogaster* females. The characters are recessives and combinations of recessives two or three at a time.

| | |
|---|---|
| Wild | 40·6 |
| Purple (eye) | 21·8 |
| Arc (wing) | 28·2 |
| Speck (axilla) | 38·8 |
| Purple, arc | 32·0 |
| Purple, speck | 23·0 |
| Arc, speck | 34·7 |
| Purple, arc, speck | 40·7 |

Clearly this last combination represents a physiological balance as good (under the artificial culture conditions) as the normal. All other combinations are below the viabilities of the triple dominant or the triple recessive. It is well known that when species are crossed, the $F_1$ generation, though itself often vigorous, produces gametes and zygotes less vigorous than those of the parental types. In some cases I conceive that related species are simply those genotypes, out of a large possible number, which possess the highest viability.

I contend, then, that all specific differences so far analysed may be due to the cumulative action of known types of varietal difference. Whether they actually are so is another question, but on the principle that *entia non sunt multiplicanda praeter necessitatem*, we are justified in assuming, as a provisional working hypothesis, that they are. The question as to how species arise in Nature is a much more complicated one. Natural selection undoubtedly occurs; on the other hand, the environment may influence the rate of mutation, and it is probable that mere chance plays a certain part in establishing new types. Many other causes of evolution have of course been postulated. Which of these processes is the more important is a matter which can only be decided by observation of Nature, and not by experiment alone.

## Aspects of Psychology in Education.[1]

By Dr. C. W. KIMMINS.

ONE of the most significant of recent movements in education is the change of attitude towards the mental development of the very young child. Until comparatively recently, the physical condition of the child up to the age of six years was the only matter that appeared to need serious attention. Educationists and psychologists now, however, at long last, fully realise that the period from two to six years of age is far and away the most important of the child's life. In other words, there must be a really sound foundation if a satisfactory superstructure is to result in the child's development. The mental as well as the physical welfare of the young child must receive adequate attention. The reliable evidence we possess that many of the cases of serious mental trouble in later life may be traced to unwise treatment in early childhood is a case in point. During this period of active habit formation, when the necessary sublimation of nascent instinctive impulses is relatively an easy matter, the value of intelligent guidance is too obvious to need further mention.

As if to make up for the neglect of past years of the importance—the extraordinary importance—of a fuller knowledge of the beginnings of education and the dawn of intelligence of the young child, there has been of recent years a concentration of investigation on this period by distinguished experts, which has fully compensated for the lack of adequate research in earlier times. The manifest difficulty of discovering by direct observation how the very young child approaches and overcomes obstacles in the great adventure of becoming acquainted with the nature of his strange environment, has to a very considerable extent been aided by experiments with the more intelligent animals.

The great value of this type of investigation is that tasks of varying difficulty can be given to the animals, such as the improvement on repetition, the memory of success in an earlier experiment in attempting a more difficult task of the same nature and so on, can be carried out and conclusions reached. Obviously, it would be impossible to make a young child go through a long series of conditioned experiments, and thus acquire a knowledge which can be obtained so readily by experiments with animals. When isolated experiments of a like nature were carried out with young children, the similarities of response and the means adopted in reaching the desired end were very significant.

The remarkable difference which exists between the child's world and that of the adult presents very serious difficulties in the study of young children. This has, in the past, given rise to much serious misunderstanding as to the real attitude of the child to life. A fertile source of this difficulty is to expect a child to adopt the adult position before the appropriate time in his mental growth has been reached. Long after speech has been acquired, the meaning of a simple expression, in exactly the same words, may convey to the mind of the child something entirely different from the meaning which it conveys to the mind of the adult. Much work in this connexion has been carried on in recent years with considerable success. Many attempts have been made to summarise the main points of difference between the two worlds.

The astounding progress made in the past twenty-five years in our knowledge of the pre-school child must be referred to not only for its intrinsic importance, but also because original work at this stage of development has had such a beneficent effect in popularising education, especially in its social implications. In the school we have a sufficiently large number of children for observation, and possibly for experiment. We can generalise and compare group with group. But the pre-school child is a thing apart, and the nursery is the nearest approach to the class-room. On the physical side the pre-school child is within reach of experts. The local doctor, the mother and the nurse, or other attendant, possess, or should possess, a fair knowledge of childish ailments. On the mental side, however, there is a lamentable deficiency of anything in the nature of expert guidance, the general opinion being that this side of the child's development can safely be neglected until the child goes to school.

We have already pointed out the folly of such

[1] From the presidential address to Section L (Educational Science) of the British Association, entitled "Modern Movements in Education", delivered at Cape Town on July 25.

a generalisation. The pre-school period is singularly rich in the opportunity it offers for wise, expert assistance. Parents, however, are now beginning to realise how remarkably clever their young children are, and what native ability they possess of overcoming obstacles which present themselves.

The period of about three to six years of age is characterised by abnormal imaginative power. This is the stage at which the invisible friend or other childish fantasy makes its appearance. At three years of age the child fully recognises himself as a separate entity in the environment. During this imaginative period the child delights in making up stories, and many of those which have been recorded exhibit a very remarkable ability in this direction.

A careful study of childish *naïveté* affords ample evidence of the very considerable ability of the pre-school child. It reveals interesting glimpses of the mental make-up, the quaint judgments, the curious application of words the true meanings of which are imperfectly understood, and the child's sense of justice. In many ways such a study is far more interesting than that of the school child, whose submission to authority has somewhat diminished his originality and standardised his outlook on life.

This greatly increased interest in the mental welfare of the young child has naturally resulted in a renewed demand for a better provision of institutions, such as nursery schools and kindergartens, concerned with the care and education of pre-school children with a range of age of two to six years.

Apart from the new attitude to the pre-school child, the most important movement in education since 1905, the date of the last meeting of the British Association in South Africa, is the coming of the intelligence test and its incorporation as an essential element in the general scheme of education. Probably more research has been carried out in recent years in connexion with tests for intelligence than in any other department of educational activity. Even if only rough approximations could be secured in the measurement of native ability, the advantage of such a discovery would naturally make a very strong appeal to the mind of progressive educationists. The researches of Binet and Simon clearly pointed the way to the attainment of a means of estimating innate intelligence. As a consequence, the Binet-Simon scale has been the starting-point for an enormous amount of original research on a subject which was destined to yield a rich harvest to the investigator if a really satisfactory working method of testing native ability could be obtained.

Various revisions of the scale have been adopted in different countries and improvements have been, and are still being, made. We are as yet very far from having reached the ideal form of intelligence test, but sufficient has already been done to show by actual experience, in a variety of ways, the remarkable value of individual and group tests.

Intelligence tests in connexion with school organisation are found to be of great value as an additional factor in promoting children from class to class. It is evident that, as there is such a wide range of native ability in boys and girls of the same age, anything in the nature of a rigid chronological basis in school classification must be profoundly unsatisfactory. Not only that; imperfect classification may, and frequently does, inflict very serious injury on the misplaced child. The super-normal boy or girl placed in classes with children of the same age, but of markedly inferior ability, runs a great risk of becoming an exceptionally lazy person, though he or she may without the slightest difficulty be at the top of the form or class, and be the recipient of wholly unmerited praise.

In the *Begabten Schulen* in Germany, where, in the final selection for admission, the results are based almost entirely on the intelligence quotients of the candidates, one cannot fail to be greatly impressed by the ease with which these children, without any undue pressure, can successfully cover as much ground in one year as normal children would require at least two years to accomplish. In the days to come we shall give far more attention to the super-normal child than we do at present. One of the many virtues of the Dalton plan, which is having a profound effect on English and American education, is that it makes ample provision for the super-normal child.

A very promising direction in which intelligence tests may render invaluable assistance is to be found in vocational guidance. In view of the enormous—and ever increasing—expenditure on education, it is remarkable that until recently so little attention has been given to the successful marketing of the produce of our schools. The 'after-care' agencies—frequently voluntary organisations—have done excellent service in various districts in looking after the interests of children seeking employment on leaving school. Their activities have, however, been largely of a social order, involving securing information as to the reputation of firms employing children and the conditions of labour, the possibilities of advancement, and so on. The members of such welfare committees often keep in touch with the employees and advise the children when difficulties, which by friendly co-operation can be adjusted, occur in connexion with their employment. The frequent changes of employment, which have such a demoralising effect on children, may be diminished to a marked degree in districts which are fortunate in possessing a really efficient after-care committee.

The judgment of the school as to the type of employment for which a particular child is suited is also of considerable value. Without underestimating in any way the importance of the beneficent effect resulting from the various after-care agencies on the future welfare of the children, it is evident that if by intelligence and specially devised vocational tests, a clear statement could be made, on a scientific basis, as to the kind of occupation, or group of occupations, in which a child, on leaving school, may find the fullest expression for any native ability which he is found to possess, it would be of the greatest possible service.

Indeed, it is not unreasonable to hope that, in

days to come, every boy (and girl) on leaving school will have reliable information as to the kind of work in which he can most effectively use the ability he possesses, with pleasure and satisfaction to himself and to his employer. In this case the hopeless situation involved in 'the square peg in the round hole' will tend to disappear.

In dealing with modern movements in education it is necessary to make a passing reference to the great possibilities offered by the cinema and the wireless. Experiments in various directions have been, and are still being, made to explore methods which may result in one, or, still better, both, playing a useful part in modern schemes of education. The natural objections raised to purely visual or purely auditory instruments in educational procedure may be met within the near future by the speaking film or the synchronisation of the normal educational film with the loud-speaker, thus eliminating the obvious necessity of the film lecturer.

The comparative failure of the so-called educational film in picture houses is largely due to the attempt to satisfy the student, and at the same time to secure the interest of the larger *clientèle* of the picture palace, the popular audience, which is rendered necessary for financial reasons. During the sitting of the Cinema Commission, an investigation was made of the popularity of different types of film among the school children frequenting picture palaces. In practically every case the educational film was at the bottom of the list. It did not appear possible to meet the claims of the two classes of patrons, although praiseworthy attempts were made to produce exceptionally good results from the point of view of successful production. For educational purposes it is evident that the element of popular appeal must be subordinate to the instructional objective.

On the other hand, a valuable research has been carried out, aided by generous subventions by the Carnegie Trust and the National Council of Public Morals, to test the efficacy of the moving picture (film) as compared with the static picture (lantern slide) for teaching purposes. Prof. Spearman accepted the chairmanship of the committee appointed, and his psychological laboratory at University College, London, was fitted up with cinema appliances for the conduct of the investigation. Groups of children from neighbouring schools were instructed in different subjects by means of the lantern and the film respectively. The result was that there appeared to be an advantage of about 20 per cent for the moving picture both for immediate and delayed memory tests.

Many schools have recently experimented in using broadcast material as part of the general scheme of instruction with considerable success, any initial difficulties having been successfully overcome. It is probable that, in the days to come, the employment of the means of instruction offered by the cinema and broadcasting, either separately or together, will exercise increasingly useful functions in educational processes.

## The Gorgas Memorial Laboratory of Tropical Disease.

IN fitting tribute to the memory of General Gorgas, 'The Redeemer of the Tropics', the Congress of the United States of America, at its session which closed on May 29 last year, authorised a permanent annual appropriation out of the United States Treasury of 50,000 dollars, as the contribution of the United States towards the maintenance and operation of the Gorgas Memorial Laboratory on the Isthmus of Panama.

On July 4, 1920, there died an American citizen, William Crawford Gorgas, who, from an obscure doctor in the United States Army Medical Corps, rose to become the greatest tropical sanitarian of history. He served as chief sanitary officer of Cuba from 1898 until 1902; as chief sanitary officer of the Panama Canal Zone from 1904 until 1907; as member of the Isthmian Canal Commission from 1907 until 1914, when the Canal was completed, and as Surgeon-General of the United States Army in the World War, from 1914 to his retirement, at sixty-four years of age, on Oct. 3, 1918. To him was given the vision and practical ability to make possible the conquest of disease in the tropics. He eliminated yellow fever from Havana, pursuing his plans in the face of great opposition, ridicule, and indifference. His successful campaigns in both Cuba and Panama for the suppression of mosquitoes greatly reduced the ravages of yellow fever and malaria, and made possible the conversion of a pestilential region into a safe cross-roads for the ships of the world.

The Gorgas Memorial Institute of Tropical and Preventive Medicine (Inc.) was created after the death of Gorgas, by his assistants and co-workers in the War, eminent physicians, surgeons, and sanitarians of international reputation. It forms no inanimate monument, but a living, working memorial to perpetuate the man's name by carrying on his ideas and ideals.

The key-note of the 'Gorgas idea' is that health is the foundation of our social and economic structure. The fundamental purpose of the Gorgas Memorial Institute is to conduct research into all preventable diseases, and to train men and women to assist in this prevention. Two main lines of approach are contemplated for the accomplishment of this purpose:

(*a*) A national educational campaign, through such channels as public press, radio and cinema, featuring the contributions of medicine to human progress, and the share and responsibility of the public in these contributions.

(*b*) The intensive study, in the tropics, of the causes and prevention of disease.

The first half of this programme has already been well organised and shown splendid results. The second half is now made possible under the terms of the Act and by means of funds thereby

authorised, and with the co-operation and aid of the Latin-American countries invited and authorised by the Act. The work of the Gorgas Memorial Institute has thus far been maintained wholly by funds raised through popular contributions.

Even with the assured prospect of funds, however, the purposes of the Institute remain purely humanitarian and scientific. It operates without profit; no part of the endowment fund is to be spent for buildings or equipment, nor any investment to be made in elaborate offices. The Republic of Panama has given a site and guaranteed initial buildings and equipment for tropical research laboratories, in recognition of Gorgas's great work in Panama, and is conducting a campaign to raise its quota for the endowment fund. Through economical administration the overhead expenses are kept extremely low. Those invited to serve as founder members are asked to subscribe 100 dollars to the endowment fund.

Governing boards are formed on the basis of 100 members to 1,000,000 population. Seventy-five per cent of the personnel of each committee will consist of medical men, and twenty-five per cent of influential laymen and women. The permanent activities of the organisation will be supervised by these governing boards sitting in their respective States.

The need and value of the proposed tropical research work are enormous. We have only to remember the conquests of yellow fever, malaria, and bubonic plague to realise the incalculable results which may come from the discovery of the method of transmission of a disease. On the single finding, by the Walter Reed Board in Cuba, that the *Stegomyia* mosquito is the transmitting agency of yellow fever, were based the great results in quarantine and mosquito work achieved in Cuba and Panama by the late General Gorgas, and the banishment from both these regions of this malignant, age-old plague. So, too, bubonic plague was brought under preventive control through the discovery that it was transmitted by the rat flea.

The malignant tropical maladies calling for further intensive laboratory research and study as to cause, transmission, control and prevention, are many. They include, among the better-known forms, malaria, yellow fever, leprosy, bubonic plague, sleeping sickness, amœbic dysentery, hookworm disease, etc. These diseases, it is true, are indigenous to the tropics, yet some of the most fatal—as leprosy and bubonic plague—may thrive with equal virulence and destructive power in the temperate regions. The almost universal scourge of malaria provides an ever-present problem of world-wide application. Finally, the discovery of sources and transmitting agencies of infection and of methods of control and prevention does not end the task. There remains the vital necessity of increased efficiency of these controlling and preventive measures.

While such research is the primary purpose of such an establishment as the Gorgas Memorial Laboratory, its nature and position give it another character, namely, that of an important centre to which will be invited students from all countries, so that it may receive the best of international thought and that its findings on the causes and prevention of tropical disease may be disseminated throughout the world. In view of the vastness of the field involved, it is obvious that there will be no overlapping of activities of any of the existing institutions by the establishment of the Gorgas Memorial Laboratory, since the work will be mutually supplemental.

Another useful purpose is served by the co-operation of the Latin-American countries, already referred to. To quote Dr. Franklin Martin (chairman of the Board of Directors of the Gorgas Memorial Institute), "Not only will the work serve a great humanitarian purpose in itself, along the lines of the conquest of the malignant maladies of the Tropics, but it offers an opportunity for an added bond of friendship between the United States and her sister nations on the Western Hemisphere". The United States are as much concerned by protective measures as the countries of central and southern America, since diseases indigenous to the tropics are easily transplanted into temperate zones owing to increased facilities in transport. In fact, all nations of the world are equally concerned, and all discoveries made in the Laboratory will manifestly be of world-wide benefit.

In his evidence before the House of Representatives, the Hon. Maurice H. Thatcher quoted from Dr. Wellcome's testimony as follows:

> "In respect to Panama being the ideal location for the Gorgas Memorial Tropical Research Laboratory, I would say that Sir Patrick Manson . . . considered Panama to be one of the great tropical disease danger centres of the world. A number of years ago he pointed out that ships passing through the Panama Canal, and to and from the Isthmus and all parts of the world, would bring and carry all manner of diseases—bringing and leaving diseases while picking up and carrying others to various parts of the world. Sir Patrick regarded this as a very serious matter, and he expressed to me repeatedly his very strong views on this subject. I have heard him make similar statements at the London School of Tropical Medicine and elsewhere. Furthermore, I know that General Gorgas also held that same view."

The Isthmus of Panama is a peculiarly suitable site for the establishment of the Gorgas Memorial Laboratory for many reasons. Lying as it does in the heart of tropical America, it forms a convenient centre for the study of tropical disease. The Panama Canal, as one of the great focal points of international traffic, forms also a passage-way for the possible transmission of disease to and from every quarter, providing an admirable centre for preventive work. Finally, it is but fitting that the memorial honouring the name of the man who rid this region of pestilence and made the building of the Canal possible should stand here at the cross-roads of the world as a beacon light of safety and health, throwing its rays into all lands burdened with disease.

## Obituary.

### DR. T. J. I'A. BROMWICH, F.R.S.

THOMAS JOHN I'ANSON BROMWICH, who died at Northampton on Aug. 24, was the son of John I'anson Bromwich and was born at Wolverhampton on Feb. 8, 1875; he was educated at Bridgnorth, and later, when his parents had migrated to South Africa, at Durban. He went up to St. John's College, Cambridge, in 1892, and graduated as Senior Wrangler three years later.

Bromwich's 'year' was a remarkable one; in Part II. of the Tripos, Division I. of Class I. contained the record number of seven names, Bromwich's companions being Godfrey, Grace, Bertram Hopkinson, Maclaurin, Western, and Whittaker; in the same Tripos list occur the names of Alfred Young and of the present Master of Clare. The Smith's prizes in 1897 fell to Whittaker, Maclaurin, and Western; Bromwich received an honourable mention and was elected to a fellowship at St. John's later in the year.

In 1902, Bromwich was appointed to the chair of mathematics at Galway, but he resigned after a brief period in order to return to Cambridge in 1907 to take up a lectureship at St. John's. In Cambridge his industry in teaching, examining, and research soon became proverbial; but after ten years his health completely broke down, and teaching had to be discontinued, though at times he was well enough to make some of the most valuable of his investigations, and so recently as last June he was hoping to resume some teaching in the autumn.

Bromwich's earlier papers were mainly algebraic, on bilinear forms and allied topics, and these culminated in his 'Cambridge Tract' of 1906 on "Quadratic Forms and Their Classification". While at Galway he was compiling his book on "The Theory of Infinite Series"—a veritable encyclopædia—which appeared in 1908; for some years it was out of print and second-hand copies commanded fabulous prices until he was able to bring out a new and revised edition in 1926. The papers which he published while at Cambridge were mainly in the field of applied mathematics; in them is frequently apparent the influence of the work of Stokes, for whom he had a profound admiration. No small part of his energy at this period was spent in the service of the London Mathematical Society, of which he was secretary from 1911 until 1919.

The last phase of Bromwich's researches opened in 1916 with his memoir, now a classic, on "Normal Coordinates in Dynamical Systems". In this memoir he pointed out that Heaviside's calculus of symbolic operators could be put on a basis which was satisfactory to conventional pure mathematicians by treating Heaviside's operators as equivalent to contour integrals; he thereby began to open up a region which, so far as mathematicians were concerned, had been veiled in obscurity for some twenty years. Most of his subsequent papers may be regarded as developments of this memoir; they have already borne abundant fruit in the increasing attention which has been given in recent years to the developments of Heaviside's ideas. It may well be that by 'popularising Heaviside' he has contributed even more to the advancement of mathematical knowledge than by his book on infinite series.

Bromwich was elected a fellow of the Royal Society in 1906 and was awarded the Cambridge doctorate in 1909. He leaves a widow and one son.

G. N. W.

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PROF. A. P. PAVLOV, professor of geology and one of the oldest members of the University of Moscow and a member of the Russian Academy of Sciences, died recently in Telz, Germany. Born in 1854, after completing his studies in the University of Moscow, where he took his degree in 1878, he was appointed a teacher in a secondary school in Tver. Two years later he was invited to become the Keeper of the Geological Department in the University of Moscow, and since 1886 he has been professor of geology and palæontology. In 1916 he was elected an ordinary member of the Russian Academy of Sciences. He attained widespread fame by his researches of the Mesozoic and Quaternary deposits of the Volga region and Central Russia, and by his classical works on the fauna of the Mesozoic period.

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WE regret to announce the following deaths:

Mr. V. G. Bell, deputy commissioner of forests in the Federated Malay States, on Sept. 6, aged thirty-nine years.

Prof. Robert H. Bowen, assistant professor of zoology at Columbia University, who worked on cytoplasmic structures and the cytology of secretion, on Aug. 19, aged thirty-seven years.

Prof. Edward F. Buchner, since 1915 professor of education at the Johns Hopkins University and director of the college for teachers, and formerly professor of analytical psychology in New York University, on Aug. 23, aged sixty years.

Prof. E. E. Glynn, formerly professor of pathology in the University of Liverpool, and author of reports on enteritis, the bacteriology of pneumonia for the Medical Research Council, on Sept. 22, aged fifty-six years.

Prof. F. A. Gooch, emeritus professor of chemistry at Yale University, a member of the U.S. National Academy of Sciences and distinguished for his work in analytical methods, on Aug. 12, aged seventy-seven years.

Prof. J. S. Kingsley, emeritus professor of zoology of the University of Illinois, formerly editor of the *American Naturalist* and of the *Journal of Morphology*, aged seventy-five years.

Mr. E. H. Man, C.I.E., late deputy commissioner, Andaman Islands, author of "The Aboriginal Inhabitants of the Andaman Islands," on Sept. 28, aged eighty-three years.

Prof. R. Zsigmondy, professor of inorganic chemistry at the University of Göttingen, who was awarded the Nobel prize for chemistry in 1925, aged sixty-four years.

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## Reviews.

### Magic and Witchcraft.

(1) *The Magic Island.* By W. B. Seabrook. Pp. 320 + 35 plates. (London, Bombay and Sydney: George G. Harrap and Co., Ltd., 1929.) 12*s.* 6*d.* net.

(2) *Witchcraft in Old and New England.* By G. L. Kittredge. Pp. viii + 641. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1929.) 27*s.* net.

(1) HAITI, the Black Republic, was one of the most interesting and instructive of the many social experiments of the nineteenth century. In its early days it was favoured by the liberal and philanthropic movements which followed the ideals of the French Revolution. But the rapacity and brutality of the leaders of the Haitian revolt horrified the civilised world, while their vainglory and ostentation and their assumption of high-sounding but ridiculous titles gave rise to a derision which militated against recognition of the significance of the course of events in the island. If we now smile involuntarily at such titles as the Duke of Lemonade and the Prince of Marmalade, letters still extant from these two noblemen bear witness to their sincere desire to educate their people and a genuine interest in their advancement.

Haiti inevitably invites comparison with Liberia, the republic of the liberated American slaves. In Haiti the impulse to reach freedom and self-determination came from within. Yet in the ultimate analysis the results in both cases were not dissimilar, excepting for the greater infusion of European culture which constitutes the tragedy of Haiti. What is to be the outcome? Mr. Seabrook's sketch of Haitian society under the regime instituted by the United States after the occupation during the War is by no means reassuring. The Haitians do not appear to accord the settled law and order imposed *ab extra* an untempered enthusiasm. Be that as it may, the lessons taught by the two republics give pause to schemes for the overhasty advancement of backward races along lines which deviate too widely from their history and tradition.

Underneath the veneer of European culture—and it must be admitted that in many cases the veneer is highly polished—the Haitian is primitive. Outside the urban areas the peasant is at heart African. His religious beliefs have been affected by Roman Catholicism only in so far as they have been able to mould it to his own conceptions. In theory voodoo is not now permitted; in practice the rites are performed semi-surreptitiously. Mr. Seabrook traversed the country districts and lived among the negroes. He even became an initiate and was present at voodoo ceremonies. He describes, particularly and in detail, the ceremony at which the goat without a blemish used to be sacrificed. The human victim, a young girl, was present on this occasion, but with a goat as an obvious surrogate. Something like a transference of personality took place, the girl taking on the appearance of the animal in feature, which is remarkable if Mr. Seabrook has not allowed his imagination to cloud his powers of observation.

The whole account of the ceremony deserves careful study as an illustration in actual working of conceptions of incarnation, sacrifice, and the godhead with which the comparative study of primitive religion has made us familiar. The authenticity of Mr. Seabrook's narrative has been questioned. Dr. Elsie Clews Parsons, in a recently published study of Haitian spirit belief, regards the prominence given to the human sacrifices in voodoo as due to journalistic over-emphasis. Other observers have recorded little beyond magical practices and orgiastic dancing as the essentials of the belief. A recent writer, however, who visited Haiti after Mr. Seabrook, while recording evidence of magical practices only, confirms the truth of certain of his statements and, while suggesting a discount of his narrative, does actually go some way towards corroborating what he says.

While there is abundant evidence in Mr. Seabrook's account of voodoo of adapted Roman Catholic ritual, there is little to show any connexion with the more usual forms of European witchcraft. Several suggestions have been offered as to the origin of the name 'voodoo'; but there can surely

be no question as to its derivation from 'vaudois', the popular French term for organised witchcraft, generalised from its application to the heretical sect against whom the accusation of witchcraft was brought. But the 'devil worship' of the Haitian is a very different thing from the worship of the witches' sabbath. The latter, as usually described, is artificial and mechanical, the former definitely primitive in idea, if elaborate in form. The papaloi and mamaloi, however, are priest and priestess, magicians rather than witches. Nor does the belief in the 'obeah' man of negroes elsewhere in the West Indies and America point to the European witch. It is African in derivation.

(2) The distinction between magician and witch may appear one which is without a difference. Medicine man, witch, and even witch-doctor are sometimes used by writers on ethnographical subjects as if they were identical and interchangeable. White and black magic are only sometimes, but not always, differentiated in terms. Now the distinctive characteristic of the witch of the medieval trials was the compact with the devil. Recent writers, Miss Murray and Mr. Lowe Thompson in particular, regard the witch as a medicine man disestablished in the course of evolution. With the introduction of Christianity the priest has become the devil worshipper. In part this is historical fact. That we know. But how far is there continuity between the palæolithic horned leader of the dance and his presumed successors, and the historical witch? How far did a secret organised worship of the creative forces of Nature survive into medieval times as Miss Murray holds? The problem is how best to get at the facts.

Dr. Summers, accepting the validity of the dogma of the Church, engages in a heresy hunt through the evidence of the trials and other records. Miss Murray is also concerned with the legal evidence; she interprets it in the light of anthropological theory. Dr. Kittredge, in his "Witchcraft in Old and New England", attacks the problem differently. He too, necessarily, is largely concerned with legal and historical evidence, but he takes it not as evidence of what happened, but as evidence of what it was believed had happened. His is the method of the folklorist. For here in the facts of the case are the beliefs of the *folk*. Dr. Kittredge holds that the essential feature of witchcraft is then *maleficium*. Any untoward happening, whether preceded or not by a threat, is explained as the work, effected by magical means, of an individual who wishes ill to the victim. The witchcraft belief is an example of the universal primitive belief in magic surviving among the simpler members of a civilised society.

This method of attack has the advantage that it brings the whole body of the belief under one category. Medicine man and witch alike are nothing more than forms of expression of the primitive belief in magic. But the elaborate structure of medieval witchcraft then vanishes into thin air. It is, in Dr. Kittredge's view, the product of the theories of theologians and jurists—the evidence on which upholders of the reality of witchcraft rely no more than the result of leading questions based upon the formulæ devised by heresy hunters.

In working out his thesis, Dr. Kittredge does not follow the usual method of modern writers on witchcraft of describing the trials in chronological sequence. He has preferred to take each branch of magical activity, charms, divination, the wax figure, the Sabbath, and so forth, and follows up the historical evidence in each case. He is thus able to show that all the essentials of magical belief were present in England before the beginning of the reign of Queen Elizabeth; but that it was only after the outburst of feeling against the witch that the Sabbath appears. He directs attention to the patent fact that there is an essential difference between witchcraft in England and on the Continent and in Scotland. While in England witchcraft and witchcraft trials are concerned with specific acts of magic, on the Continent the charges, under the influence of lawyers and theologians, were of a more general character. Witchcraft there is a form of heresy with a definite ritual—in fact, a cult. It is this which gives colour to the theory that there was a highly organised religious body at the back of the witchcraft belief. In England, as Dr. Kittredge points out, the Sabbath first appears in the trial of the Lancashire witches in 1613, and even then, he suggests, it probably had as its base nothing more than a festive meal of the persons accused, which became a ritual feast under cross-examination. Yet there may have been more in it than that. One of the accused gave evidence that he had carried away from Mass a part of the Host, which points to a knowledge of the ritual now known as the Black Mass. Nothing was said as to the purpose of the act, as might have been expected had the fact been elicited by a series of leading questions.

Dr. Kittredge's book, attacking the problem of the witch at a different angle, makes refreshing and entertaining reading after the constant repetition of the evidence of the trials with which students of the literature are more familiar. By its insistence

upon the operations of the witch, it brings medieval witchcraft into line with primitive modes of thought and makes it more amenable to study on comparative lines as a form of religious belief. The notes appended at the end of the book give evidence of great and profound erudition.

## Bird Courtship.

*An Introduction to the Study of Bird Behaviour.* By H. Eliot Howard. Pp. xii + 136 + 11 plates. (Cambridge: At the University Press, 1929.) 42*s.* net.

THE characteristic of this interesting book is that it studies the behaviour of birds as living wholes and in their natural environments. "One reaction in itself is neither more nor less important than another; each forms a portion of the environment for others; each is sensitive to the modification of others—they form a constellation, and somewhere in the organisation of the living bird they have a common structural link." "The whole has value, the parts by themselves have none." It is a piece of work that will greatly please the author of "Holism and Evolution".

Mr. Howard begins with the reproductive behaviour of a reed-bunting, and distinguishes four phases. In the first the female does not figure as a 'situational item', and the male is occupied with his 'territory' or preserve, for example, a certain alder tree and the ground round about. In some measure he continues doing what he did before, making excursions to the feeding ground and meeting his old companions. What is new is his persistent song, his preoccupation with his territory, and his growing hostility towards other males. The old and the new are contrary, yet they persist side by side. In the second phase, about the middle of March, the female begins to play her part, affecting neighbouring males in diverse ways according to their individual physiological state. She is chased with eagerness, but seems to try to escape; for though she excites, she is not herself in a condition to breed. The male fights furiously with rivals; he expresses excitement (*a*) by a new rippling note, low and musical; (*b*) by a peculiar kind of slow sex-flight, now butterfly-like and again moth-like; (*c*) by quite peculiar expansions and vibrations of wings and tail. All the time, however, the alder tree and the rush patch retain their dominant attractiveness for the male. It is only gradually that they extend their influence through him to the female. For at first she is anything but intrigued by sexual excitement on his part, and may indeed fly to another alder and feed with another male, or be chased by several suitors. Gradually, however, as the days pass and her condition changes, she attends to her mate's movements more closely and follows them; she observes his boundaries and becomes attached to the territory; she watches a combat with some excitement; and finally she fights against intruders, fights as her mate fights, though less viciously.

The third phase is marked by coition, nest-building, and the laying of eggs. There is a great change in the female's behaviour, for she now pursues her mate, settles near him, extends and rapidly flutters a wing, and harasses him, as he used to harass her, until she is satisfied. Apparently this beginning of sexual function synchronises with her first hints of nest-building. She breaks off a piece of rush, holds it attentively, flies to the tree, drops it casually, and turns to preen her feathers! A few days later she tears off another piece and lays it in the centre of a clump of rushes near the headquarters of the territory. In a few minutes she does the same for another clump, and for another! About a fortnight after plucking the first piece of rush, her ovary ripens, and she fixes on one of the suggestions of a nest, and builds rapidly. She is assisted by the male, who has been watching her, and has also made some independent experiments of his own. The female's nest-building is curiously punctuated, for after she has worked hard for a short time, usually in the early part of the day, she turns aside and attends to something else. Two or three days pass before the finer strands are added to the nest and the lining made. The last of the five eggs is laid 19-22 days after the first attempt to build. The male is still keen about his territory, but he is mostly silent, and sex-excitement is markedly waning both in him and in her. He may even tolerate a rival male on his preserve.

The fourth phase is marked by the common care for nest, eggs, and young. With this the female is entirely preoccupied; for the male it is a new attraction, but one subordinate to the needs of the territory. "He finds food and distributes it amongst the young, broods, cleans the nest, in fact does all that she does, and may do it with even greater energy." Sexual behaviour has disappeared for the time being, but it is interesting to notice that posturing still persists, in the female at least, though the reaction with which it was formerly correlated has disappeared. Mr. Howard goes on to tell a similar story for the yellow bunting.

The courting bird is moved by constitutional impulses, hereditarily engrained and expressed in a particular sequence, just like other differentiations. The changes in the body as a whole influence the gonads, and these liberate regulative hormones; and the sequence is punctuated by external periodicities of temperature, pressure, humidity, and the like, operating from without inwards. Change of diet is probably in some cases another liberative stimulus, but Mr. Howard does not say much about this.

(1) In the first phase the male behaves in five new ways—seeking an appropriate environment, occupying a conspicuous position, singing, sometimes building, fighting with rivals. He is in a condition to behave sexually if stimulated. (2) In the second phase the female arrives, often unready. The male's song is popularly regarded as evoked by the female's presence; but "instead of singing with renewed vigour, he gives it up and sings but little—perhaps stops". The form of fighting changes, and the male eagerly chases the female, who seems to enjoy it, though not fully responsive physiologically. (3) In the third phase the female begins to posture or to posture in a new way. She may even take the initiative and incite the male. This synchronises with toying with building materials, and changes in the two activities occur simultaneously and are proportionate in intensity. (4) The fourth phase concerns incubation and the care of the young. The female loses susceptibility to sex-stimulation and this reacts discouragingly on her mate. It is difficult to tell what evokes the female's brooding, for she will brood on an empty nest. It is a primary response, rhythmically induced, part of the hereditary pattern, instinctive as many would say, but Mr. Howard declines to use the word. When the young are hatched, their note of hunger is a stimulus to the mother, yet she may bring food to the gaping youngsters and then swallow it!

Soon after the young birds leave the nest the sex-cycle may begin again, but the influence of the offspring remains upon the male more than upon the female. There appears to be some "secondary physiological control" (requiring analysis) which operates in the female, not in the male. Thus when the new cycle begins, she is finished with the young, and ignores their appeal. In the buntings, they would be lost if it were not for the still persistent *paternal* care. Similarly, at a different time the male whitethroat builds before he has been found by a hen, and the male lesser whitethroat not only builds, but also sits upon the nest. He is ahead of her in susceptibility to sexual and parental stimulation.

The next chapter is devoted to the thesis that the inherited pattern of reactions has a unity or combined singleness. The bird is an integrated whole and behaves as such. An important factor in the unification is that a reaction wanes in the course of prolonged excitation, not by muscular fatigue or the like, but in some subtler way like 'fatigue' in a reflex. This waning lessens the risk of overdoing any one line of activity, say fighting, and admits of a harmony of reactions, which makes for the attainment of a common biological end, the production of a brood at an appropriate time. The waning reaction leaves the 'common path' free for a different reaction, and conflict is avoided or lessened. The waning of a reaction under prolonged excitation is an automatic integrative agency.

Howard has gone further than his precursors in working out a connected story of the successive events in the reproductive behaviour, and in showing how they are co-ordinated towards the end-effect. We cannot do more than mention a few instances of this: the fixing on a territory helps towards the subsequent feeding of the young; the conspicuousness of the perch and the song attract the visit of a female; her presence stimulates him and she enjoys the companionship; his experiments in nest-building may arouse her similar activities; the sexual flights may increase intensity of sex-excitement and reaction, and make fertilisation eventually more secure; posturing has probably a self-stimulating as well as mate-exciting function; improvement of weather as the season advances will intensify the reaction, and break down the barrier to fertilisation; even the postponement of a reaction may be pressed into the service of the organism, for it may make for effective timing and intensification. In short, "the actions of male and female combine to form a harmonious whole, beautifully adapted to bring about appropriate synchronisation of rhythms".

The behaviour of birds at the breeding season may be physiologically described as "a neurally linked pattern of reactions for which there is inherited structural provision". Why, then, drag in mind, especially when the reactions are so perfect and so imperative? Moreover, when we are inclined without more ado to credit the bird with intelligent prevision, simple experiments will show that a slight disturbance of routine may cause it to behave in a way that looks exceedingly foolish. But Mr. Howard finds convincing evidence of mind

in the individual bird's establishment of territory. This is a mental edifice reared upon three things—song, hostility, and area. In a certain physiological state a male bird selects a territory that influences or attracts him. From the very first there is a linkage of the bodily excitement and the selected territory; there is heightened perceptor activity and an impression is made upon the bird's organisation. "And this impression is so linked with the pattern of reactions that whenever there is recurrence of the territory situation there is excitation from within of the centres initially stimulated from without and revival in the form of imagery. Hence the trees *A*, *B*, *D*, *H*, *K*, *S*, are not only objective to his mind but are susceptible of revival."

It comes to this, that perception and reference reach a higher level of activity when certain physiological changes are occurring. The bird exercises dominion over his territory, but it also exercises dominion over him. Thus from a distance out of sight, when feeding near his mate or his rivals, he will suddenly make for his tree. There is a revival in the form of imagery whenever there is a return of the bodily commotion which primarily intensified the bird's power of reference. Almost everything the bird does is in reference to his territory; it has a controlling guiding influence; a cognitive reference introduces a prospective factor; and this prospective factor is not disclosed in the physiological part of the story.

Mere sensory stimulation fails to account for the way a male bird behaves to his territory. The physiological story needs to be completed by a psychological story in terms of reference and revival in the form of imagery. Thus mind integrates the reactions.

Mr. Howard's book is one of the most important contributions yet made to the study of bird behaviour. His patient and critical observations show that the courtship has an intricacy, subtlety, and individuality greater than we knew; the sequence of the chapters in the story has been made clearer; the importance of recognising the creature as a whole has been corroborated; and the supposed uselessness of the mind has been disproved. The book is written in a pleasant conversational style, as if the author was taking us with him on his excursions and vigils. We get the suggestion that he has read much of Fabre, for the style is often similar. But perhaps this simply means a similarity of observing genius. The ten plates and frontispiece by G. E. Lodge are masterly.

## Vibration Theory and Engineering Practice.

*Vibration Problems in Engineering.* By Prof. S. Timoshenko. Pp. vi + 351. (London: Constable and Co., Ltd., 1929.) 21*s*. net.

INTRICATE vibration phenomena have at all times attracted the attention of the physical investigator, and vibration theory is a wide field well and fruitfully cultivated by the mathematician. The achievements of pure science and of analytical method in this line are quite remarkable; but in the past the engineer has only had a casual interest therein, the simplest elements of the subject serving his purposes. Within comparatively recent times, however, he has been compelled to change that attitude. The extraordinary advances in size, speed, and type of modern engines have brought in their train a somewhat confused but certainly important series of vibration problems. These have only been reasonably solved under the combined impetus of serious failures, elaborate investigation, and the resources of high theory. The rise, development, and control of these difficulties have been rapid, and it is therefore not surprising that authoritative treatises on the methods of analysis of problems peculiar to vibration phenomena in mechanical engineering are mainly conspicuous by their absence. A warm welcome is therefore to be extended to the present attempt to fill the gap, especially when the author is so able a writer on analytical subjects as Prof. Timoshenko of the University of Michigan.

At the present time it would appear that American and German publishers possess the initiative in this class and standard of publication, which is rather surprising, and scarcely satisfactory, in view of the great contributions made to the analytical and engineering aspects of the subject in Great Britain. The time is certainly ripe for the issue of treatises in English of the class now before us, dealing comprehensively with those theoretical methods to which the greatest practical significance now attaches. The rise of such problems as are connoted by the balancing of high-speed machinery; the whirling of shafts; torsional oscillations in engine arrangements; the vibration of rotating turbine wheels, etc.; have taxed severely—and in some directions, overtaxed—both engineering technique and analytical resource; but the dependence of practice upon theoretical guidance is undeniable; and this book shows it clearly.

Prof. Timoshenko follows a classification in line with theoretical distinctions, and inserts the technical problems in the appropriate order. His

chapters only number four altogether, but each is comprehensive and the full scope of the subject is well covered.

The first chapter deals wholly with harmonic vibrations of single systems. The theoretical work here covers the usual treatment of damped and forced vibrations and is concisely and clearly developed. It is applied to vibrographs, dynamical balancing machines, and first order critical speeds. Useful references are given to sources of information regarding damping effects; and the condition of constant damping is referred to briefly. The energy method of attack is developed and the Rayleigh principle is very usefully introduced. The second chapter deals with matter less familiar to engineers. In it the non-harmonic vibrations of systems having one degree of freedom are discussed. The so-called pseudo-harmonic vibrations, in which the flexibility of the spring depends upon the displacement of the system; and quasi-harmonic vibrations, in which the spring constant is a function of the time, are both considered. The general solution of these is really only possible in certain special cases, but numerical and graphical methods for free and forced vibrations are given. The main technical application made is that of the vibration of the side rod drive systems of electric locomotives—in connexion with which many earlier failures occurred.

In the third chapter the author deals with systems having several degrees of freedom; and in the first part provides an excellent, though brief, theoretical discussion, along orthodox lines, introducing generalised co-ordinates and Lagrange's equations; and outlining the general theory of free and forced vibrations. The subsequent applications are important and include considerations of the vibrations of wheeled vehicles, the torsional oscillations of shaft and geared-shaft systems, the lateral vibrations of multi-bearing shafts, some secondary effects in critical speeds, and the theory of the so-called dynamic vibration absorber. These cases represent schemes in which it is permissible to separate the elastic and mass effects, and so achieve the reduction of fairly complex arrangements to ideal combinations with a limited number of degrees of freedom.

It is left to Chapter iv. to deal with those which cannot be so reduced. It is headed "Vibrations of Elastic Bodies", by which is really implied those continuous systems in which the elastic and mass properties are inseparably associated—systems with infinite degrees of freedom. The general discussion of the vibrations of prismatical bars—longitudinal, lateral and torsional, free and forced—leads towards the treatment of such outstanding engineering matters as the vibrations of beams and bridge girders, impact effects, vibration of ships, turbine blades, etc.; while a discussion of membranes precedes the theory of plate vibration leading to the consideration of turbine disc oscillations. This remarkable practical case of vibration closes the theoretical work of the book, but there is a twenty-page appendix on various instruments for the measurement of vibration. The description of each is brief, but the range is comprehensive and includes vibrographs, torsiographs, strain recorders, and torsionmeters.

The author's scholarship is profound, and the book, in addition to its own wide scope, provides a wealth of references. In the development of the subject matter, symbolism, description, and diagram are all aptly used and skilfully balanced. The volume may be highly recommended to the advanced engineering student. To one well acquainted with, say, Lamb's treatises on mechanics, it opens up wide fields of interesting practical matters and gives new meanings to the abstractions of formal dynamics. It will, however, prove rather difficult reading to most students. It lacks the graduated exercises of the normal text-book, and the theory in places is rather briefly developed. From the point of view of the technical practitioner, it is perhaps a pity that more use was not made of vector methods, and that more specific information on damping effects was not included. In regard to this last, it may safely be asserted that many of the vibrational engineering problems of the moment stand more in need of investigations on damping than of dissertations on theory. Minor criticism apart, however, the author's handling of this highly important subject in mechanical engineering is of great value, and sets a high standard for those other attempts that will assuredly be made in the near future.

## Osler's Library.

*Bibliotheca Osleriana.* A Catalogue of Books illustrating the History of Medicine and Science, collected, arranged, and annotated by Sir William Osler, Bt., and bequeathed to McGill University. Pp. xxxvi + 786. (Oxford: Clarendon Press; London: Oxford University Press, 1929.) 63*s.* net.

IT is a remarkable fact that the glamour of Osler's name exercises a spell even on the generation that has never known him. Each of

his books reflects something of his philosophy. None tells us more than the few introductory pages "On the Collecting of a Library" that stand at the head of this volume. The humorous yet pious gratitude for early influences and teachers; the vein of melancholy that was scarcely veiled by sparkling fun; the abiding sense of infinite issues that was always fraught with love, all find their place in these few pages. They help us to understand the fortitude and the simple greatness of the man who, finding his dearest human hopes shattered, could turn with more than *aequanimitas* to consider and expound how he could pass on what had most enriched his own passage on earth.

"A library", Osler tells us, "represents the mind of its collector, his fancies and foibles, his strength and weakness, his prejudices and preferences. Particularly is this the case if to the character of a collector he adds—or tries to add—the qualities of a student who wishes to know the books and the lives of the men who wrote them. . . . The years spent in the United States, 1884–1905, brought troops of friends whose affection is part of my life; they brought me, too, into sympathetic touch with another company, those friends of the spirit, the great and good men of the past who, through much tribulation, handed on the torch to our generation. It was the height of my ambition as a teacher to live up to the ideals of Morgan and Rush, of Hossack and Gerhard and Bigelow. . . . To know and to make known to students the lives and works of these men was a labour of love. . . . Gradually, as the books increased, the hope matured into a scheme for a library which would have (*a*) a definite educational value, (*b*) a literary, and (*c*) an historical interest. To break a collection into sections is hazardous, but I consider that, after all, this would form a special part of the Medical Faculty library just as the latter is a section of the University library. So I decided to follow my own plan and group the books into the following divisions:

I. Prima, which gives in chronological order a biobibliographical account of the evolution of science, including medicine.

II. Secunda, the works of men who have made notable contributions, or whose works have some special interest, but scarcely up to the mark of those in Prima.

III. Litteraria, the literary works written by medical men, and books dealing in a general way with doctors and the profession.

IV. Historica, with the stories of institutions, etc.

V. Biographica.

VI. Bibliographica.

VII. Incunabula, and

VIII. Manuscripts."

Thus the vision is placed before us. In the final words of the introduction again we get a flash of light on the man and his thought: "The library is for the use of students of the history of science and medicine without any other qualifications, and I particularly wish that it may be used by my French-Canadian colleagues, who will find it rich in the best of French literature."

So the gifts have reached their destined homes, and above all the main library has made its way to McGill University at Montreal, where it will help not only to keep fresh the memory of a noble soul, but also to stimulate others to the paths that Osler thought worth treading.

To a wider circle than could read the books, Osler hoped that the Catalogue would act as a guide. There are nearly 8000 entries in this volume. The editors have had Osler's own classification on which to base their labours, and in many cases they have appended to the entries notes by him either on the books themselves or on the history of his particular copies. No pains have been spared to give every possible bibliographical information that can throw light on the volumes. Thus every collector of books on the history of science will find this volume an indispensable work of reference. Its helpfulness as well as the pleasure of using it is enhanced by the beautiful printing and set-out of the pages. The Clarendon Press has produced a worthy monument to one of its Delegates, than whom none brought to its service a more vivid appreciation of its tradition nor a more active and effective goodwill towards its fulfilment and enlargement.

DOROTHEA WALEY SINGER.

## Theoretical Physics.

(1) *Introduction to Theoretical Physics.* By Prof. Leigh Page. Pp. x + 587. (London: Macmillan and Co., Ltd., 1929.) 35*s.* net.

(2) *The General Properties of Matter.* By Prof. F. H. Newman and V. H. L. Searle. Pp. 388. (London: Ernest Benn, Ltd., 1928.) 25*s.* net.

(1) PROF. LEIGH PAGE covers the usual ground expected of a book on theoretical physics. After an introduction on vector notation and analysis, there follow four chapters on dynamics, two on hydrodynamics, three on thermodynamics and kinetic theory, three on electrodynamics, and three on optics and spectroscopy. The treatment throughout is on classical and essentially mathematical lines, and forms a thoroughly adequate and clear exposition of the analysis associated with the various branches of classical physics. There is an almost complete lack of physics in the book, and in this respect it is somewhat disappointing,

but if there had been more it would have been probably too bulky.

In the details of the book there is little novelty and therefore little to criticise. The definitions of the electric and magnetic force intensities do not allow for possible induction effects, and there is an extraordinary statement on p. 222 about a minimum wind-velocity necessary to generate waves on water being implied by the existence of a minimum value of the velocity of propagation of waves on the surface of water under a stationary atmosphere.

These are, however, small blemishes on an otherwise sound production, which can be strongly commended to English students of physics as a mathematical compendium to the groundwork of their studies in classical physics.

(2) The second volume under notice is, in the words of the authors, an attempt to present a fairly complete survey of the fundamental properties of matter, with the special aim of developing those branches of the subject, such as surface tension, osmosis, and viscosity, which verge towards chemistry, and hydrodynamics and vibrations, which are of importance and interest more particularly to the mathematician and engineer.

While the descriptive parts of the work combine to make a very useful collection of really up-to-date material which should be in the hands of every student of physics, one cannot but feel that the attempt to weave them into a survey of the whole problem would have been more successful had the authors paid more attention to the necessities of logical argument—or cut out the argument altogether. As it is, the numerous attempts at deductive reasoning are spoilt by the omission of step after step until the arguments have become worse than useless and at times positively inaccurate. Take, for example, the way in which an elaborate discussion of gyroscopic motion is based on a chance remark about uniformly accelerated angular motion (in which the whole physics of the problem is hidden) at the end of a paragraph on vectors; or the following sentences, typical of many others too numerous to detail.

"In many general formulæ of motion it is convenient to suppose that, although the particle is in equilibrium, it suffers a virtual infinitesimal displacement" (p. 29).

"If a ball is made to roll down the line of maximum slope of a spherical surface placed with its concavity upwards, the oscillation about the lowest point in the surface will be simple harmonic" (p. 33).

"The distance traversed by a molecule between wo successive collisions is termed the mean free path" (p. 235).

"If the function $f(x)$ to be analysed is given between the limits $x=0$ and $x=l$, then expansion into a Fourier series may be made in three different ways" (p. 270).

In reviewing, as a mathematician, the state of applied mathematics teaching in Great Britain, one is often inclined to suggest that possibly it would be better taught by physicists than it is at present in the hands of the mathematicians, but a book like this makes one hasten to withdraw any such suggestion. G. H. L.

## History of Technology.

*The Newcomen Society for the Study of the History of Engineering and Technology: Transactions*, Vol. 7, 1926–1927. Pp. xi+159+21 plates. (London: Newcomen Society, 1928.) 20*s*.

THE seventh volume of the *Transactions* of the Newcomen Society conforms to the high standard that we have been led to expect. We are beginning to look forward with real pleasure to these annual volumes. The study of the history of technology and industry is, it seems, at last receiving the attention to which the importance and interest of the subject entitle it, and it is a matter of great gratification that Great Britain is now playing its part in the collection, sifting, and evaluation of the available evidence. Germany has hitherto been ahead of us in this respect, for the "Beiträge zur Geschichte der Technik", a publication of the Verein Deutscher Ingenieure, was started so long ago as 1909 and was followed a few years later by two other independent journals of similar scope, both of which are still running. But the Newcomen Society is, so far as we know, the only existing organised body devoted exclusively to the study of the historical side of technology, and as such it is in an excellent position to act as a clearing house for all information on the subject and, by suggesting lines of investigation hitherto but little explored, to stimulate whatever latent desire for research there may be amongst us. That the Society is fully alive to this position seems evident from the work it has already accomplished, and all concerned are to be congratulated on the conspicuous contributions it is making to our knowledge.

The new volume deals with the proceedings and the papers given before the Society during the session 1926–27. The international scope of the Society's activities is here well illustrated, for of the nine original papers printed in the volume, two are concerned with the work of the Swedish

engineers, Christopher Polhem and Martin Triewald respectively, and three are by French writers and relate to Marc Séguin and the early railways of France, whilst some notes on the first steam engine in America were also read at one of the meetings but have not been printed. The contributions from Sweden must be especially emphasised, for their subjects should certainly be better known in Great Britain, and they throw a good deal of light on some of the engineering problems of the early eighteenth century and the way they were attacked. Particularly interesting to us is the connexion of Triewald with England and the new information his 'life' supplies on the early days of the Newcomen steam engine.

Other papers that must be mentioned are the presidential address of Mr. Rhys Jenkins, which passes in review very clearly the rise and progress of manufacturing industry in England up to the eighteenth century, and incidentally dispels the widely held idea that this country was particularly backward industrially in Elizabethan times; an interesting account of early lead mining and smelting in west Yorkshire; and some illuminating notes on Trevithick and his single-acting expansive engine, with special reference to certain MSS. recently discovered. A further instalment of the analytical bibliography of the history of engineering and applied science, containing about 400 entries, is also included. It is noteworthy that in the compilation of these bibliographies the Society is co-operating with the German engineering society and that an exchange of bibliographical material on technological history takes place between them, for inclusion in their respective publications.

The volume is excellently produced and printed and is well illustrated, and should be on the shelves of all engineers.

## Grass in Orchards.

*The English Grass Orchard, and the Principles of Fruit Growing: an Account of the Cultivation of Cherries, Apples, and Plums on the Grass Orchard Principle.* By A. H. Hoare. Pp. 227. (London: Ernest Benn, Ltd., 1928.) 32*s.* 6*d.* net.

NOT everyone will agree with the suggestion in the author's preface that "the value of this book, if any, is due to the attempt that has been made to include the latest results of scientific research work". Such results have already been included in the various leaflets and reports published by the Ministry of Agriculture and by the research institutions, and must surely be familiar to all serious students of fruit growing. For these the value of the book will lie in the chapters dealing with grass orchard management. This is a field which has not yet been thoroughly explored by the research workers, and the present-day planter must therefore depend for guidance upon empirical knowledge.

Mr. Hoare's admirable description of the orchard practice prevailing in the cherry districts of north-east Kent gives just the details which are most useful and at the same time most difficult to obtain. How far the author is right in recommending the planting of permanent fruit orchards must depend upon what are the optimum conditions for the production of high quality fruit. So far as cherries are concerned, there appears to be little doubt, from such evidence as exists, that high quality in the fruit is intimately bound up with well-managed grass, and Mr. Hoare is undoubtedly on safe ground in recommending the establishment of grass cherry orchards where conditions are favourable.

In the cherry districts of Kent, however, a comparatively low rainfall and high rate of evaporation tend to produce a short herbage which is at once the envy and the despair of visitors from other parts. Nor must it be forgotten that the magnificent flocks of Romney Marsh sheep which are to be seen grazing, ten to the acre, on the lawn-like cherry orchards, are the peculiar pride of a race of farmers whose hereditary traditions have linked sheep farming with cherry growing for hundreds of years, and that the local custom of wintering these flocks on marshland pastures has largely solved for them the awkward problem of winter keep. In how many of the twenty-two counties mentioned on page 41 will be found such a happy combination of soil and climatic conditions with local farming practice?

Apart from cherry growing, the case for grass orchards as a means of producing high quality fruit in the most economical manner has yet to be proved. Large acreages of plums are grown on cultivated ground both in the Vale of Evesham and in Kent, and there are those who maintain that high quality apples are most economically produced from low bush trees.

Whatever the truth of the matter may be, Mr. Hoare has stated his case with marked conviction and clearness, although exception might possibly be taken to his figure of £300 an acre as an index to the economic position of the English grass orchard.

# Our Bookshelf.

## Agriculture and Horticulture.

*A Tour in Australia and New Zealand: Grass Land and other Studies.* By Prof. R. G. Stapledon. Pp. xv + 128 + 8 plates. (London: Oxford University Press, 1928.) 7*s*. 6*d*. net.

In general, if a man goes to a country for a few weeks, he should not write a book about it, but Prof. Stapledon is an exception, and we welcome this delightful account of his visit to New Zealand and Australia, with its vivid and characteristic touches and its shrewd comments on men and things. It is nominally about grasses, and the author begins by giving himself the rather forbidding title of 'agrostologist'. But as with Dr. Johnson's philosopher: in spite of all efforts "cheerfulness would break out", and so (as we knew he would) Prof. Stapledon breaks out in all directions, uncontrollable but always interesting.

Prof. Stapledon began in New Zealand and has much to say about the fat lamb and the dairy industries (he stayed in Taranaki); like other visitors, too, he soon became impressed by the regrettable fact that Great Britain had almost ceased to count as a supplier of motor-cars and of agricultural implements, both of which are imported in great numbers from America. It is, however, when he gets on to the grazing and the cultivated land that he has most that is new to say. About the herbage he gives valuable information not easily obtained elsewhere, and as a careful observer he makes many helpful comments of ecological and agricultural value. One of the most interesting chapters in the book is called "Followers of Man and his Grazing Animals"; it describes the plants that came in or were brought in after the land was inhabited, and shows how they have settled down as either valuable crops or pestilential weeds. *Paspalum*, *Danthonia*, subterranean clover and others, are described at length, and there is a fund of information about many others.

The casual reader may find some difficulty in disentangling the accounts of New Zealand and of Australia. But whether he reads it casually or studies it closely, the reader will enjoy the book thoroughly, and those of us who have been over the same ground will enjoy it most of all. E. J. R.

*Fertilisers and Manures.* By Sir A. Daniel Hall. Third edition, revised and enlarged. Pp. xxiii + 414 + 6 plates. (London: John Murray, 1929.) 8*s*. net.

This well-known book has now reached its third edition: the first, which appeared in 1908, was reprinted no less than seven times; the second came in 1921. It presents the knowledge gained by the older field methods—the classical methods—so completely and so lucidly that it is not likely to be supplanted. The basis of the book is still as in 1908, but with alterations and additions to bring the information up-to-date. Teachers who have long used it and know their way through it will welcome it in its revised form; and as the older classical methods are now being given up, it is improbable that any subsequent book will be based upon them quite so completely as this is.

In the new experiments the methods have been altered as the result of the introduction of statistical analysis: the work has been largely done at Rothamsted during the past five or six years, and it has scarcely yet reached a stable position. But it is already clear that the new methods have three great advantages over the old: the results are more accurate, their degree of trustworthiness can be estimated, and, much more important, the field measurements of yield and other quantities can be correlated with other data such as those dealing with weather, soil conditions, etc. For many years these measurements have been taken but not used: comparisons have sometimes been made between a few selected dry years and a few selected wet ones, but the results were always untrustworthy. The new methods open up the hope of yielding much fuller information, but it will be some years before a book can be written about the results; in the meantime, this volume will give the student the information he needs.

*The Book of the Tulip.* By Sir A. Daniel Hall. Pp. 224 + 24 plates. (London: Martin Hopkinson, Ltd., 1929.) 21*s*. net.

This book has been written as an aid to the gardener or lover of flowers who desires to learn something about the scientific as well as the cultural aspects of the tulip. An account of the life-cycle of plants of the genus is followed by nine other chapters concerned with the history, taxonomy, sporting, hybridisation, and cultivation of wild species and garden races. The chapter on taxonomy is the most interesting botanically, and it is much to be regretted that it is not more complete. The importance of cytological data is well emphasised, and since diploid, triploid, tetraploid, and pentaploid tulips have been recognised as species, knowledge of the chromosome numbers is an aid to both the systematist and the breeder of new horticultural races. The best known species are briefly described, some account is given of their distribution, and cultural details are provided. The value of this chapter would have been much increased had an artificial key to the accepted species been added.

The origin of the garden tulips is wrapped in mystery. That they came to Europe from the Nearer East is practically certain. The great number of 'varieties' is well known, but the extent of the breeding and selecting still proceeding is indicated by the breaking down of the classification proposed by a committee appointed by the Royal Horticultural Society in 1914.

Twelve plates in colour, and an equal number in black and white, illustrate the book. Many of the

plates are fine reproductions of what must be beautiful originals, but some (as the frontispiece) are less satisfactory, and the considerable and varied reductions must be regarded as unfortunate. The plates are unnumbered, though they are referred to by Roman numerals in the text.

W. B. T.

*Agricultural Economics.* By Prof. George O'Brien. Pp. viii + 195. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1929.) 10*s.* 6*d.* net.

It is clearly impossible to deal with a subject so complex and widespread as the economics of the agricultural industry in one little volume; rather does it require an encyclopædia or a library. Moreover, the systematic study of agricultural organisation is of such recent origin that materials are not yet available for a comprehensive survey, and nothing more is possible at this stage of knowledge than an introductory treatment of the whole field, or intensive studies of particular problems.

No one, probably, realises this more clearly than Prof. O'Brien, and in his book, which is an elaboration of a course of lectures delivered to students, he has limited himself to fundamental economic conceptions and to the consideration of scope and method in the examination of the structure of the farming industry. At the same time, the numerous references to published work upon particular aspects of the subject provide the reader anxious to extend his studies with a useful bibliography. The book fills a blank in the agricultural student's library, and fills it well.

## Anthropology and Archæology.

*On Alexander's Track to the Indus: Personal Narrative of Explorations on the North-West Frontier of India; carried out under the Orders of H.M. Indian Government.* By Sir Aurel Stein. Pp. xvi + 182 + 64 plates. (London: Macmillan and Co., Ltd., 1929.) 21*s.* net.

The publication of this book, of which a foretaste was given in the columns of the *Times*, has been eagerly awaited by those—and they are many—who love to follow in the footsteps of Sir Aurel Stein. In this account of his journey in the Valley of Swat in 1926, a twofold attraction is offered his readers. For more than a quarter of a century this had been a 'Promised Land' which political conditions did not allow him to penetrate, though he had seen it from afar. It was, too, ground which previously had been inaccessible to Europeans. Secondly, Sir Aurel was, as his title says, following in the footsteps of Alexander in the memorable campaign to the Indus. In parenthesis it may be noted as a remarkable fact that Alexander does not survive as a figure in tradition or in popular folk-lore, as might reasonably be expected.

The country which the author traversed is rich in historical relics. It is in this part of the North-West Frontier, where the main routes descend from the Afghan Hills, that India first comes into contact with both East and West. The Aryan invaders, as well as Darius, were Alexander's fore-runners, and after his day, under the Indo-Scythians, it was by this route that Græco-Buddhist art and Indian culture spread to Central Asia and China. Much of Sir Aurel Stein's narrative is taken up with his account of the Buddhist relics which he was able to examine. But the principle objective of his expedition was the identification of the stronghold of Aornos which, as narrated by Arrian and Curtius, was held against Alexander by the fugitive Assakenoi and besieged and captured by him. This fortress Sir Aurel Stein holds to have been located on the Pir-Sar range. The topographical and strategic arguments which he marshals in support of his contention are completely convincing. Apart from its archæological interest, Sir Aurel Stein's narrative is an enthralling record, to which a magnificent series of photographs gives added value.

*Our Forefathers, the Gothonic Nations: a Manual of the Ethnography of the Gothic, German, Dutch, Anglo-Saxon, Frisian and Scandinavian Peoples.* By Dr. Gudmund Schütte. (Published with the aid of Subventions from the Carlsberg Fund and the Rask Ørsted Fund.) Vol. 1. Translated by Jean Young. Pp. xi + 302. (Cambridge: At the University Press, 1929.) 21*s.* net.

"Our Forefathers" is a translation of a volume published originally in Danish in 1926. In his preface, the author explains that his study of the peoples who have contributed to the make-up of the populations of northern Europe is not a book but a skeleton. He modestly disclaims the qualifications for writing a book such as he has in mind. It could, he holds, only be written by a committee of experts. In default of such a committee, and in view of the improbability of such an undertaking being initiated by any but an individual, he has here sketched a history of what he calls the Gothonic nations which will comprehend the material afforded by all the various possible lines of research.

By 'Gothonic' Dr. Schütte covers, broadly speaking, the related peoples who at various times have overrun and settled in the more northerly parts of Europe. In this first volume he deals with them as a major group, considering their names, ethnic position, environment, old home, language, civilisation, and history. In a second volume the individual nations forming the major group will be studied in accordance with the same scheme. Dr. Schütte has a wide and intimate acquaintance with the early literary authorities, and his book will be valuable as a book of reference from this point of view, as it will be also on the philological side of the argument. For the archæologist and student of the anthropology of Europe in early historical times it will rather be found suggestive. The author's special studies in the religions of the peoples of the group are responsible for a valuable section written on comparative lines which is all too brief.

*Au pays de Tagore : la civilisation rurale du Bengale occidental et ses facteurs géographiques.* Par Dr. Arthur Geddes. Pp. iii + 235. (Paris : Armand Colin, n.d.) 25 francs.

Dr. Geddes' detailed geographical and sociological study of a small area of Bengal is enhanced by his intimate knowledge of the Hindu spirit and ideals derived from long association with Rabindranath Tagore. This has enabled him to see the peasants' point of view and to consider with sympathy the rural civilisation of Bengal and the ideals for its regeneration which have been advocated by thoughtful leaders in India. The volume is thus not only a contribution to Indian geography and sociology, but also has value in any schemes of sane reorganisation in the India of to-morrow.

*Materials for the Study of Inheritance in Man.* By Franz Boas. (Columbia University Contributions to Anthropology, Vol. 6.) Pp. viii + 540. (New York : Columbia University Press ; London : Oxford University Press, 1928.) 50*s*. net.

This book consists of records of measurements of families of immigrants living in New York. It deals mainly with southern Europeans, Scotch, and Hebrews, and the records refer to head measurements, stature, eye-colour, and hair-colour. The records must prove of the greatest usefulness to students of human inheritance, and particularly to those who are studying the effect of a change of environment upon the physical characteristics of the human subject.

## Biology.

*Die stiftführenden Sinnesorgane : Morphologie und Physiologie der chordotonalen und der tympanalen Sinnesapparate der Insekten.* Von Prof. Dr. Friedrich Eggers. (Zoologische Bausteine : Ausschnitte aus dem Gesamtgebiet der Zoologie, herausgegeben von Prof. Dr. Paul Schulze, Band 2, Heft 1.) Pp. vii + 354. (Berlin : Gebrüder Borntraeger, 1928.) 34 gold marks.

The highly differentiated scolopal organs of insects include the chordotonal and tympanal as well as that peculiar organ called the sense organ of Johnston, which is widely distributed in insects in the second antennal segment. Speaking broadly, their function includes not only sound-perception, but probably also regulation of the animal's movements. It is not improbable that in the various orders of insects scolopal organs have arisen independently, and have acquired a general similarity through convergence.

Much patient investigation has been devoted to these interesting organs by a variety of authors, whose results have been published in various scientific publications not always readily accessible. All this work has now been collected and systematically arranged within the compass of a single volume. The value of the book has been greatly enhanced by the contributions from the author's own original researches. Consequently, he has been able to elucidate many obscure features concerning the structure of scolopal organs by his treatment of the subject on a comparative basis.

The structure of the chordotonal organs is carefully reviewed, and their distribution in the insect body and appendages is clearly shown. Johnston's sense organ is similarly discussed in detail, and the section of the book dealing with morphology is terminated by an exhaustive account of the complicated tympanal organs in the Acridiidæ, Gryllidæ, Lepidoptera, and Rhynchota. The description of the histological structure of the scolopal organs is readily followed with the assistance of the numerous well-executed illustrations, and due attention is paid to the physiology of the organs. Terminating the section on morphology there is a useful table summarising our knowledge of the occurrence of all scolopal organs in the individual insect groups and their distribution in the different parts of the insect body.

Concerning the development of scolopal organs, there are many problems still awaiting solution. The development of the tympanal organs of Orthoptera has been extensively investigated by Graber, and the author has greatly increased our knowledge of the corresponding organs in Lepidoptera. A. E. C.

*Contribution à l'étude du peuplement des Hautes Montagnes.* Par P. Allorge, R. Benoist, A. Chevalier, L. Chopard, L. Germain, H. Heim de Balsac, R. Heim, H. Humbert, R. Jeannel, L. Joleaud, L. Lavauden, R. Maire, E. de Martonne, C. Motas, P. de Peyerimhoff, E. Pittard, J. Sainte-Claire Deville, R. F. Scharf, B. P. Uvarov, A. Vandel. (Mémoires de la Société de Biogéographie, 2.) Pp. 259. (Paris : Paul Lechevalier, 1928.) 55 francs.

A series of twenty-one interesting and individually complete articles by as many authors is published in this book. Together they form a symposium on the subject of life at high altitudes. For the most part it is the mountains of Central Europe (Alps and Pyrenees) and those of the French territories in Africa which form the areas considered. Prof. Martonne has a useful account of the physical conditions found in high mountains, with special reference to the Alps. Prof. Pittard deals with the history and distribution of *Homo alpinus*. Fourteen papers consider aspects of animal life in mountains and include accounts of mammals, birds, insects, and molluscs.

The authors are especially, but not entirely, concerned with the composition, origin, distribution, and dispersal of the groups on which they have specialised. The faunistic peculiarities of high mountains are partly paralleled in the plant world. As an incomplete indication of this, five papers conclude these studies with accounts of North African, Mascarene, and West African high mountain phanerogamic vegetation, of the fungi of the Alps, and of the moss flora of the high summits of the Iberian Peninsula. It is unfortunate that no editorial synthesis is provided of the chief results reached by the different authors. Most of the papers are accompanied by useful lists of literature.

*Flowering Plants of the Northern and Central Sudan.* By Grace M. Crowfoot. Forming a Companion Volume to the List of Sudan Flora. Pp. xxv + 172 plates. (London: Wheldon and Wesley, Ltd., n.d.) 7*s.* 6*d.* net.

Mrs. Crowfoot's illustrations of the Anglo-Sudan flowers come at a very opportune moment, when tourists are visiting that country in increasing numbers every year. The 163 outline drawings depict the characteristic leaves, flowers, and fruits of the plants generally met with, and the thumbnail sketches of the outline form of some of the more typical trees are a convenient aid to identification of the common objects of the landscape. Each drawing is accompanied by the botanical name, family, vernacular names, and a few lines descriptive of the plant, with a note as to its general occurrence.

The outline figures are followed by eight plates which give a little idea of some parts of the country, whilst two typical plants are shown in the frontispiece. A sketch map shows that the part of the Sudan to which this work refers is that bounded by the Egyptian frontier on the north and the Red Sea and Abyssinia on the east, with an equal distance west of the Nile, and southwards to the beginning of the Sudd region. It pays particular attention to the little known and very interesting vegetation of the Red Sea hills around Erkowit.

Mr. A. F. Broun, lately Director of Woods and Forests of the Sudan, contributes nine introductory pages, in which he gives a useful and interesting sketch of the general features of the vegetation of the northern and central Sudan.

This useful little volume will be welcomed not only by visitors to the country but also by those many residents who find pleasure and relaxation in studying the local flora, to which hitherto there has been no popular guide.

*Letters from the Steppe: written in the Years 1886–1887.* By William Bateson. Edited, with an Introduction, by Beatrice Bateson. Pp. xvi + 222. (London: Methuen and Co., Ltd., 1928.) 7*s.* 6*d.* net.

In 1886, William Bateson, then a young man of twenty-five years, set out for the Steppe of Asia to test two definite problems of evolution which had stirred his imagination, one distributional, the other adaptational. He summarised these aims in a letter written from Omsk to Sir Sidney Harmer towards the end of his journey on Sept. 8, 1887: "I came to look for two things: firstly, beasts which had lived in the *Asiatic Mediterranean*, and which might be lingering on here; and, secondly, to get the fauna of a great variety of isolated waters in order to ascertain whether these differences of environment produce constant change of form in their fauna." In the first aim he failed, for he found no trace of the gradual extensive shrinkage which had been postulated for the Sea of Aral, but he found great variety of lakes from which he made extensive collections, and he sent home a series of lively letters which, along with extracts from his field note-books, make up this volume.

The letters do not bear much upon Bateson's scientific work, but they give a vivid account of the difficulties, discomforts, even dangers of his journey, and of the Kirghiz peoples amongst whom he lived on terms of equality. Throughout they breathe the enthusiasm, dogged perseverance, and buoyancy of spirit which characterised their writer in later years. The letters and field-notes have been well edited and collated by Beatrice Bateson, who, in a short introduction, sets the stage for the traveller's tale.

*The Plant Lice or Aphididae of Great Britain.* By Fred. V. Theobald. Vol. 3. Pp. vi + 364. (Ashford and London: Headley Bros., 1929.) 30*s.*

We welcome the appearance of the third volume of this important work, and congratulate its author upon the completion of so laborious a task. It concludes the description of the British Aphides so far as known at present, and will unquestionably form an indispensable aid to all students of the group for a number of years to come. Many more species will no doubt yet be found in Great Britain, and the existence of Mr. Theobald's treatise cannot fail to prove a great stimulus in bringing them to light. The importance of the study of Aphides is increasingly recognised the world over, not only on account of the injurious propensities of these insects, but also because they are now known to be important vectors in the spread of virus diseases from infected to healthy plants. To the general biologist, their reproductive phenomenon, alternation of hosts, and other features have long been of outstanding interest.

The difficulties and expense involved in producing a three-volume book, which can only appeal to a relatively limited circle of buyers, are such as to render all entomologists under a debt of gratitude to the author in seeing it through to completion. In this connexion it is gratifying to note that, through the Ministry of Agriculture, the Development Commission granted the financial assistance necessary to enable this last volume to be printed —a fact which, in itself, testifies to the value of such a book to horticultural and agricultural progress. Like its predecessors the volume is well printed, profusely illustrated, and separately indexed.

A. D. I.

*Spitsbergen Papers.* Vol. 2: *Scientific Results of the Second and Third Oxford University Expeditions to Spitsbergen in 1923 and 1924.* 25 papers. (London: Oxford University Press, 1929.) 30*s.* net.

The first volume of Spitsbergen papers which was published in 1925 contained the collected results of the Oxford University expedition of 1921. The present volume serves a similar purpose for the two Spitsbergen expeditions under the successful leadership of Mr. F. G. Binney, the Merton College expedition of 1923, and the Oxford University Arctic expedition of 1924. Some papers remain over to form a third volume. All the papers are reprints from various journals and proceedings of

scientific societies, bound together for convenience in reference. The papers are geographical, meteorological, geological, and biological. Many of the biological papers deal with systematic lists of species, but some take a wider outlook. If one may be singled out for mention, it is that of Messrs. V. S. Summerhayes and C. S. Elton on the ecology of Spitsbergen. This should be of interest to all ecologists and all students of the polar regions. Another paper of much importance is that by Dr. K. S. Sandford on the geology of North-East Land. The collection of papers shows how much careful work can be done by a small expedition within the short space of the Arctic summer.

*The Botany of Iceland.* Edited by Dr. L. Kolderup Rosenvinge and Dr. Eug. Warming. Vol. 2, Part 2. 7: *The Fresh-water Cyanophyceæ of Iceland*, by Johs. Boye Petersen; 8: *The Aërial Algæ of Iceland*, by Johs. Boye Petersen. Pp. 249-447. (Copenhagen: J. Frimodt; London: Wheldon and Wesley, Ltd., 1928.) 8.00 kroner.

DANISH botanists are to be congratulated on the thoroughness with which they pursue the investigation of their possessions, and in no group has research been more active than in algæ. Quite apart from the masterly researches by Rosenvinge on the marine algæ of Denmark, papers on the algæ of the Faröes, Iceland, and the Danish West Indies are familiar to all algologists. The most recent treatise completes the series on the freshwater algæ of Iceland. The marine algæ of this island were dealt with by Jonsson in 1912, marine diatoms by Østrup in 1918, freshwater diatoms in 1920, and the freshwater Cyanophyceæ by J. B. Petersen in 1923. Petersen's last treatise (which, it may be explained, is bound up with his "Freshwater Cyanophyceæ" with continuous pagination, in the "Botany of Iceland" series) deals with those land species which he designates Aerial Algæ. Under this term are included all algæ which do not grow in water or are able to grow, in periods at any rate, without being immersed. In addition to the systematic list with critical notes, there is an interesting ecological account occupying 37 pages, and the work as a whole maintains the high standard of the previous publications.

*Ants, Bees and Wasps: a Record of Observations on the Habits of the Social Hymenoptera.* By Sir John Lubbock (Lord Avebury). New edition, based on seventeenth, edited and annotated by Dr. J. G. Myers. Pp. xix + 377 + 6 plates. (London: Kegan Paul and Co., Ltd.; New York: E. P. Dutton and Co., Inc., 1929.) 10*s.* 6*d.* net.

THE popularity of this book is evidenced by the fact that seventeen editions have appeared since 1882. During this period great advances in our knowledge of social insects have been made both in Europe and America. The present edition leaves Lubbock's original text unaltered, but the annotations at the end serve to acquaint the reader with the more important results of recent investigation. In these notes (pp. 249-366) Dr. Myers has greatly enhanced the value and interest of the book, since he brings to notice many interesting facts and theories little known outside the realm of specialists. Lubbock's five coloured plates have been replaced by new ones painted by the well-known entomological artist, Mr. A. J. Enzel Terzi, whose skill is almost unsurpassed. The social Hymenoptera have attracted investigators of the highest order and their discoveries have long interested students of animal behaviour and psychology, as well as appealing to a wide circle of general readers. It is to all of these, as well as to entomologists, that we commend the new edition of this well-known volume. A. D. I.

*Agricultural Entomology.* By D. H. Robinson and S. G. Jary. Pp. xi + 314. (London: Gerald Duckworth and Co., Ltd., 1929.) 15*s.* net.

THIS book is an elementary manual of insects affecting agriculture. It is divided into seven chapters dealing with the elements of morphology and classification, and twelve chapters which treat of insects of economic importance together with the principles of their control. There are also appendices on other invertebrates which are of concern to agriculturists. The book is concisely written, well illustrated, and clearly printed, and it should meet the needs of the agricultural student and also prove useful to growers and others interested in pest control.

*Vie et réproduction: notions actuelles sur les problèmes généraux de la biologie animale.* Par Prof. Max Aron. Pp. xi + 366. (Paris: Masson et Cie, 1929.) 38 francs.

To the Strasbourg school of biology we are greatly indebted for much original work, and of those who are collected round Prof. Bouin, no one has earned a greater reputation than the author of this book, which presents in a very complete fashion an introduction to the study of biology, special reference being given to the facts and theories relating to sex and to reproduction. There is no better book of its kind in the French language than this.

## Chemistry.

*Gmelins Handbuch der anorganischen Chemie.* Achte völlig neu bearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. Bearbeitet von R. J. Meyer. (1) System-Nummer 21: *Natrium.* Pp. xxxiii + 992. 150 gold marks. (2) System-Nummer 31: *Radium und Isotope.* Pp. xviii + iv + 80. 15 gold marks. (Berlin: Verlag Chemie G.m.b.H., 1928.)

(1) THE enormous amount of labour which is involved in the compilation of the new edition of Gmelin's "Handbuch" may be gauged from the size of the part dealing with sodium, which extends to nearly a thousand pages of closely printed matter, in spite of the fact that it includes only such compounds as the metal forms with elements preceding it in the general scheme of the work. Thus while

the tartrates of sodium come under review, the consideration of Rochelle salt is postponed to a later volume.

In a brief historical introduction it is pointed out that soda and potash were not clearly differentiated (in Europe) until the middle of the eighteenth century, Stahl's previous observations in 1700 that the sulphate and nitrate derived from common salt were different from those obtained from wood-ashes having been generally overlooked. On the other hand, it is recorded that the Indians were aware of the difference between the two carbonates two and a half centuries before the Christian era.

This volume, which is the joint work of twelve collaborators, whose names appear on the back of the title-page, consists mainly of a record of the physical and chemical properties of sodium and of compounds of sodium, without critical discussion, but with copious references to the literature, which has been most carefully reviewed to the end of 1927. The text is illustrated with 75 figures, most of which are phase-rule diagrams. In addition, there are several special sections dealing with technical methods which are used in the preparation of common salt and in the manufacture of caustic soda and other products of the electrolysis of aqueous solutions of common salt. The two parts, dealing with lithium (previously reviewed) and sodium respectively, constitute one complete volume of the whole work.

(2) The much smaller section on radium and its isotopes opens with a summary of general literature on the subject and a table showing the relationships in the different disintegration series. This is followed by a detailed account of the geographical distribution and mineral sources of the four isotopes of element No. 88, together with their physical and chemical properties. There is also an interesting table showing the price fluctuations in gold marks per milligram of radium since 1902. These volumes will be indispensable to the inorganic chemist.

*Physikalische Chemie der Silikate.* Von Wilhelm Eitel. Pp. xi + 552. (Leipzig: Leopold Voss, 1929.) 80 gold marks.

Dr. Eitel's book on the physical chemistry of the silicates is a very modern work, and is a striking illustration of the enormous progress which has been made in experimental methods during the past thirty or forty years. A book on this subject written during the nineteenth century would have been concerned mainly with empirical formulæ, constructed to represent the bewildering analyses of the silicate minerals, together with drawings and data to represent the external form of the crystals, and their optical properties. These aspects of the problem can still be presented, and substantial advances have been made in our knowledge of subjects such as the distribution of the elements in the lithosphere; but already on p. 19 of Dr. Eitel's book we have reached a section on "The Determination of Crystal Structure by Röntgen-methods", and a study of the still rather limited results obtained by these methods has displaced the mass of crystallographic data which still await a clear interpretation in this way.

Another enormous field of work, on which only a limited range of results has been obtained, is that which is concerned with the application of the phase rule to silicate systems. Work on these lines is far more difficult than in the case of the metals, since the high melting-point of the silicates is accompanied by a low thermal conductivity, and the melts are so viscous that they give rise to glasses even more readily than to crystalline solids; but progress is being made and, in spite of experimental difficulties, no alternative method of study can give such useful information as to the processes involved in the formation of rocks, and the conditions under which crystalline minerals have separated from them.

Dr. Eitel's book deals also with problems such as the measurement of the density, viscosity, surface tension, and electrolytic conductivity of silicate melts, all of which have required the development of special or modified types of apparatus, and with technical glasses and slags. It is therefore an indispensable work of reference for all those whose scientific, professional, or industrial interests are concerned with materials in which silica is a component. T. M. L.

*Organic Laboratory Methods.* By the late Prof. Lassar-Cohn. Authorised translation from the General Part of the fifth revised edition. By Prof. Ralph E. Oesper. Edited by Roger Adams and Hans T. Clarke. (The World Wide Chemical Translation Series, edited by Prof. E. Emmet Reid, No. 2.) Pp. xi + 469. (London: Baillière, Tindall and Cox, 1928.) 30*s.* net.

An English version of the general part of Lassar-Cohn's familiar "Arbeitsmethoden für organisch-chemische Laboratorien" will be a convenience to many advanced students and research workers in organic chemistry. It deals in a comprehensive manner with the laboratory technique of general operations, such as distillation, dialysis, extraction, filtration, crystallisation, sublimation, and drying; the determination of molecular weight, melting point, and boiling point; and the detection and determination of nitrogen, the halogens and sulphur in organic compounds.

The translation has been made in a commendable manner from the last (fifth) German edition, and the text has been supplemented by a number of useful footnotes; but, as stated in the preface, "the work makes no claims as to completeness . . . new methods are appearing almost every day". In this respect the book possibly invites criticism. As an example, while the thirty-two pages descriptive of methods of determining molecular weight contain little information which is not available in standard text-books, there is no mention of the camphor method of Rast (*Ber.*, p. 1051; 1922), which is now widely used in organic chemical practice. Omissions of this kind could readily have been avoided by inserting brief references to original papers. In other instances, useful references,

contained for the most part in footnotes, are difficult to trace, owing to the incompleteness of the subject index and the absence of an author index. The book is well produced, and there are 186 diagrams in the text. It is not proposed to issue a translation of the second volume of the original work, dealing with general organic chemical reactions.

J. R.

*A Concise Summary of Elementary Organic Chemistry.* By Dr. F. H. Constable. Pp. xii + 149. (London: Methuen and Co., Ltd., 1929.) 4*s.* 6*d.*

THIS book is intended to suit the needs of scholarship candidates and others who have not completed their university course. They are expected to have studied the subject elsewhere, since the main facts are merely summarised without discussion. For example, we are tersely told that "on being heated dry the α-hydroxyacids become cyclic double esters (lactides) and may give lactyllactic acids", and "a diazonium salt gives nuclear substitution products (Sandmeyer's reaction) in the presence of suitable catalysts". Occasionally, very brief explanatory notes introduce topics such as optical isomerism, tautomerism and the structure of benzene, but the isomerism of maleic and fumaric acids has been unaccountably omitted.

The use of such books is not without danger, since the mental discipline involved in revision is invaluable, but the present summary is probably much fuller and more compact than private notes are likely to be, and for that reason it will be welcomed by teachers and students. Moreover, it is probable that in using it for revision the student who is beginning to appreciate the subject will frequently need to search the pages of his books of reference in order to comprehend fully the notes which are available here.

The use of the term 'straight chains' is unfortunate, but the general arrangement of the material is good and misprints are infrequent. The book may well justify the author's boldly expressed hope that it "may help to shorten the time and labour spent on elementary work, so that the earnest student may the more rapidly be in a position to make his own contribution" to this very wide subject.

*Volumetric Analysis: with a Chapter on Simple Gravimetric Determinations.* By A. J. Berry. (Cambridge Physical Series.) Fourth edition. Pp. vii + 154. (Cambridge: At the University Press, 1929.) 6*s.*

THAT this little book has established its position is shown by the fact that three fresh editions have been called for since its first appearance in 1915. Little remains, therefore, except to offer one or two suggestions.

The varying strengths of 'normal' solutions of, for example, potassium bi-iodate (p. 5), according as it functions as an acid or as an oxidising agent, would be avoided by the use of 'molar' solutions, a scheme gaining much favour abroad. Examples are given (pp. 98 and 99, not pp. 96 and 97 as in the index) of the use of potassium iodate as oxidising agent, but the practically valuable bromate process for antimony (atomic weight 121·77, not 120·2 as given on p. 144) is worthy of inclusion. Mention might advantageously be made of units of volume to the possible exclusion of the chapter on simple gravimetric determinations, the merits of the inclusion of which in a book entitled externally simply "Volumetric Analysis" appears uncertain.

These comments, however, in no wise detract from the general utility of a book of this type, for a large field is covered in relatively little space and at small cost, while the revision which the frequent editions permit keeps a useful little volume up-to-date.

B. A. E.

*Applied Chemistry; a Practical Handbook for Students of Household Science and Public Health.* By Prof. C. Kenneth Tinkler and Helen Masters. Vol. 1: *Water, Detergents, Textiles, Fuels, etc.* Second edition, revised. Pp. xii + 296. (London: Crosby Lockwood and Son, 1929.) 15*s.* net.

EXAMINATIONS involve courses, and these necessitate text-books, so that the diligent student may imbibe just so much of a particular subject as will enable him or her to pass and no more—all most satisfactory for the student but a disaster from the point of view of the acquisition of real culture and of the knowledge how to learn. However, the sin is that of the senate and the framers of a syllabus, and must not be visited on the humble writers of text-books.

In this case the subject is that of household and social science, now elevated to the status of a degree, and the science that of applied chemistry, which is of sufficient magnitude to be dealt with in two volumes. The fact that this is the second edition, and the status and achievements of the joint authors, are sufficient to guarantee that the book is thoroughly and carefully done, and our own perusal of the volume has satisfied us on this point. But how sad and how dull to be forced to learn the chemistry of everyday life in such a manner so as to pass an examination—how the students must envy their forbears who lived in the days of the old still room books such as the "Closet of Sir Kenhelm Digby" and from them really learned domestic science.

All the same, we congratulate the authors on a very satisfactory production.

E. F. A.

*The Foundations of the Theory of Dilute Solutions.* Papers on Osmotic Pressure, by J. H. Van't Hoff; and on Electrolytic Dissociation, by Svante Arrhenius. (Alembic Club Reprints, No. 19.) Pp. 67. (Edinburgh: Oliver and Boyd; London: Gurney and Jackson, 1929.) 2*s.* 6*d.*

WITHOUT waiting for a jubilee, which is not due for another eight years, the editor of the Alembic Club Reprints has provided an English translation of the papers by van't Hoff on osmotic pressure and by Arrhenius on electrolytic dissociation, which appeared in the first volume of the *Zeitschrift für physikalische Chemie* in 1887. These will be of real value to teachers and students alike, since they will

make it easy, especially for those who dislike the effort of reading German, to obtain a first-hand knowledge of the early work of the group of actors who for so many years occupied the centre of the stage on which the newly labelled cult of physical chemistry was displayed. Modern workers have thrown grave doubts on the validity of the deductions which were then made with so much confidence, and have used as evidence of discrepancy the same data which were formerly cited as evidence of concordance between theory and experiment; but for this very reason it is all the more important that the original texts should be accessible. The reprint would have been of even greater value if it had included the critical but constructive work of Debye and Hückel, but it seems likely that the rules of the Alembic Club prohibit the payment of such a compliment to contemporary workers. T. M. L.

*Industrial Carbon.* By Dr. C. L. Mantell. (Industrial Chemical Monographs.) Pp. ix+410. (London: Chapman and Hall, Ltd., 1928.) 21*s.* net.

THE author remarks that, although the industrial applications of carbon are numerous and very specialised, the literature on the subject is scattered and often contradictory. He has therefore performed a very useful service in presenting the information on the technological uses of elementary carbon, apart from fuels, in a compact and critical form. The subjects dealt with include diamonds, natural and artificial graphites, carbon black and lampblack, adsorbent charcoal, electrodes and brushes, arc carbons, refractories and minor uses. The treatment is good, although the information on active carbons is rather sketchy and not easily followed. The treatment of electrodes is full, and here, as in other parts of the book, there are useful tables and curves.

The book is one which should be found of great service to the many users of carbon in one or other of its forms, and includes much information not easily obtainable elsewhere. It is well printed and illustrated and provided with an index. The references to the literature are not very numerous, and in a future edition the bibliography might with advantage be extended. This would most usefully take the form of a selection of works and papers which themselves include bibliographies rather than a mass of references (generally inaccurate), which is too often what is found in technical literature.

*Inorganic Chemical Technology.* By Prof. W. L. Badger and Prof. E. M. Baker. (Chemical Engineering Series.) Pp. viii+228. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1928.) 12*s.* 6*d.* net.

ALTHOUGH the authors limit themselves to American practice, their method of dealing with industrial processes from the engineering point of view rather than from that of the industrial chemist is generally applicable, and their choice of material is good. The amount of detail is carefully chosen to correspond with the limits of the work, and although quantitative data are given throughout, no attempt has been made to produce a book of reference. Numerical problems are given at the ends of sections, and there is a limited but useful bibliography. This book is one which should prove valuable to students proposing to enter industry, and the average chemical student will find it convenient in supplementing the information given in the usual text-books. The most modern developments in processes are described, and the illustrations are very good.

*A General Discussion on Homogeneous Catalysis held in the Physical Chemistry Laboratory of the University of Cambridge, on Friday and Saturday, 28th and 29th September 1928.* Pp. iii+545-740. (London: The Faraday Society, 1929.) 12*s.* 6*d.*

THIS volume contains the papers presented at the fiftieth discussion arranged by the Faraday Society, and, like the preceding ones, it serves a useful purpose in bringing together many lines of development of a subject. It is divided into three parts, dealing with general relations, intermediate addition compounds and chain reactions, and neutral salt and activity effects. There are about six papers in each section, and these are followed by a general discussion of all the sections. Prof. Lowry contributes a conclusion, in which the main points raised are summarised. The volume exhibits a diversity of opinion rather greater than usual in these discussions, and some space is taken up with claims for priority which are out of place in such a publication. The volume is one which will be found most useful by research workers and students. An account of the main issues raised was given in NATURE of Oct. 13, 1928, p. 589.

## Engineering.

(1) *The Ventilation of Mines: Generation of the Air Current.* By Prof. Henry Briggs. (Methuen's Monographs on Coal-Mining.) Pp. xiv+136. (London: Methuen and Co., Ltd., 1929.) 7*s.* 6*d.* net.

(2) *Mining Subsidence.* By Prof. Henry Briggs. Pp. vii+215. (London: Edward Arnold and Co., 1929.) 14*s.* net.

(1) PROF. HENRY BRIGGS, Hood professor of mining in the University of Edinburgh, is the general editor of Messrs. Methuen's monographs on coal-mining, of which the volume on "The Ventilation of Mines" is one. Based on lectures given in the Royal School of Mines in 1927 and afterwards amplified in *Colliery Engineering* during the following year, the book treats of the flow of air in galleries, control of ventilation, various types of fans, measurement of pressures, and fan testing. Efficiency in ventilation is an important economic problem, and in some collieries the actual weight of the air put through per day is stated to be as much as ten or twelve times the tonnage of coal extracted. In a certain Prussian mine the fan is nearly 30 feet in diameter: it is rated to deliver 710,000 cubic feet per minute against a 14¼-in. water gauge and is driven by a steam engine of 2140 h.p.

(2) In the second volume under notice, Prof. Briggs gives examples of the damage to buildings, bridges, tunnels, roads, railways and water, gas,

and electricity mains, and reviews briefly the law governing mining subsidence in Great Britain. He presents a critical summary of the more important theories of subsidence which have been brought forward and discusses the methods used for mitigating the damage to property. Two chapters are devoted to the observations made in Great Britain, America, and India on the occurrence of subsidence. Prof. Briggs also deals with the bending of the strata and the fracture due to shear, and gives his conclusions regarding the mechanism of mining subsidence.

Though addressed particularly to members of the coal-mining profession, the book refers to a subject which in some parts of Great Britain is of great importance to lawyers, architects, engineers, public utility companies, and local authorities.

*Operational Circuit Analysis.* By Prof. Vannevar Bush. With an Appendix by Prof. Norbert Wiener. Pp. x+392. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1929.) 22*s.* 6*d.* net.

THE literature on the subject of operational circuit analysis is now quite extensive. Authors are simplifying and developing the methods introduced by Oliver Heaviside in his "Electrical Papers" and in his "Electromagnetic Theory". Yet beyond a recent paper published by Dr. Sumpner in the June number of the *Proceedings of the Physical Society*, there are few books or papers which explain these methods in a way that can be understood by physicists and engineers. Some use these methods without understanding in the least the mathematics of the differential equations on which they are based; they are, in fact, simply computers.

Heaviside usually evaluated his operators by expanding them in series and applying them term by term to the original function. This process has the advantage that only elementary mathematics is needed. In many cases, however, when the legitimacy of the steps is examined carefully, pitfalls are found which it is necessary to avoid. In dealing with series developments of operators, it is only too easy to get off the track. Sometimes we have to use series which converge up to a certain term and then they begin to diverge. It is absolutely necessary to know where to stop.

Prof. Bush emphasises the fact that he writes as an engineer and not as a mathematician. To engineers, this book will be found helpful. The mathematicians now treat Heaviside's operator on the lines of a complex variable and submit it to contour integration (see a paper by the late Dr. Bromwich in the *Proc. Lond. Math. Soc.*, **15**, 401-408; 1916). He shows that if the operators are interpreted in the form of complex integrals, the slippery places reveal themselves at once.

*Electricity Applied to Mining.* By H. Cotton. Pp. xi+625. (London: Sir Isaac Pitman and Sons, Ltd., 1929.) 35*s.* net.

RECENT events in the mining industry point conclusively to the fact that its continued existence necessitates that old methods and old machinery should be ruthlessly scrapped, and that electric power should be used to a far greater extent than in the past. We are glad, therefore, that in this volume the more recent methods and modern specialised plant are adequately discussed. In the earlier chapters the usual academic discussion of generation and distribution is given. Later on, when describing the electrical gear requisite for any particular drive, full particulars are given of the peculiar characteristics of the drive. For example, the operating engineer must know whether it is a fan, a compressor, or a pump. Speed regulation is of great importance with certain drives, and the author rightly lays stress on this.

The increased capacity of the machinery now available for handling the coal taken from the coal-face makes the replacement of hand labour by machine coal cutting inevitable. The actual process of coal winning is of greater importance than pumping, ventilating, or hauling. It is not economical to retain hand labour in a pit where the use of coal cutters is permissible. It has been calculated that about three times the output can be obtained from a given working face by using machines instead of hand labour. The motive power used for the coal cutter is either electricity or compressed air. In certain districts, especially in South Wales, the seams are so 'gassy' that compressed air must be used. On the other hand, in Scotland, where the mines are not gassy, the motive power for the coal cutters is nearly always electricity. We hope that many collieries will be able to obtain power from the national high tension mains.

*Engineering Economics.* By T. H. Burnham. Pp. xiii+326. (London: Sir Isaac Pitman and Sons, Ltd., 1929.) 10*s.* 6*d.* net.

AT the time of the inclusion of the subject of engineering economics in the syllabus for the examination for the associate membership of the Institution of Mechanical Engineers, there was no general text-book to which students could go for guidance in their studies. Attempts have been made to supply this need, and among the most successful must be placed this book by Mr. Burnham. Engineers who rise to the head of their profession are often more engaged in questions of administration than in questions of design and production, and some of the matters on which they have to be informed are indicated by the chapters in this book, namely, finance, foreign exchange, joint-stock companies, insurance, organisation, industrial legislation, and research.

The industrialist often asks: Does research pay? This, to our mind, is a curious question when one remembers that the steam engine is the direct outcome of the discovery of Torricelli of the pressure of the atmosphere, that our knowledge of electricity really begins with Gilbert's work, and our knowledge of the laws of motion with that of Galileo. Pasteur was one of the world's greatest investigators, and it was Huxley who said, "Pasteur's discoveries have brought France more

than the five milliards of indemnity paid to Germany after the war of 1870". Mr. Burnham rightly says, "Scientific research is essential to any attempt to develop or expand British industry".

*Steam Turbines.* By Eng. Lieut.-Comdr. T. M. Naylor. Pp. viii+207+13 plates. (London: Chapman and Hall, Ltd., 1929.) · 12*s.* 6*d.* net.

THIS book takes rather an unusual form and is perhaps best described as being something intermediate between a textbook and a handbook. It is primarily designed to meet the requirements of engineering students in their final years at colleges, etc., and for this purpose should prove exceedingly useful. The object throughout is to give all essential information without any unnecessary overloading. Fundamental and derived formulæ are given with a skeleton connexion between them. This method of presentation not only gives all that is really necessary, but also provides a little mental stimulus in following the steps.

In the interests of brevity, the general treatment of the properties of steam, thermodynamics, and the theory of lubrication have been entirely omitted, it being considered that these subjects will have been dealt with in a more general study. A chapter on condensers is wisely included, since the vacuum requirements of turbines are special to themselves. The descriptive matter is concise but not quite up-to-date. As an example, the recent development of marine installations having reciprocating engines and exhaust steam turbines is not mentioned. This defect, however, is a consequence of the rapid progress made in this branch of engineering, and is an almost general characteristic of books on this subject. A future edition would be improved by some addition and a little elimination of described examples.

## Geology and Geography.

*Die Kriegsschauplätze 1914–1918 geologisch dargestellt.* In 14 Heften. Herausgegeben von Prof. Dr. J. Wilser. (1) Heft 6: *Reims, La Fère und Ardennen.* Von Dr. C. Schnarrenberger. Pp. iv+45. 8 gold marks. (2) Heft 7: *Artois und Hennegau.* Von Prof. Dr. H. Stille. Pp. vi+40+2 Tafeln. 14 gold marks. (3) Heft 10, Teil 2: *Bodenschätze im Ostbaltikum (Ostbaltikum*, Teil 3). Von Dr. C. Gäbert und Prof. Dr. H. Scupin. Pp. vii+112+1 Tafel. 16·80 gold marks. (Berlin: Gebrüder Borntraeger, 1928.)

THREE more of the expensive monographs on the geology of the fields of War have now been issued. (1) The sixth in the series is an account by Dr. C. Schnarrenberger of the district between Rheims, La Fère, and the Southern Ardennes. It includes an account of the Jurassic iron ores, of the Cretaceous rocks of this district, and of the Kainozoic between the Montian, which is left in the Cretaceous, and the Aquitanian, which is included in the Oligocene.

(2) Prof. Stille of Göttingen describes Artois and Hainault (Hennegau), where the rocks range from the Palæozoic to the Cretaceous, and, after the Lamaride folding, to the Kainozoic, of which in one respect his classification is less satisfactory than that of Dr. Schnarrenberger; his Palæocene includes the Landenian, which is said to be overlain by the Lower Eocene Thanetian, and thus reverses the sequence of the ordinary correlation. The most interesting section in this book is the account of the distribution of the ground-water which was such an important influence during the War on the trenching and mining. The memoir is illustrated by valuable hydrogeological maps and sections.

(3) The mineral deposits of Esthonia are described in the second part of No. 10 of the series. The useful minerals are varied and include materials used for building, cement, and bricks; there are also various mineral springs and peat. The two most important are the Ordovician phosphates and the oil shale, the remarkable kuckersite, which has been known since 1777. The author shows that its age is Middle Llandeilo; he gives a valuable account of the origin of the economic constituents in both the phosphates and oil shale.

*Westward to Mecca: a Journey of Adventure through Afghanistan, Bolshevik Asia, Persia, Iraq and Hijaz to the Cradle of Islam.* By Sirdar Ikbal Ali Shah. Pp. 224+12 plates. (London: H. F. and G. Witherby, 1928.) 12*s.* 6*d.* net.

THIS is an account of the adventures of an Afghan sirdar in the course of a journey from his native country to Mecca. The journey may be performed in two ways—the shorter, the sea route via Karachi or Bombay, or the longer way, round through Afghanistan, Persia, Iraq, and the Arabian desert to the City of the Prophet.

The longer the route, however, the greater the merit, so after a preliminary failure to take the shorter route, our author determines to make his way from India across the Himalayas, Central Asia, Persia, Iraq, and thence across Arabia to the Holy City. His first attempt failed, as the friend he was travelling with died in the Himalaya mountains, and he had to return to India and start afresh via Kabul, Persia, and Turkistan. Eventually he reached Baghdad, but finding he could not continue his journey by land, owing to the disturbed state of affairs on the Arabian frontier, he decided to go by sea to Bombay and start again from there in one of the pilgrims ships, and so to Jeddeh and Mecca.

The author certainly did go the longest way round, and we must hope acquired corresponding merit. We scarcely know what to make of the somewhat extraordinary adventures he had on this long drawn out journey, they seem to be so different from those of which one generally reads. The book is well illustrated, but contains no map. It may be recalled that the author broadcast a talk on Afghan affairs a short time ago.

H. L. C.

*Some Notable Surveyors and Map-Makers of the Sixteenth, Seventeenth, and Eighteenth Centuries and their Work: a Study in the History of Cartography.* By Sir Herbert George Fordham. Pp. xii + 99 + 4 plates. (Cambridge: At the University Press, 1929.) 6*s.* net.

THIS book has a melancholy interest, as the author, Sir Herbert George Fordham, has died since its publication, only this year. Sir George was a well-known map collector, and, we believe, had one of the finest collection of old maps in England, which he exhibited on several occasions, notably at the Southampton meeting of the British Association. A list of his works on the subject of ancient maps and cartography shows how widely and deeply he had studied the subject. As a historian of maps he will be a great loss.

The present volume begins with a sketch of the Elizabethan surveyors and their methods; gives an account of the French school of cartography in the seventeenth century and its development as an exact science under the influence of the Cassini family. The last part of the book treats of British cartography in the second half of the eighteenth century, and the connexion of the triangulations of England and France, which marks the beginnings of the Ordnance Survey. Specimens of maps of various dates are given, together with a useful list of works of reference. H. L. C.

## Mathematical and Physical Sciences.

*Quellen und Studien zur Geschichte der Mathematik.* Herausgegeben von O. Neugebauer, J. Stenzel, O. Toeplitz. Abteilung B: *Studien.* Band 1, Heft 1. Pp. 112. (Berlin: Julius Springer, 1929.) 12 gold marks.

WE have here the first part of a new series which is to contain sources (Section A) and studies (Section B) of the history of mathematics. The sources are to consist of original texts with translations and all necessary elucidations. No parts of this section are yet to hand; we shall welcome them when received. Three papers in the present part of Section B are on the relation of Plato and Aristotle to certain developments in mathematics; two of them connect themselves with recent efforts to find in one of the principles of Plato's idea-numbers, the 'indefinite dyad', or the 'great and small', gropings after a system of numbers which shall include not only integers but irrationals, after the fashion of G. Cantor and Dedekind.

Of more direct mathematical interest are two papers containing accounts of old Babylonian mathematical texts recently published. One type of problem is the mensuration of parallel-trapezia obtained by cutting a right-angled triangle by one or more straight lines drawn parallel to one of the perpendicular sides. One such problem amounts to finding five unknown quantities from five equations. Certain cases in which there is only one parallel and therefore only one trapezium lead to the equivalent of 'mixed' quadratic equations; and we are assured that another document to be published in the series will show that the Babylonian solution of such equations was, step for step, equivalent to ours. Some calculations of the heights of segments of circles from their bases and vice versa imply a knowledge (1) of Thales' proposition that the angle in a semicircle is a right angle, and (2) of Pythagoras's theorem of the square on the hypotenuse. Numbers are expressed on the sexagesimal system (but without any sign for zero); the successive sexagesimal fractions are also consistently used. A remarkable fact is that, when the Babylonian wishes to calculate a fractional part of a number, he turns the fraction into a sum of successive sexagesimal fractions and *multiplies*.

It cannot be denied that the publication of these fragments throws new light on the ancient Babylonian mathematics. The authors use the expression "old Babylonian"; but we should welcome the assignment of an approximate date to the documents. T. L. H.

*Soap Films: a Study of Molecular Individuality.* By A. S. C. Lawrence. Pp. xi + 141 + 17 plates. (London: G. Bell and Sons, Ltd., 1929.) 12*s.* 6*d.* net.

No fuller or more useful book on soap films than Mr. Lawrence's new volume exists, or indeed will be needed until considerable further research has been done. It is extremely thorough, giving a most detailed account of all important work, and much that has hitherto remained unpublished, or buried in hasty description in an obscure corner of an original paper, is here set forth for the first time. Although nothing of any importance seems to have been omitted, and full literature references are given, the book is nevertheless extremely readable. Sufficient of the chemistry and physical chemistry of soaps is given to enable the reader to fix the relation of these films to other branches of knowledge, with which he may perhaps not be fully familiar before reading the book; and any special points of physical theory used in the study of soap films are briefly explained, so that nothing beyond an elementary acquaintance with physics and chemistry is required of the reader.

The book is excellently got up, and Mr. Lawrence is admirably equipped for writing it, for not only has he himself repeated Perrin's most intriguing work on the stratification of soap films under the influence of dyes and light, but he also acted as assistant to Sir James Dewar for some time. When one reads that in the cellars of the Royal Institution a soap film was once kept unbroken for three years, and considers that the ordinary mortal is proud of a soap bubble which lasts a couple of minutes, the discernment of the writer of "Biography for Beginners" (about 1910), when referring to earlier achievements, will be endorsed.

> "Sir James Dewar
> Is a better man than you are;
> None of you asses
> Can condense gases."

The book is, however, an independent survey of the subject, and by no means a mere reflection

of someone else's views; it is heartily to be recommended, not only as a work on soap films, but also as an introduction to other related subjects in which great advances in our knowledge have recently been made. N. K. A.

*Air Ministry: Meteorological Office. Réseau Mondial 1922: Monthly and Annual Summaries of Pressure, Temperature and Precipitation based on a World-wide Network of Observing Stations.* Published by the Authority of the Meteorological Committee. (M.O. No. 314.) Pp. xvi + 115. (London: H.M. Stationery Office, 1929.) 25*s.* net.

THE Meteorological Office publication dealing with the year 1922, known as the "Réseau Mondial", has recently been issued from the Air Ministry. It contains monthly and annual summaries of atmospheric pressure, temperature, and precipitation for 1922 for a world-wide network of stations arranged according to a definite plan on the lines of the earlier numbers, which start with the volume for the year 1911.

The system of representation adopted involves primarily the division of the globe into zones extending over ten degrees of latitude, and these are in each case further divided into thirty-six 'squares' covering ten degrees of both latitude and longitude, generally with two representative stations, but sometimes more. This formidable mass of statistics is unaccompanied by any brief summary of what may be revealed by them to the expert eye about the particular character of the year under consideration, as compared with other years, and the casual student of meteorology will therefore gain little from its perusal, but one of the many uses to which such a work may be turned by the expert is shown by recent papers on the radiation of the earth and its atmosphere by Dr. G. C. Simpson, Director of the Meteorological Office, in the series of memoirs of the Royal Meteorological Society. The kind of information given is clearly suitable also for studies of large scale meteorological anomalies such as the cold European and North American winters of 1928–29, and the recent run of wet years in the British Isles.

The volume under review does not differ greatly from earlier volumes, but is an advance over them in that the introduction of information from the oceans, made on a very limited scale in the volume for 1921, is here extended to include considerable areas in the North Atlantic and North Pacific Oceans.

*Handbuch der Experimentalphysik.* Herausgegeben von W. Wien und F. Harms. Unter Mitarbeit von H. Lenz. Band 9, Teil 1: *Hohe und tiefe Temperaturen*, von Prof. H. von Wartenberg; *Gasverflüssigung und ihre thermodynamischen Grundlagen*, von H. Lenz; *Wärmeleitung*, von Prof. Osc. Knoblauch und H. Reiher; *Wärmestrahlung*, von W. Wien und Dr. C. Müller. Pp. xiv + 484. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1929.) 44·60 gold marks.

THE first section of this book contains a practical and useful account of high-temperature ovens and enclosures and low-temperature baths, and of methods of temperature measurement. The second section deals with the liquefaction of gases. It includes a summary of the most important experiments on the Joule-Kelvin effect, and a descriptive account of the methods used at Leyden and at the Reichsanstalt for the production of liquid hydrogen and liquid helium. Unfortunately, the proof-readers of this part have overlooked a considerable number of algebraical errors and inconsistencies.

The third section, on the transfer of heat, is written with an emphasis throughout on work which is of importance in technical applications. The experimental work on conduction in metals and solid 'insulators' is dealt with in detail. It may be noted that the accurate work of Hercus and Laby on the conductivity of air has been overlooked. A useful account of work on the loss of heat by convection is included.

In the first chapter of section four a brief sketch is given of the thermodynamical theory of radiation. The second chapter deals with the statistical theory and includes a short account of Saha's theory of the temperature radiation from gases. The third chapter includes an account of instruments for the measurement of heat radiation; also of standard sources of radiation, and of the measurement of the pressure of radiation. The fourth chapter deals with the measurement of Stefan's constant, and the fifth with the experimental determination of the distribution of energy in the spectrum of a black body. The third, fourth, and fifth chapters form a useful and interesting summary of the experimental work. J. K. R.

*Der vierdimensionale Raum.* Von Prof. Dr. Roland Weitzenböck. (Die Wissenschaft, Sammlung von Einzeldarstellungen aus den Gebieten der Naturwissenschaft und der Technik, herausgegeben von Prof. Dr. Wilhelm Westphal, Band 80.) Pp. viii + 142. (Braunschweig: Friedr. Vieweg und Sohn A.-G., 1929.) 9 gold marks.

PROF. WEITZENBÖCK'S little book deals with the fourth dimension from many points of view, including those of geometry, physics, religion, spiritualism, metaphysics, mysticism, and phantastic fiction, and ends with an extensive bibliography. The greater part of the discussion, intended for the general reader, will be found easy and even amusing, but the author insists that a mathematical foundation is necessary, and some parts of this will be found rather difficult.

In abstract geometry, regarded as a set of logical deductions from certain axioms which are merely unproved statements concerning certain undefined terms, the number of dimensions may be any we please. Some geometers, following up Geiser's discussion of the bitangents of a plane quartic curve by means of an associated cubic surface, have found it advantageous to use four-dimensional loci in order to obtain properties of three-dimensional ones. These properties cannot be regarded merely as abstractions, for they can be verified, to a high degree of approximation, by constructing models. By the aid of analogy and analytical geometry,

thinking in four dimensions can be cultivated so as to become almost intuitional.

The application of four-dimensional space-time to relativity is now well established, but the attempts made about fifty years ago to explain physical phenomena by assuming a fourth dimension of space alone met with no success, and have now been almost forgotten. H. T. H. P.

*Lehrbuch der Physik in elementarer Darstellung.* Von Arnold Berliner. Vierte Auflage. Pp. v + 658. (Berlin: Julius Springer, 1928.) 19·80 gold marks.

THE fact that after an interval of only four years a new edition of Dr. Berliner's text-book of physics has been called for, is sufficient testimony to the quality of his work. A comparison of the fourth with the third edition shows that the text has been carefully revised and a considerable amount of additional information has been incorporated. Although the subject matter has been amplified, the number of pages is nearly the same as before. It is, perhaps, to be regretted that the table of contents is so greatly reduced and the chronological table at the end of the volume omitted. Some of the diagrams have been diminished in size and the appearance of the pages is slightly less pleasing than that of the earlier edition. But in view of the continual growth of scientific knowledge, how is an author or a publisher to meet the new conditions? We notice new sections dealing with tops and gyroscopes and with Coriolis motion. The important subject of crystal structure receives fuller treatment, and Dr. Haber contributes a useful section on flames. The additions in connexion with atomic physics are valuable and up-to-date; there is, for example, a paragraph on the experiments of Stern and Gerlach in proof of the theory of quantisation in space, and a couple of pages dealing with the Compton effect. It is remarkable how much information the author is able to convey in a clear and interesting manner in a small space.

H. S. A.

*Le théorème de Picard-Borel et la théorie des fonctions méromorphes.* Par Prof. Rolf Nevanlinna. (Collection de monographies sur la théorie des fonctions.) Pp. vii + 174. (Paris: Gauthier-Villars et Cie, 1929.) 35 francs.

IN elementary algebra the well-known remainder theorem enables us to determine a polynomial, except for a numerical factor, when all the zeroes are given. If we replace the polynomial by an integral function with an infinite number of zeroes, we can still determine a good deal about the function, though not so much as about the polynomial. In 1879 Picard proved a theorem which at that time appeared to have no connexion with the preceding results. He showed that a function that is uniform in the vicinity of an isolated essential singularity takes infinitely many times every value with the possible exception of two. Much later Borel and others linked up these two subjects of investigation, and studied the distribution of values of a complex variable for which a meromorphic function is equal to a given constant. This is the principal topic dealt with by the book under review. The discussion is based on the Poisson-Jensen formula, which connects the modulus of a meromorphic function at any point within a circle with its values on the circumference and the position of its zeroes and poles inside. For lack of space, Prof. Nevanlinna confines himself to a consideration of the *moduli*. The other half of the problem, the discussion of the *arguments* of the roots, can be found in Valiron's "Lectures on the General Theory of Integral Functions" (Toulouse, 1923) and elsewhere.

H. T. H. P.

*E. Lechers Lehrbuch der Physik: für Mediziner, Biologen und Psychologen.* Fünfte Auflage, bearbeitet von Prof. Dr. Stefan Meyer und Prof. Dr. Egon Schweidler. Pp. ix + 469. (Leipzig und Berlin: B. G. Teubner, 1928.) 18 gold marks.

ANY text-book of physics which seriously attempts to show the young medical student that a knowledge of physics is certain to be of real use to him in his future career certainly deserves to be brought to the attention of teachers of physics. The fifth edition of Lecher's text-book has been edited by Stefan Meyer and Egon Schweidler, whose names are sufficient guarantee of its excellence. It covers a rather wide range for an introductory course of physics, but the more advanced portions are dealt with quite briefly and may easily be assimilated. It is very well illustrated, and no pains have been spared to collect examples of the physical measurements necessary in physiological or medical practice.

## Medical Sciences.

*Blood: a Study in General Physiology.* By Prof. Lawrence J. Henderson. (Yale University: Mrs. Hepsa Ely Silliman Memorial Lectures.) Pp. xix + 397. (New Haven, Conn.: Yale University Press; London: Oxford University Press, 1928.) 23*s.* net.

THE application in recent years of physical and chemical methods of investigation to the subject of physiology has yielded an enormous amount of knowledge, which is usually of so detailed and descriptive a character that its literature is rapidly becoming the despair of the student with a strictly scientific mind. It is consequently very refreshing to meet a truly philosophical contribution like the present volume.

In the problem of the determination of the elementary condition of life enunciated by Claude Bernard, morphologists have been content with a description of the characters of the single cell while biologists have conferred upon protoplasm the possession of the elementary conditions. Prof. Henderson has effected a notable advance towards a more rational solution of this problem by shifting the focus of attention from the cell to the medium bathing it—the *milieu intérieur* of Claude Bernard—and carrying the processes of generalisation and abstraction further to a single physico-chemical system in heterogeneous equilibrium as representing the elementary condition of the phenomena of life.

Established facts are analysed mathematically; the many dependent variables by subjection to nomographic treatment are brought into graphical relationship and the whole integrated by a rational synthesis.

Interest in the volume is enhanced by a study of the problems of adaptation both in health and disease.

*Magician and Leech: a Study in the Beginnings of Medicine, with Special Reference to Ancient Egypt.* By Warren R. Dawson. Pp. xiii + 159 + 4 plates. (London: Methuen and Co., Ltd., 1929.) 7*s.* 6*d.* net.

Mr. Dawson, although not a medical man, has devoted much time and thought to the elucidation of the medical texts of ancient Egypt, as the pages of the periodicals of various learned bodies bear witness. In this little book, while a general account of Egyptian medical knowledge and practices forms the central theme, the author's object is to show, on one hand, how closely allied was Egyptian art to primitive magical ideas, out of which indeed it had grown, and on the other hand, to how great an extent medical science was promoted by the special conditions which prevailed in Egypt. Of these, perhaps the most important was the practice of mummification, which gave the Egyptians an opportunity of acquiring an exact knowledge of human anatomy.

Mr. Dawson concludes his account with examples of the survival of Egyptian theory and drugs in later medicine. An interesting example of a persistent belief is that of the therapeutic value of mice. The eating of a skinned mouse is prescribed in a papyrus of 1400 B.C., but remains of mice have been discovered in the alimentary canals of children in predynastic graves more than six thousand years old, and they have been prescribed as a remedy for whooping-cough for children within living memory in England.

*Recent Advances in Physiology.* By Prof. C. Lovatt Evans. (Recent Advances Series.) Third edition. Pp. xiii + 403. (London: J. and A. Churchill, 1928.) 12*s.* 6*d.* net.

The fact that this volume has reached its third edition in three years is a good recommendation of its value. It is, in fact, an excellent introduction to advanced physiology and gives a readable account of recent work on certain aspects of the subject. The chapters have been rearranged; two have been added on excitability and chronaxie and on the nervous impulse, and three have been omitted, two on the blood and one on the work of the heart. In spite of these alterations, the number of pages is slightly greater than in the second edition. Whether the present order is the best is somewhat open to question, since the new chapter on excitability and chronaxie is the first, and this is a subject which is one of the most difficult for the novice to follow. A very good account of the work of Pavlov and his pupils on conditioned reflexes is given, and serves as a useful introduction to the English translations of this work which are now available.

The book is well up-to-date and remarkably free from errors; we note, however, in the chapter on active principles of some endocrine organs, an absence of a reference to the international standard of posterior lobe of pituitary gland, and also that the international standard of insulin is stated to contain 24 units per mgm. instead of 8, some confusion between 'rabbit' and 'clinical' units being evident. This is a readable volume and should be in the hands of all those taking an advanced course of physiology.

*A History of Pathology.* By Prof. Esmond R. Long. Pp. xxiv + 291 + 49 plates. (London: Baillière, Tindall and Cox, 1928.) 22*s.* 6*d.* net.

Prof. Long, who holds the chair of pathology in the University of Chicago, has given in this little volume the first definite and systematic account in English of the history of his subject. The work is divided into twelve chapters devoted respectively to the pathology of antiquity, Galen and the Middle Ages, the pathology of the Renaissance, the seventeenth century, Morgagni and the eighteenth century, pathology in France, England, Vienna, and Berlin respectively in the early part of the nineteenth century, pathological histology and the last third of the nineteenth century, the rise of bacteriology and immunology, and experimental and chemical pathology. An appendix contains a list of the classical works on the subject from Hippocrates to Cohnheim. The book, which contains a vast amount of information presented in an attractive manner, is illustrated by numerous portraits and figures from the older works on pathology.

## Miscellany.

*The Principles and Practice of the Dilution Method of Sewage Disposal.* By Dr. W. E. Adeney. (Cambridge Public Health Series.) Pp. xii + 161. (Cambridge: At the University Press, 1928.) 12*s.* 6*d.* net.

When soluble organic matter is discharged into a river, seventy to eighty per cent undergoes complete oxidation into carbon dioxide through the agency of bacteria, the remainder for the most part being converted into humic substances as by-products of bacterial activity, and only a relatively small proportion going to build up the bacteria themselves. The ammonia formed in the process is finally oxidised by bacteria to nitrites and nitrates. If, however, there is insufficient oxygen present in the water for these changes to be completed, noxious products are produced and the ammonia remains unoxidised.

The quantity and rate at which oxygen is used during these changes is described with many examples from Dr. Adeney's own experimental results; the researches of the author and his co-workers on the rate at which waters dissolve oxygen from the atmosphere under open-air conditions are clearly presented.

It is possible to estimate the extent to which the waters of a river can deal with the sewage of a neighbouring community, having regard to the

absence of noxious decomposition products on one hand, and on the other hand, to the economical discharge of the duties of the local authority. As an example of the quantitative nature of such an estimate, the daily amount of oxygen required for the bacterial oxidation of the sewage entering New York Harbour was found experimentally, the rate at which oxygen was entering the harbour water from the atmosphere was calculated, and from these a value obtained for the oxygen content of the harbour water, which value was in good agreement with the quantities actually found.

The book includes full directions for the estimation of dissolved gases in water, and useful information concerning the interpretation of the results of some arbitrary but common methods of water analyses. It is of wider interest than the title suggests. H. W. H.

*School Laboratory Fittings.* By Alan E. Munby. Pp. vii + 88. (London: George Bell and Sons, Ltd., 1929.) 7*s.* 6*d.* net.

Mr. Munby is well known as an ingenious and successful architect of science laboratories, and his large book on laboratory design and equipment is generally recognised as the best work on the subject. The present book deals with a more circumscribed topic, namely, the fittings of school laboratories. A handbook of this kind, embodying the results of long and wide experience, cannot fail to prove of great assistance to educational authorities and to exercise a beneficial effect upon science teaching in the schools. As Mr. Munby truly says, the present-day cost of education calls for a high efficiency in the material requirements of teaching, and particularly in laboratories the need for intelligent planning and fitting is urgent.

A noteworthy feature of the book is that all the arrangements and fittings described have actually been put into use, in the laboratories of Clifton College and elsewhere, while the illustrations are largely based upon the author's working drawings. Attention may be directed in particular to the excellent scheme for an elementary chemical laboratory, where ample fume-cupboard accommodation is provided for a class of thirty, and the benches are so arranged that the master has complete and easy control over the whole room.

The book is well printed and excellently illustrated, and Mr. Munby must be thanked for presenting us, at a nominal price, with professional information of a high practical and financial value to all who are about to build or fit school laboratories.

*Industrial Tyneside: a Social Survey made for the Bureau of Social Research for Tyneside.* By Dr. Henry A. Mess. Pp. 184. (London: Ernest Benn, Ltd., 1928.) 10*s.* 6*d.* net.

In this volume the author has tried to present the facts of the social conditions of the eleven municipal areas from Newburn and Blaydon along both banks of the Tyne to the sea. Most of the information was collected in the years 1926–27, but the survey does not claim to give a complete view of the area in those particular years. The author has attempted, with much success, to indicate the forces that are at work in changing the life of Tyneside. The result is a valuable study of the evolution of human society in one of the oldest areas of industrial England. The influence of place in the growth of this human 'conurbation' is not neglected, but the study might have had wider value if the geographical factors in the rise and growth of Newcastle and other centres had been given more attention. The poorness of the maps is out of keeping with the care and trouble that the work in general has demanded.

## Psychology.

*The Fundamentals of Human Motivation.* By Prof. Leonard T. Troland. Pp. xiv + 521. (London: Macmillan and Co., Ltd., 1928.) 21*s.* net.

Of books on general psychology as at present understood there is a goodly array. Their name is legion, and we gather that it would not have occurred to Dr. Troland to add another to the list. The problems he sets out to solve are essentially practical. Why do people behave and feel as they do? What are the foundations of impulse, desire, emotion, purpose, and habit? Yet his book does not belong to the category of 'applied psychology'. Though he is guided by practical considerations, his aim is to fill a gap in the literature of pure psychology. His treatment, which is very thorough, eventuates in a form of psychological hedonism, according to which our voluntary choices are determined by the summation of all past affections. This 'hedonism of the past', which is his interpretation of happiness, constitutes the basis of preferability among alternative courses of action.

Dr. Troland applies his principle to a large number of 'motivational processes', including those involved in such a primitive interest as sex, and such modern interests as motor-cars, music, the drama, radio, and so on. The book is not an easy one to read, for the author is not concerned to temper the wind to the shorn lamb. He helps the general reader of good education, however, by supplying a glossary of the more difficult, and, we may add, the neologistic, terms.

*Introduction to Social Psychology: Mind in Society.* By Dr. Radhakamal Mukerjee and Dr. Narendra Nath Sen-Gupta. Pp. xv + 304. (London and Sydney: D. C. Heath and Co., 1928.) 7*s.* 6*d.* net.

Though emanating from India, this book is in fact an American production. Not only have the authors been very largely influenced by American writings on the subject, but also they have adopted the American form of presentation. Within the limits of this class of literature, it is a careful and competent production. But the limits of usefulness of text-books of social psychology are obvious. On one hand, the foundations are in many respects anything but firm in the present state of our knowledge. On the other hand, concrete studies of the behaviour of man in society are few. Of necessity, therefore, a text-book is unsatisfactory. It

gives the impression of vague inexactness and fails to achieve the one result of value which may at present be looked for from social psychologists. They can at times throw light into dark corners and so illuminate social problems; but this they do, not by a methodical working over the whole field of social organisation, but here and there as they are enabled to relate some social activity to some psychological characteristic. The attempt to reduce the subject to the form of a science can scarcely end in anything but failure. It is presumably made to satisfy the call upon teaching institutions to include social psychology in their courses.

*Industrial Psychology.* Edited by Dr. Charles S. Myers. (Home University Library of Modern Knowledge.) Pp. 252. (London: Thornton Butterworth, Ltd., 1929.) 2*s.* 6*d.* net.

THE subject with which this book deals is comparatively new as a definite department of scientific investigation, but already it is far enough advanced to justify recognition in the Home University Library. Most of the chapters have been contributed by members of the staff of the National Institute of Industrial Psychology. Dr. C. S. Myers, the well-known Director of the Institute, provides an introduction in which he explains the scope of industrial psychology, and its relations to general, and to other branches of applied, psychology.

The topics dealt with by the several contributors include the relations of work to environment and to rest, unproductive working time, industrial accidents, the measurement of intelligence, fitting the man to the job, and the economic aspects of industrial psychology. The book represents work done by competent psychologists in actual contact with industrial conditions, and it is probably the most successful attempt yet made to put the principles and methods of industrial psychology in language which any educated reader can understand. The application of scientific methods to industrial problems ought to become known, not only to industrialists, but also to everyone who is interested in social progress.

*Objectives and Problems of Vocational Education.* Edited by Prof. Edwin A. Lee. (McGraw-Hill Vocational Texts.) Pp. viii + 451. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1928.) 15*s.* net.

THIS book consists of seventeen articles written by "men who have been part and parcel of the movement for vocational education [in the United States] from its inception". In 1914 Congress appointed the Commission on National Aid to Vocational Education, and in 1917 the Smith Hughes Act for Vocational Education became law. From a study of the past, and more especially the immediate past, present 'ends in education' are considered with an eye to the future. Education for the professions, agriculture, commerce, home economics, industry, pass in review, and questions of vocational guidance, rehabilitation of the disabled, vocational teacher training, and the attitude of employer, worker, and parent to the present working schemes, are dealt with by experts in their subject. The result is a valuable book for those wrestling with the problem of how best to bridge the gulf between school and work. R. J. B.

*Emotion and Delinquency: a Clinical Study of Five Hundred Criminals in the Making.* By Dr. L. Grimberg. (Library of Educational Psychology.) Pp. ix + 147. (London: Kegan Paul and Co., Ltd., 1928.) 7*s.* 6*d.* net.

DR. GRIMBERG develops the hypothesis that the delinquent errs not so much through any great intellectual defect as through a defect of emotional balance which at bottom is based on a constitutional defect of the endocrine system. The groups of girl delinquents which he deals with consisted of (*a*) those who were of low average mentality; (*b*) those who were frankly amoral and were quite unable to adjust to their environment. In both groups it was found that economic conditions had very little to do with the delinquency. In the first group, the delinquency started after leaving what had often been a very strict home where life had not adapted them for meeting modern requirements of social conditions. In the second group, delinquency had begun at home, where conditions were usually bad, struggling and immoral.

An excellent presentation by a writer with a very wide knowledge of the maladjusted personality.

*Matter and Method in Education.* By Mary Sturt and Ellen C. Oakden. Pp. xiv + 345. (London: Kegan Paul and Co., Ltd., 1928.) 7*s.* 6*d.* net.

THIS book is well written and deals in an attractive way with a survey of modern educational practice. The first part raises the question of the curriculum, and emphasis is laid on the æsthetic and humanistic sides of teaching. The second part gives ample guidance in such practical needs as form of lesson, time-table, examinations, promotion, discipline. Useful comparisons are made between English and American methods. The book concludes with a discussion of the position of the teacher.

More than a passing reference is made to the educational outlook of Sanderson of Oundle, and, although primarily concerned with the elementary school, this book is of value to all interested in teaching. Its scope does not apparently admit of any lengthy discussion of the place of science in the curriculum. The writers claim that "it is an exposition of school practice and methods of to-day against their historical background". H. D. A.

*Testing Intelligence and Achievement.* By Dr. Albert J. Levine and Louis Marks. Pp. ix + 399. (New York: The Macmillan Co., 1928.) 8*s.* 6*d.*

A CONCISE and readable survey of the field of psychological testing is given. Intelligence tests, achievement tests, and tests of 'non-intelligence traits of personality' are dealt with in order and their practical value brought out by chapters dealing with the mental defective, the neurotic and the superior child, and ending in each case with the educational problem associated with these marked variations from the normal. R. J. B.

# Forthcoming Books of Science.

### Agriculture, Forestry, and Horticulture.

*Chapman and Hall, Ltd.*—Dairy Farming, Fraser; Growing Tree and Small Fruits, H. B. Knapp and C. E. Auchter. *W. Heffer and Sons, Ltd. (Cambridge).*—Sugar Beet in the Eastern Counties, 1928, No. 2. Report No. 13 of the Farm Economics Branch, Department of Agriculture, Cambridge, C. Burgess, with some observations by G. Ll. Rogers. *Macmillan and Co., Ltd.*—Text-Book of Tropical Agriculture, Sir H. A. A. Nicholls, second edition, revised by J. H. Holland. *Oxford University Press.*—Index Londinensis. An emended and enlarged edition continued up to the end of the Year 1920 of Pritzel's Alphabetical Register of Representations of Flowering Plants and Ferns. Prepared for the Royal Horticultural Society of London by Dr. O. Stapf. In six volumes, vol. 1; Index Kewensis. An Enumeration of the Genera and Species of Flowering Plants from the time of Linnaeus; Supplement VII. Additional References for the Years 1921–1925, Dr. A. W. Hill; Economics of Forestry, W. E. Hiley (The Oxford Manuals of Forestry. Vol. 2).

### Anthropology and Archæology.

*W. Heffer and Sons, Ltd. (Cambridge).*—Excavations of Early Iron Age Site at Landford, J. P. Preston. *Macmillan and Co., Ltd.*—Myths of the Origin of Fire: an Essay, Sir James Frazer. *Methuen and Co., Ltd.*—Rock Paintings from South Africa. From parts of the Eastern Province and Orange Free State. Seventy-two reproductions in coloured collotype from drawings copied from the originals by G. W. Stow, and a Map. With an Introduction and Descriptive Notes by Dorothea F. Bleek. *Oxford University Press.*—The Danube in Prehistory, Prof. V. Gordon Childe; The Corridors of Time, H. Peake and Prof. H. J. Fleure. VI. The Way of the Sea; Ancient Emigrants. A History of the Norse Settlements of Scotland, Prof. A. W. Brøgger; A History of Iberian Civilization, J. P. de Oliveira Martins. Translated by A. F. G. Bell. With a Preface by Prof. de Madariaga; The Near East and American Philanthropy: A Survey conducted under the Guidance of the General Committee of the Near East Survey, F. A. Ross, C. L. Fry, and E. Sibley; The Evolution of Earth and Man. Edited by G. A. Baitsell; Art and Religion of Fossil Man, G. H. Luquet. Translated by J. T. Russell, Jr. *G. Routledge and Sons, Ltd.*—Are We Civilized? Human Culture in Perspective, Prof. R. H. Lowie. *Williams and Norgate, Ltd.*—Further Discoveries in the Antiquity of Man, Sir Arthur Keith; Old Civilizations of the New World, A. H. Verrill; Stone Age Finds in Finnmark, A. Nummedal.

### Biology.

*Edward Arnold and Co.*—Man's Place Among the Mammals, Prof. F. Wood Jones. *Baillière, Tindall and Cox.*—Laboratory and Field Ecology: The Responses of Animals as Indicators of Correct Working Methods, Prof. V. E. Shelford. *Thornton Butterworth, Ltd.*—The Natural History of Selborne, Gilbert White. Edited and with Introduction by E. M. Nicholson. Illustrated with woodcuts by E. F. Daglish; The New Nature Study, F. J. Wright. *Cambridge University Press.*—Gnetales, the late Prof. H. H. W. Pearson (Cambridge Botanical Handbooks). *Constable and Co., Ltd.*—Heredity in Man, Prof. R. R. Gates. *Longmans and Co., Ltd.*—Growth and Tropic Movements of Plants, Sir J. C. Bose. *Macmillan and Co., Ltd.*—Studies on the Structure and Development of Vertebrates, Prof. E. S. Goodrich. *Oxford University Press.*—The Great Apes, R. M. and A. W. Yerkes. *Williams and Norgate, Ltd.*—The Essentials of Biology, Prof. J. A. Thomson and Prof. P. Geddes.

### Chemistry.

*Edward Arnold and Co.*—Elder Pliny's Chapters on Chemical Subjects, Dr. K. C. Bailey, Part 1. *Baillière, Tindall and Cox.*—Coal Carbonisation, R. Wigginton. *Chapman and Hall, Ltd.*—The Conductivity of Solutions and the Modern Dissociation Theory, C. W. Davies; Solvents, Dr. T. H. Durrans; The Principles and Practice of Lubrication, Prof. A. W. Nash and Dr. A. R. Bowen; Handbook of Chemical Microscopy, Chamot and Mason. Vol. 1; Outlines of Biochemistry, Gortner; Applied Inorganic Analysis, Hildebrand and Lundell; Colloid Symposium Annual, vol. 7, Weiser. *C. Griffin and Co., Ltd.*—Friend's Inorganic Chemistry, Vol. 6, Part 3: Vanadium, Niobium, and Tantalum, S. Marks; Friend's Inorganic Chemistry, Vol. II. Part 2: Organometallic Compounds: Derivatives of Arsenic, A. E. Goddard; The Quantitative Analysis of Inorganic Materials, N. Hackney. *Gurney and Jackson.*—Lunge's Technical Chemists' Handbook, Tables and Methods of Analysis for Manufacturers of Inorganic Chemical Products, third edition revised by Dr. A. C. Cumming. *Longmans and Co., Ltd.*—The Spirit of Chemistry, Prof. A. Findlay; The Effects of Moisture on Chemical and Physical Changes, Dr. J. W. Smith; Photo-Processes in Gaseous and Liquid Systems, Dr. R. O. Griffith and Dr. A. McKeown; Sulphuric Acid and its Manufacture, Dr. H. A. Auden; Gaseous Combustion at High Pressures: An Account of the Researches carried out in the High Pressure Gas Research Laboratories of the Imperial College of Science and Technology, London, together with the Equipment and Experimental Methods employed, Prof. W. A. Bone, Dr. D. M. Newitt, and Dr. T. A. Townend; Elementary Inorganic Chemistry, Dr. J. W. Mellor; Bacterial Metabolism, Marjory Stephenson. *Oxford University Press.*—The Kinetics of Chemical Change in Gaseous Systems, C. N. Hinshelwood, second edition; The Colloid Chemistry of Rubber, P. Stamberger. *G. Routledge and Sons, Ltd.*—The Parachor and Valency Theories, Dr. S. Sugden (Twentieth-Century Chemistry Series).

### Engineering.

*Edward Arnold and Co.*—The Balancing of Engines, Prof. W. E. Dalby, fourth edition. *Chapman and Hall, Ltd.*—High Voltage Cables, L. Emanueli, with an Introduction by Prof. C. L. Fortescue; Overhead Power Lines, W. Morecombe; Commercial A.C. Measurements, G. W. Stubbings; The A.B.C. of Television, or, Seeing by Radio, R. F. Yates; A Study of the Induction Motor, Dr. F. T. Chapman; The New Ford Model "A" Car: Construction, Operation, and Repair, V. W. Pagé; Electrical Engineering Practice, J. W. Meares and R. E. Neale, fourth edition; Telegraphy and Telephony, including Wireless Communication, Prof. E. Mallett; Experimental Engineering, Diederichs, Upton and Gage; Radio Traffic Manual and Operating Regulations, R. L. Duncan and C. E. Drew; How to Pass U.S. Government Radio License Examination, R. L. Duncan and C. E. Drew; Principles of Radio, Henney; Highway Curves, H. C. Ives; Design of Electrical Apparatus, Kuhlman; Electric Street Lighting, Stahl; Aircraft Instruments, C. J. Stewart; Modern Aviation Engines, Major V. W. Pagé, 2 vols. *Constable and Co., Ltd.*—Articulated Locomotives, L. Wiener. *C. Griffin and Co., Ltd.*—Questions and Answers on the Construction and Operation of Diesel, Semi-Diesel, and other Internal Combustion Engines, J. Lamb, third edition; The Balancing of Oil Engines (in theory and practice), W. K. Wilson; Electricity Supply Transformer Systems and their Operation. W. T. Taylor. *Crosby Lockwood and Son.*—The Strength of Shafts in Vibration, Captain J. Morris; Farm and Industrial Tractors, D. N. M'Hardy; Railway and Seaport Freight Movement, Comprising Modern British and North American Practice, G. Bulkeley; Modern Bridge Construction, F. J. Taylor; Industrial Refrigeration, Cold Storage, and Ice-Making, A. J. Wallis-Tayler. Edited by R. J. Cracknell; Gas Appliances and Installations, A. T. Gilbert; Design of Merchant Ships and Cost Estimating, A. Kari, second edition; Electric Overhead Crane Design, B. A. Barson; Metalliferous Mine Surveying, T. Hanton. *Oxford University Press.*—The Practical Engineer Mechani-

cal Pocket Book and Diary for 1930, edited by E. G. Beck; The Practical Engineer Electrical Pocket Book and Diary for 1930, edited by C. Arnold. *Sir Isaac Pitman and Sons, Ltd.*—The Wireless Manual, Capt. J. Frost, second edition; The Motorist's Electrical Guide, A. H. Avery; Engineering Materials, A. W. Judge, Vol. 1; Preliminary Mathematics for Engineers, W. S. Ibbetson; Electric Wiring of Buildings, F. C. Raphael; High Voltage Cables, P. Dunsheath; Examples in Electric Traction and Power Distribution; The Electric and Magnetic Circuits, Prof. E. N. Pink.

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### Geology, Mineralogy, and Mining.

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### Mathematical and Physical Sciences.

*Edward Arnold and Co.*—The Acoustics of Orchestral Instruments and of the Organ, Dr. E. G. Richardson. *Cambridge University Press.*—Cambridge Five-Figure Tables, F. G. Hall and Dr. E. K. Rideal; Riders in Geometry, T. H. Ward Hill; Arithmetical Problem Papers, Rev. E. M. Radford. *Chapman and Hall, Ltd.*—Plane Trigonometry, Rosenbach and Whitman; Mechanical Working Drawing, Townsend and Cleary. *Constable and Co., Ltd.*—Introduction to Statistical Mechanics for Students of Physics and Physical Chemistry, Dr. J. Rice; Introduction to Theoretical Physics, Prof. A. Haas. Translated by Dr. T. Verschoyle, Volume 2, second edition. *Macmillan and Co., Ltd.*—An Introduction to the Theory of Fourier's Series and Integrals, Prof. H. S. Carslaw, third edition; Lectures on Theoretical Physics delivered at the University of Leiden, Prof. H. A. Lorentz. Authorised Translation by Dr. L. Silberstein and A. P. H. Trivelli, Vol. 3: The Principal of Relativity for Uniform Translations (Special Theory of Relativity). *Methuen and Co., Ltd.*—An Introduction to the Study of Wave Mechanics, Louis de Broglie. Translated by Dr. H. T. Flint; Wave Mechanics: Being a supplementary volume to 'Atomic Structure and Spectral Lines,' Prof. A. Sommerfeld; X-Rays, Dr. B. L. Worsnop; Magnetism, Dr. E. C. Stoner; Mine Atmospheres, Prof. I. C. F. Statham and W. Payman. *Oxford University Press.*—The Size of the Universe, Dr. L. Silberstein; Modern Cosmologies. An Historical Sketch of Researches and Theories Concerning the Structure of the Universe, Dr. H. Macpherson; Adjustment of Errors in Practical Science, R. W. M. Gibbs; Advanced Mathematics for Students of Physics and Engineering, D. Humphrey, 2 Parts and complete. *Sir Isaac Pitman and Sons, Ltd.*—Photoelectric Cells, Dr. N. R. Campbell and Dorothy Ritchie; Applied Optics, Dr. L. C. Martin, Vol. 1.

### Medical Science and Physiology.

*Edward Arnold and Co.*—The Principles of Bacteriology and Immunity, Prof. W. W. C. Topley and Dr. G. S. Wilson. *Baillière, Tindall and Cox.*—Bacteriological Technique, Prof. J. Eyre. *Chapman and Hall, Ltd.*—The Essentials of Human Embryology, Dodds. *J. and A. Churchill.*—Recent Advances in Preventive Medicine, Dr. J. F. C. Haslam; Applied Pharmacology, Prof. A. J. Clark, third edition. *W. Heffer and Sons, Ltd. (Cambridge).*—Fundamentals of Bio-Chemistry in Relation to Human Physiology, T. R. Parsons, third edition, second impression. *E. and S. Livingstone.*—A Handbook of Practical Therapeutics, Dr. D. Campbell; A Text-book of Public Health, Prof. J. R. Currie. *Longmans and Co., Ltd.*—The Internal Secretions of the Ovary, Dr. A. S. Parkes. *Macmillan and Co., Ltd.*—Life of Sir Clifford Allbutt, Sir Humphry Rolleston, Bart. *Methuen and Co., Ltd.*—Nerve Troubles: Causes and Cures, Dr. C. Webb-Johnson. *Oxford University Press.*—Mammalian Physiology: A Course of Practical Exercises, E. G. T. Liddell and Sir Charles Sherrington, new edition; Experiments and Observations on the Gastric Juice and the Physiology of Digestion, W. Beaumont, with Introduction by Sir William Osler; De Oculis eorumque Egritudinibus et Curis, Benevenutus Grassus. Translated by C. D. Wood. *Kegan Paul and Co., Ltd.*—Disease and the Man, Dr. G. Draper; Cancer of the Larynx, Sir St. Clair Thomson and L. Colledge (Anglo-French Library of Medical and Biological Science); Problems of Neurosis: a Book of Case Histories, A. Adler. Edited by P. Mairet, with Introduction by Dr. F. G. Crookshank.

### Metallurgy.

*Chapman and Hall, Ltd.*—Stainless Iron and Steel, J. H. G. Monypenny, second edition.

### Meteorology.

*Oxford University Press.*—Climate, W. G. Kendrew.

### Miscellany.

*Baillière, Tindall and Cox.*—Law and Industry, G. S. Marlow; Tales of Discovery, Invention and Research (Popular Research Narrative Series). *Cambridge University Press.*—A History of Science and its Relations with Philosophy and Religion, W. C. D. Dampier-Whetham. *C. Griffin and Co., Ltd.*—The Law Relating to Weights and Measures, G. A. Owen. *Hodder and Stoughton, Ltd.*—The Phantom Walls, Sir Oliver Lodge. *Methuen and Co., Ltd.*—The Technical Arts and Sciences of the Ancients, A. Neuburger. Translated by Dr. H. L. Brose. *Oliver and Boyd (Edinburgh).*—Dictionary of Scientific Terms. Pronunciation, Derivation, and Definition of Terms in Biology, Botany, Zoology, Anatomy, Cytology, Embryology, Physiology, I. F. Henderson and Dr. W. D. Henderson, second edition. *Kegan Paul and Co., Ltd.*—Isis, or the Future of Oxford, W. J. Diplock (To-day and To-morrow Series). *G. Routledge and Sons, Ltd.*—

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## News and Views.

DR. F. E. SMITH, Director of Scientific Research at the Admiralty since 1920, has been appointed by His Majesty the King in Council to be Secretary to the Committee of the Privy Council for Scientific and Industrial Research, with effect from Oct. 1, in succession to Mr. H. T. Tizard, who recently resigned upon his appointment as Rector of the Imperial College of Science and Technology. Before Dr. Smith went to the Admiralty he was superintendent of the Electrical Department, National Physical Laboratory, for nine years, and his work on the development of electrical standards and related subjects was of the highest scientific and practical importance. It was largely in recognition of this work that he was awarded the Duddell Medal of the Physical Society in 1927. Dr. Smith's particular genius is, indeed, in the field of scientific instruments, and while he has been at the Admiralty he has brought physical apparatus used in various departments of the naval service to a high state of perfection. We cannot help regretting that the Admiralty will lose such an original and ingenious experimenter, for Dr. Smith's duties will, in future, be chiefly administrative, and therefore very different from those which he has carried out to national advantage for the past nine years. We are sure, however, that he will be equally successful as an administrator, for he has been one of the honorary secretaries of the British Association since 1922 and has great organising ability. He was chiefly responsible for raising the subsidy required for the recent South Africa meeting of the Association, and at every stage of the meeting his work and efficient organisation earned high tributes of praise from all the members. He is sure to make his influence felt in the Department of Scientific and Industrial Research, but it will be difficult to replace him at the Admiralty.

THE first of the series of television broadcasts conducted by the Baird Television Development Co. through the 2LO stations took place between 11 and 11.30 A.M. on Sept. 30. Both the speech and television signals originated from the Baird television studio in Long Acre. Only one wave-length was available, so speech and television had to be transmitted alternately. Television and sound receivers were installed at Savoy Hill, at the General Post Office, at the Radio Exhibition at Olympia, at the Baird Laboratory, and at Mr. Baird's private residence on Boxhill. These are the only sets which have been manufactured under the supervision of the Baird Co., but in addition it is estimated that about twenty television sets made by enthusiastic amateurs from instructions published in *Television* were in operation. Representatives of the Press were able to form their impressions of this first public demonstration either at Long Acre or Boxhill. There was a slight technical hitch at first, a negative instead of a positive image being transmitted, but this was quickly put right and the images were afterwards clearly received. Sir Ambrose Fleming was the first to be transmitted, followed by Prof. Andrade and Major Church. Sir Ambrose Fleming paid a tribute to the pioneer work of Mr. Baird and briefly outlined the possible developments of television. The speeches of those televised and a message from Mr. William Graham, President of the Board of Trade, in which he welcomed the introduction of television as a new development of the radio industry calculated to have a marked effect on the employment of skilled craftsmen and scientific technicians, and congratulating Mr. Baird on the success which had attended his efforts to establish television as a British industry, were received on ordinary wireless sets. Further demonstrations are being given daily between 11 and 11.30 A.M.

PROPOSALS for the organised development of the resources of the British Empire were made by Sir Robert Hadfield in a speech delivered at the annual meeting of Messrs. Hadfield, Ltd., last spring, and have since been published in the *Empire Mail* for June. The scheme is being discussed at the autumn meeting in Edinburgh on Oct. 2–4 of the Association of British Chambers of Commerce. Sir Robert Hadfield contrasts the crowded population and shortage of work in Great Britain with the scanty population and undeveloped resources of vast areas of the Empire. The Empire was thoroughly organised for war, but he sees a lack of co-ordination and foresight in the plans for development in time of peace. He maintains that the first practical step in banishing unemployment and trade depression would be to take stock of the Empire resources and opportunities and its needs for capital and labour. This has hitherto been done only in a piecemeal fashion and there has been a lack of co-ordination between the home country and the various parts of the Empire. Many opportunities of Empire development are thus lost, and neither capital nor labour are directed into the most useful channels. Sir Robert Hadfield regards the various Imperial conferences as too restricted in outlook, being interested mainly in Empire policy, defence, and administration. The Imperial Economic Conference has helped to develop trade facilities and communications, but was too little concerned with the development of fresh resources.

SIR ROBERT HADFIELD proposes the immediate formation of an Empire Development Board representative of all parts of the Empire, with a permanent organisation and personnel in each country. The sessions should be frequent and should be held in Great Britain and the various dominions and principal colonies in rotation, so that every member might have first-hand conditions of the requirements and possibilities of different parts of the Empire. It is suggested that the time of service of each member should be limited in order to ensure a continual fresh outlook. The affairs of the Board would involve problems of transport, new industries, hydro-electric power plant, the control of forestry, etc. Means would have to be taken to raise an adequate Empire development fund, to which all parts of the Empire would make contributions. Sir Robert Hadfield lays great stress on the scheme being a federal one,

in which co-operation and not dictation must be the guiding principle. He rightly insists that every part of the Empire would stand to gain. There is no suggestion that Great Britain alone would benefit or should in any way domineer over or exploit the oversea parts of the Empire. It is important that, as he proposes, the Empire Development Board should be kept free from the machinery of party politics.

MEMBERS of the British Association visiting South Africa this year who were interested in the archæology of the sub-continent would be grateful to the Trustees of the South African Museum for the opportune publication of the monograph on "The Stone Age Culture of South Africa", which was issued as Vol. 27 of the *Annals* of that institution just before the meeting took place. This publication, which may be regarded as the most important which has yet appeared on the Stone Age in South Africa, has been written by Mr. C. van Riet Lowe and Mr. A. J. H. Goodwin, the geologist, in collaboration. Some of the results of Mr. Lowe's investigations in the Vaal River Valley as reported to the Anthropological Section at Johannesburg were summarised in a recent issue of NATURE (Sept. 14, p. 413), and from this their importance may be gauged. The problems of the Stone Age in South Africa are many and complex. Those of grouping and typology have been boldly attacked and some considerable progress has been made, not indeed towards finality, but at any rate to such an agreed system as will afford a basis for a very real and rapid advance in the study of the implements themselves. The geological problems, upon which the prehistoric chronology depends and by which the sequence of types in time is to be determined, have hitherto been obscure. On both these sides of the investigation the progress of the last three or four years has been revolutionary. For this we are greatly indebted to the authors of this monograph, which sums up their work. It will be a standard work of reference for years to come.

THE reports that appeared in the Press during the last few days of September of an exceptionally severe hurricane in the Bahamas were not sufficiently precise to indicate exactly what path the storm followed. This want of precise information was apparently due in part to the interruption of communications caused by the storm itself, which is said to have caused more damage in Nassau than has any other visitation of a like kind so far back as records are available. The mean path of September storms passes directly across a part of the West Indies, and the fact that this particular storm appears to have joined the normal path near the southern extremity of Florida without passing over any part of the West Indies was taken to indicate that it was moving in an abnormal manner. Statistics in regard to the frequency of West Indian hurricanes in different months show that 70 per cent have occurred before the beginning of October, and that in forty-four years forty-five have occurred in October and only four in November; consequently, granted an average year, the worst should be over by now. Against the comfort to be derived from these statistics should be set, however, the possibility that the abnormal extension this year of summer warmth into autumn on both sides of the Atlantic may disturb the normal expectation and prolong the cyclone season beyond its usual span.

ON Sunday, Sept. 22, Sir J. S. Allen, M.P., unveiled a memorial plaque in the new Westminster Cathedral at Vancouver to the memory of Captain Cook. The plaque was given by the Royal Empire Society and the inscription reads as follows:

"To Commemorate the Life and Work of
the intrepid explorer of the Pacific
JAMES COOK
(1728–1779)
Captain in the Royal Navy.
Who prepared the way for General Wolfe
to Quebec
and in the month of March 1778
First revealed the wealth of this Province."

Captain Cook's voyage up the west coast of North America in 1718, which took him as far as the Bering Straits, is believed to have inspired the journey made fourteen years later by Vancouver, who circumnavigated the island which now bears his name. Vancouver, it may be added, sailed with Cook twice; was made a commander in 1790 and as such was appointed to the *Discovery*. His voyage of exploration lasting four years (1791–1795) took him to Australia, New Zealand, and North America. He died in May 1798, when his work "Voyage of Discovery to the North Pacific Ocean" was nearing completion.

THE *Canberra Times* of Aug. 6 gives an account of the impressive funeral ceremony of the late Dr. W. G. Duffield, Director of the Commonwealth Solar Observatory, whose scientific work was described in our issue of Sept. 21. The site was appropriately chosen near the summit of Mt. Strombo, within view of the observatory which is indebted so largely for its inception and equipment to his personal enthusiasm and generosity, and near the spot where the giant telescope which it is hoped to provide is to be installed. The site was specially consecrated by the Bishop of Goulburn, and the funeral was attended by the Ministers of Defence and of Home Affairs, and other government officials, and by a large concourse of friends.

THE first formal meeting of the Radium Commission, under the chairmanship of Lord Lee of Fareham, was held on Sept. 27, and was devoted to a preliminary survey of the ground which has to be covered. This body, it will be remembered, was appointed, as the result of the report of a sub-committee of the Committee of Civil Research, to take charge of the radium held by the National Radium Trust (see NATURE, May 4, 1929, p. 697). Offices have now been taken for the Commission at 5 Adelphi Terrace, Strand, London, W.C.2, and Prof. S. Russ, of the Middlesex Hospital Medical School, has been appointed scientific secretary. At the recent meeting it was decided that the radium at the disposal of the Commission should be kept at the National

Physical Laboratory, which would also undertake the testing of consignments received from manufacturers. It is not expected that more than three grams will be available for distribution before the end of the present year; in addition, a four-gram 'bomb' for intensive radiation may be obtained on loan from the manufacturers, for a limited time free of charge. It has been agreed in principle that, in distributing supplies of radium, preference shall be given to centres where radium therapy will be combined with teaching and research. In order to reduce overhead charges on the National Radium Fund, the Commission proposes to lend radium on terms which will recoup it for expenses incurred, apart from the purchase price.

For nearly seven years bird sanctuaries have been established in the royal parks in London and its vicinity, and the occasion of the publication of the Annual Report for 1928 (London: H.M. Stationery Office. 9*d*. net) has been taken to review the progress made. The sanctuaries have been created at small cost and without withdrawing from the public ground to which they already had access. Development has followed on very simple lines. In certain enclosures grass has been allowed to grow, unshorn by the gardener, and additional shrubs and undergrowth such as gorse and brambles have been planted to afford cover and nesting sites for the birds. Periodical thinning is carried out where necessary in order to admit light and air, nesting-boxes and nesting-material have been provided, food is supplied during hard weather, and vermin are kept down so far as practicable. The result has been excellent from the birds' point of view, and the public shows an increasing interest in the sanctuaries and their inhabitants. Appendices to the Report describe the more interesting happenings at the various sanctuaries, and give lists of breeding birds and bird visitors. It is satisfactory to record that the Report, instead of being a duplicated foolscap document, now appears in much more convenient form as a printed octavo pamphlet.

IT is well known that the Large Copper butterfly (*Chrysophanus dispar*) is extinct in the British Isles, the last examples of this fine insect having disappeared from its home in the fen country about 1860. In the *Entomologists' Monthly Magazine* for September, reference is made to the work of the Committee for the Protection of British Lepidoptera. The lost British race of this butterfly very closely approaches in character the continental form *batavus* Obth. and the Committee has been instrumental in arranging an experiment of forming a colony of this Dutch race in England. A highly promising locality for the purpose was found in Wood Walton Fen, Hunts, and mainly owing to the efforts of Capt. E. B. Purefroy, a supply of the race *batavus* was liberated in the summer of 1927. The young larvæ survived the winter floods of 1927–28 and the butterflies have been seen in the summers of 1928 and 1929. During the present year, however, parasites reduced its numbers very considerably, but it is hoped that the future success of the colony is assured. It is noteworthy that the 'Berlin form' *rutilus* has been well established in Southern Ireland since 1914 through Capt. Purefroy's efforts. The coloured plate illustrating European races of the insect is published through the courtesy of the Entomological Society in the *Proceedings* of which (pp. 53–68; 1929) the original plate and an account of the work of the above-mentioned Committee will be found.

THE expeditions fitted out by the great museums abroad are generally looked upon as scientific luxuries, but in proper hands they result in an enormous gain to the general public as well as to the scientific expert. This is well illustrated in the Annual Report of the Director of the Field Museum of Chicago for 1928. The Museum is famous for its expeditions, of which at the time of the Report thirteen were in the field, one circumnavigating the Pacific Ocean, one in eastern China, others in Europe, Mesopotamia, Abyssinia, Arabia, and various parts of America. A glance at the completed work of the year within the walls of the Museum shows how well the expeditions are made to subserve the exhibition side of the Museum's activities. The most important of the year's natural history exhibits were habitat groups of Marco Polo's sheep, of Himalayan ibex, and of the rare mountain nyala of Abyssinia, the last group including no less than five individuals; and in each case the specimens were collected by a Field expedition.

TURN to the development programme of the Field Museum and the same utilisation of expedition results is in strong evidence. During 1928 there were completed and opened to the public six large new exhibition halls in the Department of Anthropology. They represent a floor area of 58,000 square feet. The new collections shown there illustrate the ethnology of Africa and Madagascar, the latter probably the world's finest collection of its kind, and this fine spectacle the public owes to the labours of the Captain Marshall Field Anthropological Expedition to Madagascar in 1926–27. So with the other enlarged and reinstalled collections representing the ethnology of the Melanesian regions, India, Siberia, and Korea, and Egyptian archæology. For the funds to carry out these expeditions, and for many gifts in kind besides, the Museum is indebted to the public spirit of the American people. It is a noteworthy achievement, which the great museums in Britain cannot but admire and envy. That the American public appreciates the good work being done on its behalf is shown by the fact that for the second year in succession the annual attendance of visitors has exceeded a million.

THE essential requirements of photomicrographic apparatus for metallurgical work were discussed in an article in NATURE of Oct. 8, 1927, p. 516, and attention was directed to several mechanical details in British-made apparatus in which improvement might be effected. Afterwards, Sir Robert Hadfield, on behalf of Messrs. Hadfields, Ltd., invited British manufacturers to supply an apparatus which would fulfil the specified requirements. This invitation was accepted by Messrs. R. and J. Beck, Ltd., who successfully made a specially designed instrument embodying not only the suggested improvements but

also several novel features. It is now catalogued as the Beck Hadfield Metallurgical Microscope, and we are glad to learn that instruments of this type have already been supplied by Messrs. Beck to various firms. Devices incorporated in the apparatus with the view of ease in manipulation include means for instantly transferring the image from the visual observation ocular into the camera; for observing and focusing the image on a ground glass screen at the back of the camera or, alternatively, on a second ground glass screen at the side; and for the rapid adaptation of the apparatus for macro-photographic work. A new method of illumination is adopted in which all the parts of the system are fixed, except the lamp, which may have to be adjusted if the bulb is replaced, any form of exceptional illumination being made by means of special diaphragms. Since the illuminating train cannot move out of adjustment, the instrument is always ready for the most exacting work. A complete description of the apparatus may be obtained from Messrs. R. and J. Beck, Ltd., 69 Mortimer Street, London, W.1.

AFTER a long period of development, electric trolley vehicles have proved that in certain cases they are preferable to other forms of road transport. Several tramway undertakings are adopting them either to replace their trams or as an auxiliary to them. We learn from the *English Electric Journal* for September that Bradford Corporation has been one of the most enterprising authorities in exploring possible uses for railless vehicles. Some of these weigh eight tons and have seating accommodation for 26 passengers in the lower saloon and 30 in the upper saloon. The power equipment consists of a twin 80 horse-power motor having two armatures arranged to operate with series-parallel connexions. Thus they have the same flexibility, and enable the same economies to be effected as in a series-parallel tramcar equipment. Both of the back axles of the six-wheel buses are driven by the motor. The design is very robust and inspection is easy; the cost of maintenance, therefore, is low. Connexion is made to the trolley wires by double trolleys which have a range of 16 feet on both sides of the vehicle centre line. Three brakes are provided, namely, a foot-operated electric brake with four notches, an air brake operating independently on brake drums attached to each of the six wheels, and a hand brake working on the four rear wheels. This form of road transport will probably become popular. It is as well sprung as a petrol bus and as comfortably fitted. Owing to the absence of gears it runs more smoothly and with less noise. This is particularly noticeable on gradients, owing to the steady rate at which the acceleration can be increased. Trolley buses also provide a steady load for the supply station, and so would lead to the reduction in the cost of electric power for all purposes.

THE new headquarters of the London Underground Railways at Broadway, Westminster, is electrically heated on a novel thermal storage system. A full description of this system is given in the *Electrical Review* for Sept. 20. The electric current is taken from the company's 11,000 volt traction system, and is connected with the circuit except during the two four-hour periods when the railway load is a maximum. The heating throughout is effected by piping coils through which water is kept circulating, and embedded in the concrete of the building. The water is heated in cylinders by means of immersion heaters the temperature of which varies from 130° F. to 300° F. As the water is supplied from tanks on the twelfth floor of the building at a pressure of 70 lb. per square inch, and the upper temperature limit is the boiling point. The heat is controlled automatically. So long as the temperature of the flowing water is greater than 130° F., no water is admitted from the storage cylinders, but at lower temperatures water is admitted. Three storage cylinders are used in normal working, one being kept in reserve. Each cylinder takes a load of 336 kilowatts. The whole of the storage system is 'lagged' with three-inch cork insulation. It is calculated that if the system was left from mid-day on Saturday until Monday morning filled with water at 300° F. and with the circulating system shut down, the temperature of the water would only fall by about two or three degrees. The water is obtained from two artesian wells, 500 feet deep, and is taken from the basement tanks to the roof tanks by electrically operated Sulzer pumps. These motors and pumps are controlled automatically by switches operated by floats in the roof tanks.

EARLY in the days of the application of X-rays in the field of medicine, the harmful and serious effects upon patients and operators who had exposed themselves too freely to the rays showed that they exerted a profound influence upon the organism and the cell. It was only two years ago, however, that Muller's announcement of the transmutation of the gene indicated how fundamental the influence of the rays might be. His discovery led to intense activity in a new field of research. Muller's results have been amply verified, and new ways of using X-rays to facilitate genetic research, through altering and rearranging chromosomes as well as genes, have been discovered. So suggestive and far-reaching are the results already attained that the June number of *The Journal of Heredity*, enlarged to 64 pages, has been devoted entirely to the theme. Authoritative accounts dealing with both the botanical side (on species of the genus *Nicotiana*) and the zoological side (*Drosophila* and the parasitic wasp *Habrobracon*) indicate the effects upon general growth and the more delicate interferences with cell structures. It is impossible to deal here with all the results, but, in short, it may be stated that in plants and animals two types of genetic modification take place—an aberrant distribution of chromosomes, and hence new combinations of characters, and actual mutations in genes.

IT has often been pointed out that the development of speedy and heavy traffic on main highways has been responsible for an increasing slaughter of wild creatures. Miss Jean M. Linsdale, however, points out, in the July issue of *The Condor*, that this is but one, and not the most important, influence of roadways on bird life. The undergrowth of road-sides and their

hedges afford abundance of nesting sites, telephone wires make much used perches and lines of observation, and the road surfaces supply the luxuries of dust- and water-baths. She might have added that roads have been instrumental in increasing the range of various creatures, which have followed the trail of scattered food or found a bridge a means of crossing an impassable river. On the whole, roadways and their adjuncts have probably been more potent for the increase than for the diminution of animal life.

SIR HUBERT WILKINS was to leave New York for Montevideo last week on his way to Deception Island to resume his flights in the Antarctic region. The *Times* says he will be accompanied by Mr. O. Porter, the mechanic who was previously with him in his Arctic and Antarctic flights, and two airmen, Messrs. P. Cramer and A. Cheeseman, who have had experience of Arctic flying. The two Lockheed Vega aeroplanes they are taking with them are those used in last year's expedition. Sir Hubert Wilkins proposes to make an advanced base at Margaret Bay in Hearst Land in Lat. 66° 7′ S., Long. 66° W. A small vessel lent by the British Colonial Service will transport stores and equipment. From this base a flight will be made to the Bay of Whales in the Ross Sea, where Commander R. E. Byrd has the base of his expedition. This flight, if successful, should reveal a long stretch of the unknown coast line of Antarctica. If no suitable site for a base can be found on Hearst Land, the longer flight from Deception Island to the Ross Sea, a distance of 2300 miles, will be attempted. One of the aeroplanes of the expedition will carry a radio transmitting set with a radius of 400 miles. The bases at Deception Island and Margaret Bay will have transmitting and receiving sets.

FROM a *Daily Science News Bulletin* issued by Science Service, Washington, D.C., we learn that a new bird refuge has been established on a group of islands off the tip of Florida by executive order of President Hoover. The group consists of Snake Key, North Key, and Dead Man or Bird Key. It will be known as the Cedar Keys bird refuge, and will be administered by the Biological Survey of the U.S. Department of Agriculture.

THE Annual Report of the National Physical Laboratory for 1928 has been divided into eight parts, each dealing with a particular department, and each part may now be purchased separately, at a price which averages 1*s*. 6*d*. A part of general interest is that on the units and standards employed at the Laboratory, containing 20 pages and costing 1*s*. It gives clear and precise definitions of the standards of length, mass, capacity, density, time, barometric pressure, temperature, radium, X-ray intensity, electrical units, and candle power of light sources. It will be a great help to those concerned with measurements to be able to turn to this authoritative pamphlet on the subject.

*ASLIB. Information* is the title of the new quarterly bulletin of the Association of Special Libraries and Information Bureaux. It is designed to keep members of the Association in touch with the work of the Council and with one another, for experience has shown that an annual conference is insufficient to keep together an Association unless it is supplemented by reports of progress issued at short intervals. The present number contains a useful summary of papers read at the recent Cambridge Conference. It will be interesting to see what form subsequent numbers take. *ASLIB.* includes representatives of applied science, education, and the humanities, and it will tax the ingenuity of the editor of the bulletin to find material which will be of general appeal to its members.

WE are asked to announce that Messrs. C. F. Casella and Co., Ltd., scientific instrument makers and mechanical engineers, have removed to new and larger premises at Regent House, Southampton Street, Fitzroy Square, London, W.1.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—A teacher for mechanical and electrical engineering in the Day Technical school of Kenrick Technical College—The Director of Education, Education Offices, West Bromwich (Oct. 15). Assistant inspectors under the Ministry of Agriculture and Fisheries in connexion with agricultural, dairying, and horticultural education and research—The Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, S.W.1 (Oct. 21). A Bosch professor of bacteriology in the University of Sydney—The Agent-General for New South Wales, Australia House, Strand, W.C.2 (Nov. 9). A professor of economics in the University of Tasmania — The Agent-General for Tasmania, Australia House, Strand, W.C.2 (Dec. 1). A professor of psychology (theoretical and practical) and a professor of the theory of teaching, under the Egyptian Ministry of Education—The Under-Secretary of State, Ministry of Education, Cairo. A full-time lecturer in mathematics at the Borough Polytechnic Institute—The Principal, Borough Polytechnic Institute, Borough Road, S.E.1. A handicraft teacher (wood and metal work) under the Warwickshire Education Committee—The Director of Education, County Education Office, Warwick. An assistant teacher of arts and crafts at the Woolwich Polytechnic—The Principal, Woolwich Polytechnic, S.E.18. Nautical examiners under the Aeronautical Inspection Directorate of the Air Ministry.— The Secretary, Air Ministry (I.G.), Kingsway, W.C.2. A laboratory assistant under the Government of Tanganyika Territory for the Soil Chemistry Laboratories in the Agricultural Research Station at Amani — The Crown Agents for the Colonies, 4 Millbank, S.W.1 (quoting M/1797). A junior assistant under the directorate of explosives research of the Research Department, Woolwich—The Chief Superintendent, Research Department, Woolwich, S.E.18. A director of the Imperial Institute of Veterinary Research, Muktesar, India—The Under-Secretary of State, Services and General Department, India Office, Whitehall, S.W.1. A post-graduate research student at the Cardiff City Mental Hospital—The Medical Superintendent, Cardiff City Mental Hospital, Whitchurch, near Cardiff.

## Research Items.

**A Fijian Game in Assam.**—In *Man* for September, Mr. J. H. Hutton refers to what has been called the 'national game' of Fiji, a sport called *Veitingga*, played with a reed, on specially prepared throwing grounds, where the reed is thrown so as to strike the ground and then spring upwards towards the mark. He records the occurrence in Assam of a similar game, now noted for the first time in further Asia. The game is played by the Dzunokehena group of the Angami. Here also it is played on a prepared ground. The reed is propelled under-arm, running, and distance in a straight line is the test of skill. A variant is played with a stick, instead of a reed, thrown over-arm so as to strike hard on the ground. This form is played on the Parapit River in South America. It is to be noted that a game played with flat round beans also appears both in Assam and the Pacific, the Assamese name for the bean being *alau*, and the Fijian *Walai*. In Samoa, discs of coconut shell are used. Its occurrence in the Philippine Islands affords a link between its distribution in the Pacific and the continent of Asia, where it prevails throughout Burma and the Assam hills south of the Brahmaputra.

**The Thadou Kukis.**—Mr. William Shaw, of the Assam Civil Service, has published a report on the Kukis, in particular on the Shitlha clan, in the *Journal and Proceedings of the Asiatic Society of Bengal*, N.S., vol. 24, No. 1, to which Mr. J. H. Hutton contributes an introduction and notes. Mr. Hutton points out that since the suppression of the Kuki rebellion an era of closer administration has set in and missionary work has been extended, with the result that tribal sanctions and organisation have been weakened. The result is a great deal of dislocation, litigation, and general friction, as well as a diminution of general prosperity. Mr. Shaw's account therefore describes a state of transition differing considerably from conditions of a few years ago. The Thado are a scattered hill tribe of which the total numbers probably amount to about 50,000. The Kuki race, of which they form part, is obviously of northern origin and no doubt closely related to the Kachin ; but they have absorbed many alien elements, including Shan, Mon-Kmer, and Negrito. Many of their customs are suggestive of the Khasis and Aos, both of Indonesian affinity. Points of Kuki culture are suggestive of the culture of the pagan Malays of the Indian Archipelago and the Philippines; for example, the Thado custom of burying the dead in what must be a troublesome excavation leading out of a simple pit grave reappears in Sumatra and in the Philippine Islands, where the Tingusan and Mandaya who follow it, also share with the Lushei and probably some tribes of Borneo the custom of eating part of the liver of a slain foe. All Kukis, including the Thado, are slave hunters. On the other side, a connexion with India is seen in the custom among old and old-fashioned men, who when performing ceremonies to propitiate any spirit, use an action to express their reverence which consists in placing the palms of their hands together and raising them in front of the face with the thumbs to the forehead. This custom may be compared with such uses as the word *taima* for the number 10,000, that is, a lakh, and the practice of singeing a tiger's whiskers.

**The Earliest Exhibition of Reflex Activity.**—The association of definite reflex actions with the development of the myelinisation of the central nervous system has been followed in fœtal and young kittens by Orthello R. Langworthy (Carnegie Instit., *Contributions to Embryology*, vol. 20, No. 114, 1929). In the youngest animals studied there were medullated fibres in the spinal cord, and the functioning of the myelinated reflex arcs might well explain the reflex activity of the animal. Pathways appear to become myelinated in the order in which they developed phylogenetically. As regards the correlation of reflex activity with medullation, bilateral movements of the extremities begin to co-ordinate when the ventral commissural fibres of the cord receive their myelin sheath. The animals turn the body at a time when the myelinated vestibular fibres reach the spinal cord. The hind-leg movements become better co-ordinated when myelinisation becomes more marked in the lumbar portions of the cord.

**Factors in Plumage Coloration.**—Experiments have been carried out by Drs. A. W. Greenwood and J. S. S. Blyth to test the influence of thyroid and gonad upon the coloration of the plumage of brown Leghorn fowls (*Proc. Roy. Soc. Edinburgh*, vol. 49, p. 313). Deficiency of thyroid results in decrease of melanin and increase of red pigment, associated with an increase in the amount of fringing due to lack of barbule formation. A surplus amount of thyroid produces opposite results. In the first case the female pattern tends to disappear ; in the second it shows practically no modification. The authors suggest that the plumage typical of the male is developed independently of the gonad and depends upon a high level of thyroid functioning, whereas in the female both gonad and thyroid play a part, the former stimulating the latter, so that the appearance of a hyperthyroid effect is produced. The fact that chicks of both sexes possess a female type of plumage does not invalidate the theory, since the chick plumage may be looked upon as developing under the influence of the yolk in its own yolk sac, and there is evidence that yolk may have a modifying effect on plumage similar to that of the ovary itself.

**Norwegian Herring.**—State departments administering fisheries are, periodically, by reason of public agitation, faced with the difficult task of deciding whether or not it is in the best interests of the State to revise existing laws governing some part of its fishing operations. More than once, precise knowledge of the life history of the fish concerned has provided legislators with conclusive evidence upon which to base their policy of action. In Norway, just such a situation arose regarding the fishery for young herrings. A most able review of the results of current scientific investigations as applied to the contentious questions raised has recently been published by Dr. Einar Lea in the *Journal of the International Council for the Exploration of the Sea*, vol. 4, No. 1, Copenhagen, 1929. Lea's illustrated outline of the life-cycle of the Norwegian herring brings to notice an ' oceanic stage', adopted in the third or fourth year of life and extending over one, two, or three years according to the individual. During this stage the fish develops towards first maturity. Each year, those individuals which will be ready to spawn in the coming spring separate from the rest, and in the fullness of time arrive on the spawning grounds as recruit-spawners. These new facts are, as Lea shows, of immediate and indispensable value in the legislative considerations concerning the inshore fisheries for young herrings.

**Plaice in Danish Waters.**—In *Report of the Danish Biological Station*, vol. 34 (1928), three papers deal with the life history of the plaice in Danish waters. Dr. Blegvad, discussing the possible causes contributing to a decrease in the quantity of plaice-

food during the years 1924–27, makes the suggestion that this was due to the enormous increase in numbers of the blenny *Zoarces* and gobies during these years, their consumption of food keeping down the quantity available to plaice. Dr. Johansen writes concerning the annual transplantation of plaice in the Limfjord. Each year since 1908, with the exception of two war years, 1917 and 1918, from one to three millions of plaice have been transplanted, the costs of transplantation being borne almost entirely by the State. A disquieting fact concerning the yield from the annual planting is that there has been a marked falling off in recent years. Thus, while during the period 1899–1907 only 35 per cent of the fish planted were lost before being captured as marketable fish, the corresponding loss during 1918–27 had risen to 73 per cent. Marking experiments have shown that a very large percentage of the fish planted are caught shortly after liberation. A third paper, by Dr. A. J. C. Jensen, deals with the relation between the size of the plaice-stock and the quantity of 'first class plaice food' in certain parts of the Limfjord.

**Insecticidal Constituents of Pyrethrum.**—In the *Journal of Agricultural Science*, vol. 19, part 2, April 1929, Messrs. F. Tattersfield, R. P. Hobson, and C. T. Gimingham describe the isolation of the toxic constituents of pyrethrum. The method adopted was that of Staudinger and Ruzicka, who named the constituents pyrethrin I. and pyrethrin II. It is evident from the data given by Dr. Tattersfield and his co-workers, that pyrethrin I. is, to certain insects, the most highly toxic contact poison at present known. The important fact emerges from these researches that the insecticidal properties of pyrethrum are almost entirely due to this constituent. When tested on the bean aphis (*Aphis rumicis*), it was found to be about ten times as toxic as pyrethrin II. Two micro-analytical methods of determining the pyrethrin content of the flower-heads are described, and the results obtained for a series of pyrethrum samples agreed with their observed insecticidal properties to the aphis mentioned. Pyrethrum, in being comparatively harmless to man, has advantages over most potent insecticides. Its application is, however, circumscribed owing to the fact that certain insects are very resistant to it, and to the supposed readiness with which its toxicity is lost. The authors are of opinion that its use could be extended, and suggest that this might be facilitated if the content of pyrethrin I. could be increased by selective plant breeding.

**A Rare Fossil Marsupial.**—In 1921 a new genus, *Euryzygoma*, was created by Heber A. Longman for a fossil marsupial characterised by the peculiar development of the zygomatic arches. At the time a writer in NATURE (May 19, 1921, p. 372) doubted the advisability of separating this form generically from *Nototherium*, but fresh material has now turned up from the original locality, Brigalow, Darling Downs, Queensland, and in the fragments, which compose about half a cranium of an individual much younger than the type specimen, Longman finds those peculiar developments of the zygoma which were so marked in the adult (*Mem. Queensland Mus.*, vol. 9, June 1929, p. 247). He concludes that the characters are distinctive and of generic value, and that *Euryzygoma dunense* is an extremely specialised member of the *Nototherium* group, exemplifying the evolution of a bizarre type. The suggestion is repeated, and is supported by reference to analogous structures in other extinct mammals, that the prolongation of the inferior lateral processes of the anterior part of the zygoma may have been associated with the presence of 'cheek pouches'.

**Locomotion of Urocoptid Snails.**—Snails of the family Urocoptidæ, as studied by Henry A. Pilsbry in the West Indies, exhibit a peculiar mode of locomotion (*Proc. Acad. Nat. Sci. Philadelphia*, vol. 81, 1929, p. 449). The muscular waves which pass along the foot are rather rapid in movement, are narrowly localised, and raise the sole clear of the surface upon which the snail crawls, in such a way that the edges of the raised fold are kept in contact and the wave appears as a fine straight line across the sole. In some species only one wave is in progress at a time. The result of this deep and compressed wave is that no portion of the foot *slides* upon the substratum, as happens in the case of ordinary snails. The author regards this as an adaptation to movement upon the minutely roughened and slightly porous surfaces of limestone rocks and cliffs, to which moist bodies tend to adhere. Species of other families on these cliffs, which did not possess the adaptive wave, differed from the Urocoptids in moving slowly and in exuding copious slime which lubricated the track.

**Defective Graft Unions in Apple and Pear.**—The failure of some types of apple and pear to unite with the stock when grafted on to other types, has led to the practical recognition of 'uncongeniality' between such types, although in most cases the grafting operations may be quite successful. After studying microscopically a number of 'congenial' and 'uncongenial' grafts, F. C. Bradford and B. G. Sitton (*Bull. Mich. Agric. Expt. Stat.*, **99**, p. 106; 1929) conclude that the failure of uncongenial unions is due to the inability of the cambia of scion and stock to unite, particularly on the outside, where contact between the phloem tissues should be effected. A certain amount of union on the xylem side of the cambium is common, but this tends to break down and ultimately to fail. The breaking down appears to be seasonal as it occurs after the period of maximum cambium activity. Uncongeniality appears, however, to be quite independent of the differences in duration and time of cambial activity of stock and scion. Rather it appears to result from chemical differences between the uncongenial tissues, because a marked feature of the transitional areas at the junctions is the presence of deposits or precipitates inside many of the cells. A further factor of great importance is that the stock apparently receives little or no organic food from the scion, presumably owing to lack of phloem connexions. Hence, if the stock is without leafy branches of its own, it will die. On the other hand, if the stock has independent leaves, the grafted branch may persist for some time and even bear fruit, in the same way as a ringed branch may do.

**Niagara Falls.**—Erosion and water diversion for power purposes have had a serious effect on the Horseshoe Falls at Niagara. Recession is said to average 3·7 feet a year on Canadian or Horseshoe Fall. This, together with the diminished flow, has left bare the flanks of the Canadian falls and thinned out the flow over the American falls to such an extent as to impair the scenic beauty of the falls as a whole. After two years' study of the problems involved, the International Niagara Board issued a report and suggested remedial measures which are now to be put in hand. It is believed that it will be possible to distribute the water so as to cover the bared flanks of the Canadian falls and to check the present rate of erosion. The remedial works are to be built under conditions that will admit of their being tested in the course of construction and adjusted in plan if necessary. Experiments are to be made on the effect of diversion of further quantities of water from the falls. From October to March for seven years, an additional

10,000 cubic feet per second will be diverted on each side of the river and the effect on the scenic beauty of the falls noted.

**Atmospheric Ozone.**—The September issue of the *Proceedings of the Royal Society* contains a note by Drs. Götz and Dobson on the ozone content of the atmosphere above the Arosa Observatory. They have now established the important result that the average height of the ozone in the air is not lower when there is much present than when there is little, but that, if anything, the reverse is more nearly true. There is also some indication that the height is greater in spring than at other times of the year, but this is not yet certain. The observations have been discontinued temporarily until more suitable instruments than those at present available have been obtained for making exposures when the sun is low, as this cannot be done at present when it is less than 14° above the horizon.

**Diffraction of Cathode Rays.**—A further paper on the diffraction of cathode rays has been published by Prof. G. P. Thomson in the September number of the *Proceedings of the Royal Society*. As in his earlier work, he has employed for gratings the irregularly orientated micro-crystals of extremely thin metallic foils, but in this new work he has prepared the foils by cathodic sputtering on to a base of celluloid acetate or of rock-salt, which is afterwards removed by solution, instead of preparing them by thinning beaten leaf chemically. Prof. Thomson has been unable to produce diffraction rings with the slow electrons (180-300 volts) employed by Dr. Rupp, but one practically new line which is being developed by him is likely to prove very important; by photometric measurements of the diffraction rings a curve can be deduced giving the variation of wave-scattering with angle for the *individual atoms*, and the results which he has already obtained indicate that the mean position of the scattering material is nearer the centre of the atom for X-rays than it is for electrons.

**Reaction on a Platinum Surface.**—In some experiments on the union of hydrogen and oxygen in contact with a heated platinum wire which are described by Donnelly and Hinshelwood in the August number of the *Journal of the Chemical Society*, it was found that the reaction follows a different law at normal pressure from that reported by Langmuir at low pressures. This may be due to the adsorption taking place in layers more than one molecule thick, but more probably to the presence of more active portions on the metal surface, when at higher pressures the less active centres, being now predominant, will change the velocity results completely. The experiments support the second theory, and it is suggested that if the reaction velocity law changes with pressure the presence of such centres of varying activity may be inferred. It is clear from these (and other) results that the simple Langmuir hypothesis of unimolecular adsorption layers in catalysis on surfaces is not always adequate and should not be extended into regions of pressure higher than those used by that investigator without further experiments on the influence of pressure on the course of the reaction.

**Effect of Intensive Drying on Chemical Changes.**—Many recent experiments on the effect of intensive and prolonged drying on the properties of reactive systems have given contradictory results. In the August number of the *Journal of the Chemical Society*, Prof. H. B. Baker and Prof. W. A. Bone contribute papers in which they make it clear that the utmost care in cleaning and preparing the apparatus is absolutely essential to obtain satisfactory results. Many of the recent experiments have clearly been done without sufficient attention to these details, and it is to be hoped that, in future, workers in this field will realise what is required and that the hasty publication of conflicting results will, in consequence, be minimised. As an example of the care necessary, it may be mentioned that pyrex glass is unsuitable for such work if it has been sealed off in contact with hydrogen, since water is introduced into the system by such procedure. Again, it is mentioned that in the preparation of an inert mixture of hydrogen and oxygen by drying the mixed gas from the electrolysis of baryta, it is necessary that the baryta should have been recrystallised fifteen times, with all imaginable precautions, before the gases were obtained in a state of sufficient purity; when the necessary precautions were taken the experiments were repeated with complete success by Prof. Bone. Drying by heating in a current of purified air is also more effective than baking in an electric oven, since invisible particles of dust can then be burnt up. The necessity for using purified phosphorus pentoxide, neglect of which caused earlier failures with older workers, now seems to have been realised.

**Theory of Oxidation and Reduction.**—The theory which regards oxidation as due to loss and reduction to gain of electrons requires some modification in the light of newer theories of valency, in which what are called covalent bonds are supposed to be due to sharing rather than to transfer of electrons. In the August number of the *Journal of the American Chemical Society*, Prof. W. A. Noyes has given a careful and suggestive discussion of the way in which oxidation may occur, and he distinguishes three types of oxidation: (1) Transfer of an electron; (2) oxidation by positive hydroxyl: a molecule of hydrogen peroxide is assumed to be separable into two oppositely charged OH groups, the positive one of which can add itself to a lone pair of electrons, oxidising a neutral atom to an ion; (3) oxidation by semi-polar oxygen atoms, in which an electrically neutral oxygen atom separates from one compound with its six valency electrons and attaches itself to another molecule, as is supposed to occur in the formation of perchlorate from fused chlorate; in case (3) the oxygen may unite with a hydrogen ion and form a hydroxyl group.

**Ignition of Firedamp.**—A revision of an earlier paper of 1925 on the above subject, incorporating recent investigation, has been issued as the *Safety in Mines Research Board Paper* No. 53 (London: H.M. Stationery Office. Price 6*d*.). The report is by Prof. R. V. Wheeler and Dr. H. F. Coward, and must be regarded as a very valuable contribution to the literature of the subject, which is of fundamental importance in mining. It summarises existing knowledge as to the conditions under which various forms of heat application, such as compression, contact with flames, electric discharge and friction, reach the combined intensity and duration necessary to cause ignition of various inflammable mixtures of firedamp (methane) and air. Work undertaken in other countries is considered as well as that carried out in England. The general results indicate that any ordinary sustained flame will ignite all inflammable mixtures. Heated surfaces are relatively less dangerous than lamp flames unless their temperature is unusually high. A body possessing a large surface is more dangerous than a wire, and a wire is more dangerous than a frictional spark of equal temperature. Electric sparks are more dangerous the more rapidly their energy is communicated, so that capacity sparks are more dangerous than inductance sparks of equal energy. The character of the supply, direct or alternating, does not materially affect the incendivity of inductance sparks. It is clear from the report that very valuable research is being actively carried out, and it is to be hoped that another report, with more new work, will soon be required.

## The Thirteenth International Physiological Congress.

THESE meetings have occurred triennially with the exception of the interruption caused by the War. Since the armistice, physiologists have assembled in turn at Paris, Edinburgh, and Stockholm, but this is the first occasion on which they have congregated outside Europe. The remarkable success of this experiment has far exceeded the expectations of the most optimistic among its promoters. More than 300 registered European representatives with, in many cases, wives or husbands crossed the Atlantic; 350 of these sailed on the s.s. *Minnekahda*, thus giving Europeans an additional opportunity for that contact and exchange of ideas which constitute the chief assets of a congress. This trip, though lasting ten days, was favoured with delightful weather and filled with a variety of amusements and sporting events; yet the intellectual side was not wholly neglected, for the daily lectures ranged from "The Holy Land" by a returning American lady who had been visiting Christ's 'home town' to "The Mystery of Life" by Prof. A. V. Hill. In discussing the interpretation of the records of heat production by living and dying tissues, he pointed out the necessity of accounting for all the purely physical changes first; for example, the enhanced resting heat-rate of a stimulated muscle is satisfactorily accounted for by the effect of the resulting increase of osmotic pressure in lowering the aqueous vapour pressure of the muscle and so causing a condensation of vapour from the surrounding medium.

Great as was the success of the west-bound pre-congress, it was soon to be eclipsed by the official Congress at Boston, Mass., on Aug. 19–23, which was a triumph of organisation and hospitality. 700 foreign delegates were the guests of the 1200 members of the Federation of American Societies of Experimental Biology.

The opening lecture was delivered by Prof. August Krogh of Copenhagen, on "The Progress of Physiology". He pointed out that modern physiology was growing so unwieldy that just as the practical teaching situation had necessitated the separation of pharmacology and biochemistry as independent sciences, so it would be necessary to create separate chairs of biophysics, comparative physiology, etc. Although he regarded physiology as an independent science, yet the necessities of practical medicine have created an unbreakable link, and to derive full advantage from this intimate relation, the study of disease would be the better for physiological direction and co-ordination, since it is the functional reaction of the organism to the attack of disease and to the therapeutic measures which is, after all, the central problem. He pointed out that, although our physical problems have so far usually been rather elementary, yet the situation is rapidly changing, as shown by new discoveries like that of radiations from rapidly growing tissues.

This reference presumably referred to the observation of Gurwitsch that when the tip of one actively growing onion is brought near to the tip of another growing onion, whether end-on or broadside-on, mitosis is stimulated in the latter in the neighbourhood of the growing tip of the former; various filters were interposed to determine the range of wave-lengths to which the radiations were confined. Other experimenters have attempted to reproduce these results, but the evidence so far is insufficiently conclusive to warrant acceptance of so important a principle involving such radiating centres of activity. Borodin, using disc-like cultures of yeast as receptors, has reported enhanced budding in the immediate vicinity of the tip of a growing shoot; he, however, localises the radiations to a different range of wave-lengths. Gurwitsch also maintains that there exist centres of action outside the growing embryo. The problem requires more rigid investigation, but with the evidence so far available, a statistical analysis would probably show that the number of positive results slightly exceeds the negative. Attractive as this hypothesis of biological rays may appear, we must await further proof of their action; even if direct demonstration is not forthcoming, we may by indirect methods, such, for example, as the already attempted correlation with the glucose-lactic-acid metabolism of growing tissues, lend support to this counterpart of the fields of force encountered in the physical sciences.

The hospitality extended to the delegates was on the most lavish and generous scale imaginable. The guests of honour at the banquet presided over by Prof. Cannon were the veterans of physiology—Prof. Ivan Pavlov and Prof. Léon Fredericq—who responded in appropriate speeches. The president made some appreciatory observations on the birth of physiology in Italy, to which Prof. Filippo Bottazzi replied, and, speaking on behalf of his countrymen, invited the members to hold their next congress three years hence in Italy, where they would be assured of a hearty welcome. Following a short speech by the president tracing the rapid rise of modern physiology in England, Prof. A. V. Hill was invited to speak on behalf of British physiologists. In a notable speech he did appreciable service in cementing the bond of union between the two English-speaking nations, and reminded his hearers that Boston had arisen from a colony founded in Massachusetts by John Winthrop of Trinity College, Cambridge, almost exactly three hundred years ago. Prof. Otto Frank spoke on behalf of his German colleagues, and Prof. Gley, who is one of the finest French orators, delivered a most rousing speech. After the banquet, open-air dancing was carried on into the advancing hours of the following morning in the enchanting grounds of Harvard, delightfully illuminated by Chinese lanterns and a full moon and with sufficient warmth for the lightest of dresses.

Another memorable evening, both from the musical as well as from the spectacular view, was the occasion of the concert of the Boston Symphony Orchestra, given in the quadrangle of the new and imposing buildings of the Harvard Medical School, when the marble and granite stonework, relieved by the grass landscape, was so harmoniously illuminated both from artificial and lunar sources.

The communications and demonstrations were so numerous that five or six sections were run simultaneously for seven sessions, and the subjects dealt with covered the whole range of life from the antenatal state to senility and death. They were mainly of a detailed character, representing only small advances but extending over a very wide front; consequently only a few of the points of interest are selected at random for mention.

Using a piezo-electric method already described in NATURE (**121**, 622; 1928), Harvey demonstrated the effect of high frequency sound waves on cells and tissues; bacteria can be broken up by high intensity sound waves and the suspension sterilised.

In discussing the mechanism of sleep, Hess brought forward experiments which led him to believe that sleep is an inhibitory state induced as a consequence of a state of excitation of certain subcortical centres; according to this, the induction of sleep is a positive

process—the promotion of restorative processes within the tissue. This view is directly opposed to the prevailing theories of sleep; Pavlov, from his interesting address on the part played by inhibition in the normal activity of the brain, thinks that sleep is the result of the spread of inhibition throughout the entire cortex and subcortical centres, and that the spread may originate from any point whatsoever.

The further chemical study of glutathione, a cellular constituent discovered by Hopkins and found to be of enormous importance in the oxidative mechanisms of living and actively growing tissues, has proceeded in several directions. Kendall, starting with a couple of tons of baker's yeast, has devised methods for increasing the yield and for estimating the glutathione by oxidation of the SH group with potassium ferricyanide; mention was also made that glutathione is a tri-peptid containing not only cysteine and glutamic acid, but glycine as well. [See, however, the letter from Sir F. Gowland Hopkins in NATURE of Sept. 21, p. 445.]

Progress was recorded in the extraction and purification of some of the hormones. Doisy has extracted from the urine of pregnant women by means either of chloroform or olive oil a product which on purification yielded a potent crystalline folliculin indistinguishable from that obtainable from follicular fluid; a paradoxical situation thus arises from the appearance of so large an amount of the œstrous hormone in the blood and urine during pregnancy, in view of the reports of abortion produced by injections of this hormone. Voronoff and his co-workers showed sections and photographs of parts of grafts of testes removed from animal and man; they describe a preliminary disorganisation followed by a re-organisation into two zones of which the peripheral zone is well vascularised and has seminiferous ducts possessing active epithelial cells.

Zavadovsky, in his investigations on the effects of hormones on the plumages of birds, found that activation or depression of pigment formation in brown leghorns by thyroid gland depended on the dose, depigmentation following large doses. He also came to the conclusion that the redistribution of the pigment in the feather of leghorns is to be regarded as a specific effect of interference of antagonistic influences of the thyroid hormone on one hand, and the feminine sex hormone on the other; his report was illustrated by dia-positives and skins of experimental animals.

Williams, McGlone, and Bazett produced evidence for the identity of certain specific receptors with definite nerve end-organs in the prepuce of man by a comparison of the distribution of cold and warm spots with histological preparations by noting the depths and making a count.

On the conclusion of the Boston Congress, the remaining foreign delegates, numbering now 750, were conveyed by motor buses via Plymouth to the Marine Biological Station at Wood's Hole on Long Island Sound. Demonstrations were arranged and many opportunities were given for observing the microtechnique developed by Chambers and his co-workers for physiological study of the contents of a single cell. Methods of collecting material were shown to small parties on short expeditions in the laboratory's yachts. The day was brought to a delightful close with the local festive event of a 'clam-bake'. These shellfish, most closely approached by our mussel, are dug out of the sand and baked with sweet potato or other vegetable on the sand.

The party reached New Haven next morning by steamer, where they had an opportunity of visiting Yale University; they were welcomed by Prof. Yandell Henderson, who showed them, amongst other things, radiograms illustrating the production of atelectasis and of pneumonia in animals and its relief in these cases as well as in man, by the administration of carbon dioxide.

The foreign delegates were entertained at New York by Columbia University during their second week; the programme included visits to the new Medical Centre, the Rockefeller Institute, and to the Marine Biological Station on Long Island, when a visit to Prof. Graham Lusk's country house was included. It may be mentioned that, under pressure from his friends and colleagues, Lusk has just issued a revised edition of his excellent treatise on nutrition.

The party divided into two main groups, the first 150 being invited to Toronto, and the second, numbering 60, to Rochester (N.Y.), while the remainder left for their homes or for the Psychological Congress. Those who visited Rochester were given an account and demonstration of the new colour process in kinematography by research workers from the Kodak Works; it is the munificence of the Eastman family which is the main support of medical research in Rochester. The colour process is based on a purely optical device: the coloured field is projected, after first passing through a glass colour filter with three parallel bands of blue, red, and green, on to a special film having corrugations in the celluloid parallel to the coloured strips in the filter; these corrugations act as fine astigmatic lenses which project three separate line pictures on the sensitive film. The film is developed in a special manner so as to give a positive picture—really three superimposed positive pictures. By projecting this film with a similar parallel placed glass filter, the image on the screen appears in colour, which, as judged from examples like a pond of water-lilies and goldfish, seems perfectly natural.

The party entertained at Toronto were shown the laboratories, including those where insulin was finally isolated and tested, as well as the annual Toronto Exhibition, the greatest of its kind in the new hemisphere. The parties met again at Montreal, where McGill University was found to be as active in hospitality as in medical research.

The smaller party left a day earlier to visit Quebec, where they were the guests of the French Canadian University. In both these towns the physiologists were accorded a welcome by the civic authorities and by the Government of the Province of Quebec.

About 200 members set sail from Montreal and Quebec on the s.s. *Doric*, having made new friendships and associations, and looking forward with pleasurable anticipation to a re-union three years hence.

## The Froghopper Problem in Trinidad.

THE sugar-cane froghopper, *Monecphora* (*Tomaspis*) *saccharina* Dist., is a serious enemy of the cane growers of Trinidad, and although there are records dating back to 1862, which may possibly refer to this insect, no severe outbreak occurred until 1906. Heavy intermittent attacks have followed ever since, the most disastrous year in this respect being 1917, when about 10,000 tons of sugar were lost through froghopper damage. From 1909 onwards investigations into froghopper eradication were conducted mainly by officers of the Trinidad Board of Agriculture and by certain specialists. Up to the end of 1917 this work was purely of an entomological character, but the studies of Williams and of Nowell showed the need of

approaching the problem on a wider basis. In 1924 a Committee was constituted to inquire further into, and to report upon, the froghopper pest with the view of its control and ultimate eradication. Among other proposals it led in October 1925 to the Governor appointing a Froghopper Investigation General Committee, and the deliberations of this body are published in the form of *Minutes* and *Proceedings* at frequent intervals.[1] The first meeting of this Committee was held in November 1925, and three subcommittees were appointed to deal respectively with (1) agricultural relations; (2) entomological relations; and (3) soil relations. Their personnel included planters, officers of the Department of Agriculture, and members of the staff of the Imperial College of Agriculture. The reports of these sub-committees are considered by a scientific committee which submits recommendations thereon to the general investigation committee alluded to above.

Among the more interesting features recorded or discussed in these *Proceedings*, it appears that the eggs of the froghopper hatch freely only when the humidity of the atmosphere is greater than 90 per cent of saturation. Some eggs, however, exhibit delayed hatching even though the moisture conditions are entirely favourable, a fact of considerable practical importance, and the cause of these delayed hatchings is now being investigated. No reliable method of egg-destruction has been discovered, but the practice of bare-fallowing well-ploughed land is suggested as a possible measure in that it exposes the eggs to the effects of the sun. The destruction of the nymphs by means of dusting with the proprietary agent 'Cyanogas' appears to offer considerable promise as a practicable and economic method of eradication, but no insecticidal treatment for destroying the adult insects has yet been found. The use of light traps is not considered to have been adequately explored, and, in view of some success having been obtained on certain estates, improved forms of traps are to be tested. The only other entomological measure of importance is that of biological control, and it has been decided to prosecute a vigorous campaign in the near future in order to develop this phase of the work, and with special reference to the study of egg-parasites and predators in the field.

Perhaps one of the most valuable results coming from the froghopper investigation has been its beneficial effect on general agricultural practice. Once it became to be realised that the subject is by no means exclusively entomological, increasing attention has been given to soil conditions and to the factors governing the growth of the crop in general. The fact that a fairly definite correlation exists between susceptibility of canes (especially ratoons) to froghopper attack and degree of soil acidity, has proved a great stimulus to further investigation in this direction. It has been found that (1) a positive correlation exists between the degree of saturation of the soil with lime and cane susceptibility; (2) soils of blight-free areas are absorptively saturated by lime, or nearly so; (3) soils of regularly blighted areas are less than 60 per cent saturated; (4) there is no correlation between *gross* soil content of lime and susceptibility; and (5) toxic aluminium in the soil often begins to appear when the degree of saturation falls below 60 per cent, and this may greatly increase the susceptibility to blighting.

There seems little doubt that the soils of the regions liable to froghopper attacks are lacking in combined lime (exchangeable calcium), and are therefore usually acidic in reaction. The reason why canes growing on such soils are so liable, whilst canes growing on lime-satisfied soils are resistant, to blighting, has not so far been discovered.

The subject of water relations between the soil and crop has received considerable attention. Field observations periodically recorded at three representative stations, for special 'good' and 'bad' plots, have demonstrated profound differences in soil moisture conditions. These differences are reflected in the fluctuations in the moisture-content of the leaves of canes growing on these plots and in the greater transpiration rate for bad-plot canes, leading to more rapid drying out at the time of day when the froghoppers feed. On the biochemical side it appears that the leaves of 'good' canes are much better manufacturers of sugars and proteins than 'bad' cane leaves, and that their moisture-content is less liable to fluctuation.

Many other problems of plant physiology are touched upon or discussed, and it is evident that much more experimentation, both of the laboratory and field type, is needed if the numerous suggestive indications and facts disclosed in these *Proceedings* are to be pursued to their practical issue. What is needed is a thorough fundamental ecological study of the cane-plant in relation to its full vigour and to its susceptibility to froghopper attack. It is evident from these reports that these aspects of the subject are fully appreciated, and that due attention to soil conditions and plant growth are more likely ultimately to prove of lasting value to the growers than the application of entomological methods only.

A. D. IMMS.

[1] *Minutes and Proceedings of the Froghopper Investigation Committee.* Trinidad and Tobago. Parts I-XVI, 1925–1929. Government Printing Office, Trinidad.

## Annual Conference of the Institut International de Bibliographie.

THE ninth Conference of the Institut International de Bibliographie was held, by kind permission of the governors and Prof. H. L. Callender, in the Imperial College of Science and Technology on Sept. 16 and 17. It was attended by representatives from many of the more important countries of Europe, including the following delegates: Prof. A. F. C. Pollard (President), Mr. Nemec (Czechoslovakia), M. Charles Sustrac (France), Dr. Hesse (Germany), Dr. S. C. Bradford (Great Britain), Mr. Andrau (Holland), Mr. Janički (Switzerland), and the General Secretaries, M. Henri La Fontaine (Belgium) and Mr. F. Donker Duyvis (Holland).

Monday was occupied with meetings of the Council and of the Commission of the Classification. Dr. Bradford gave a report on the discussions on classification during the recent congress of librarians in Italy. He outlined a scheme whereby, by the general adoption by bibliographical agencies of a standard classification, a comprehensive subject-index to published information of all kinds could be realised at once, with the saving of untold amounts of useless effort now wasted in repetition of previous work. It appeared that no other classification than the Decimal Classification, elaborated during more than thirty years by the collaborators of the Brussels Institute, came into discussion, and this classification is now being adopted as a standard by institutions of all kinds throughout the world.

Mr. Donker Duyvis, as secretary of the Commission of the Decimal Classification, gave his report on the present state of the printing of the new manual of the classification. About 1500 pages have now been printed, which brings the manual to the end of the

main divisions. The auxiliary tables and relative index remain to be printed. It was pointed out that the new manual has a provisional character and will serve as a basis for future enlarged editions. Various important improvements have been made and the theory of classification has been worked out in various respects and put into practice. The new manual is very comprehensive and provides at least a general class-number for practically every topic of human knowledge. Parts of the manual are being translated into five different languages. A mechanism is in existence for securing new sub-divisions as required, so as to keep the classification up-to-date.

The general assembly was opened on Tuesday, Sept. 17, with an address by the president, Prof. Pollard. In view of the visitors present, who included Sir Henry Lyons, Director of the Science Museum, as the representative of the Royal Society, Prof. Pollard first explained the function and work of the Institut. This function, he said, is, in effect, the economic distribution of means by which the information upon any given matter contained in the world's literature may be exhaustively extracted and immediately brought to light. The comparatively small but rapidly increasing literature of science is fed both by genius and exceptional intellects, which are in a class by themselves, and by those who labour in association. To the former the work of the Institut does not universally appeal, but the importance of bibliography to the latter is evidenced by the laboured bibliographies which are compiled by nearly all associative bodies concerned with scientific research and technological developments. For want of organised bibliography, the history of science and technology reveals much useless repetition and wasted effort, and even the circumscribed work of gifted intellects suffers from a neglect of bibliography.

The aim of the Institut International de Bibliographie is to provide the golden key which unlocks the treasure-house of the document, and is embodied in the study and application of bibliographical method. Daughter societies or branches of the Institut are being established in all countries of the world for the purpose of collecting, under the control of the Institut, in the most economical manner, and distributing to the student, the references to published information. It has been estimated that, if the work and labour now put into existing bibliographies were ordered and controlled, the ideal of a comprehensive index to the printed record might be realised now.

Prof. Pollard enumerated a number of important scientific societies, research associations, and bureaux in Great Britain which have adopted the methods of the Institut International de Bibliographie within the past year, chiefly through the activities of members of the British Society for International Bibliography, which has its headquarters at the Imperial College of Science and Technology, and is affiliated to the Institut. This is only a part of the first step that must be taken in order that the massed attack upon literature, which is gradually being organised by the Institut through the agency of affiliated bibliographical societies situated in civilised countries, may take effect to the lasting benefit of mankind.

An interesting discussion followed on the application of the Universal Decimal Classification and other schemes, in which the principal speakers were M. La Fontaine, Mr. Donker Duyvis, Mr. Rottenburg, Dr. Griffin, Mr. Lancaster Jones, Prof. Pollard, and Dr. Bradford. The discussion emphasised the important points that no unaided individual, however expert in a special subject, is capable in elaborating a satisfactory scheme of classification, and that a comprehensive index to published information can only be realised by the co-operation of many agencies using a standard code.

## Aeronautical Research in Great Britain.

THE spectacular setting of the Schneider Cup Race and the terrific speeds of 360 m.p.h. at which the British pilots lapped the course tend to obscure the enormous mass of scientific work of which this fine achievement is one of the more dramatic illustrations. It is on the incredible speeds attained that the excited layman focuses his attention—the mere outward and visible sign—but the problems of engine design, of structural strength under the enormous stresses in turning, of stability and controllability, of the aerodynamic properties of propellers and the other exposed aeroplane parts—these lie masked behind this single item of speed performance.

How the study of these problems is organised and their solution slowly attained is once more made evident in the Annual Report of the Aeronautical Research Committee, for the year 1928–29.[1]

The fields of research pursued by the Committee cover such subjects as aerodynamics, stability and control, engines, alloys, elasticity and fatigue, while in addition a large degree of consideration has been devoted to the problems of interference of body parts and to wing flutter. New researches in these matters have been initiated, while matters dealt with in previous annual reports have reached a more advanced stage. Amongst these are the lateral control of aeroplanes at low speeds; auto slots, for example, have been fitted to a large number of service aircraft; pilot planes are in use on experimental aircraft, and various means of putting a slot out of action if necessary, when used in conjunction with an aileron, are under trial. An important research on flutter has been completed, while researches on sleeve valve engines, on engines when highly supercharged, and on compression ignition engines are progressing rapidly.

One of the problems that has received much attention during the past year is the intensive improvement of aeroplane performance. A wide disparity still exists between the total head resistance of an ideal aeroplane the drag of which is entirely due to skin friction and that of conventional aeroplanes of present design. Attempts to reduce this large difference constitute the object of researches already initiated, and it is anticipated that much of the work of the Committee in the near future will be concerned with this problem, as there is in this field considerable scope for research which should have valuable consequences.

Arising out of this, further light is being thrown on the interesting problem of 'scale effect', for which an allowance has to be made in the prediction of full-scale resistance from model data on good stream-line bodies. It appears to be the case that much of the uncertainty in the passage from model to full scale is due to the fact that in the former case the flow is not so completely turbulent as in the latter, so that the prediction will be less liable to error if the flow in the wind tunnel can be rendered sufficiently turbulent. This question of turbulence, including both the mechanism of its origin and its general effect on performance, is considered a matter of primary importance. Thus the practical problems of flight are continually being reduced to their dependence on pure research.

[1] Aeronautical Research Committee. Report for the year 1928–29. Pp. 63. (London: H.M. Stationery Office, 1929.) 2s.

## Northern Echinoderms and Teleostei.

A VERY complete and up-to-date account of the echinoderms of the North Sea and Baltic is given by Th. Mortensen and I. Lieberkind in Lief. 12, Teil 8, Echinoderma, of Grimpe and Wagler's "Die Tierwelt der Nord- und Ostsee" (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1928). In the 128 pages a large amount of information is compressed and the whole résumé is of great value. Keys similar to those already given in Dr. Mortensen's larger works facilitate the identification of species, and the illustrations are beautifully clear and generously scattered throughout the text.

There are 69 species of echinoderms in the area described, and these are all tabulated with details of distribution, depth, and the nature of the bottom on or in which they live. Echinoderms are truly marine and do not tolerate brackish water. For this reason the low salinity of the Baltic does not encourage them: few species are to be found there, and these are never common. These few are *Astropecten irregularis*, *Henricia sanguinolenta*, *Solaster papposus*, *Asterias rubens*, *Ophiura albida*, *Psammechinus miliaris*, *Echinocyamus pusillus*, *Echinocardium flavescens*, and *Thyonidium pellucidum*. However, the North Sea harbours many of the species in great abundance and from between tide-marks to deep water (more than 3000 metres) they are to be found.

Following the systematic part, the anatomy is described in detail, movement, feeding (with a large amount of attention given to physiology), and finally reproduction and larval forms. Here again, clear keys are given for the identification of the larvæ of the commoner species in all groups. The echinoderm section of "Die Tierwelt der Nord- und Ostsee" is specially valuable and one of the best parts of this most useful work.

Georg Duncker and Erna W. Mohr give a good account of the Bleniiformes, Trachiniformes, and Gobiiformes (Teleostei, Physoclisti. 7-9. Blenniiformes, Trachiformes, Gobiiformes) in Lief. 12, Teil 12, g. 3 of "Die Tierwelt der Nord- und Ostsee". In the Gobiidae, *Gobius microps*, which only a few years ago was regarded as a variety of *G. minutus*, is now placed with *G. flavescens* (= *G. ruthensparri*) and *G. pictus*, whilst *G. minutus* is in a separate group. This is quite justified by the structural differences and now accepted by most systematists. Nearly all the British gobies are represented in this area, including *Aphya pellucida* and *Crystallogobius linearis* (= *C. nilssoni*), the Baltic Sea possessing a special race of *Gobius minutus*.

The eggs of the gobies are peculiarly interesting, being laid in masses, one layer thick, on shells and stones, each egg contained in a vase-like case, the shape characteristic of the species. Most of these eggs are known, the male parent watching over them until they are hatched.

In the Trachiformes comes the common angler, *Lophius piscatorius*, and a brief account is given of its wonderful ribbon of eggs, floating like a veil in the sea, and its well-known larval forms with figures after Smitt.

In connexion with the common blennies it is stated that neither egg nor larva is known of *Blennius gattorugine*. These are, however, both described in the *Journal of the Marine Biological Association* (vol. 12, No. 4, 1922, and vol. 14, No. 3, 1927). Also the authors assume that the pelagic larva of *Blennius pholis* is unknown, and this is also described by Ford in the first paper mentioned above.

## University and Educational Intelligence.

LIVERPOOL.—The Lady Herdman Memorial geology building of the University will be opened on Oct. 21 by the Right Hon. Stanley Baldwin.

LONDON.—A farewell dinner to Sir Gregory Foster, who retires from the position of Provost of University College, London, at the end of this year, will be given by past and present students of the College on Friday, Dec. 20. Those wishing to attend the dinner are asked to inform Mr. B. N. Parker, honorary secretary of the Old Students' Association, at the College.

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ACCREDITED universities, colleges, and other institutions for higher education and research are listed in *Bulletin*, 1929, No. 7 of the United States Bureau of Education (Washington, D.C.: Government Printing Office, 1929. 10 cents). The Bureau does not itself accredit, approve, or classify educational institutions, but performs a service of great value in making easily accessible the estimates of the various regional and national standardising agencies which have undertaken this work, and the criteria with reference to which the estimates were framed. The following associations are represented in the *Bulletin*: American Council on Education, Association of American Universities, Associations of Colleges and Secondary Schools of the Middle States and Maryland, of the Southern States, of New England and of North Central States, American Associations of Junior Colleges, of Teachers' Colleges, of Collegiate Schools of Business, of Schools and Departments of Journalism, and of Colleges of Pharmacy, Council of Medical Education and Hospitals, Dental Education Council, and American Library Association.

ORGANISATION of secondary education in two units of four years each is advocated in an article in the June issue of *School Life* by Dr. W. J. Cooper, United States Commissioner of Education. The typical American 'high school' of to-day, like its predecessors since the creation of this type of school a hundred years ago, offers courses covering four years, and more or less intermediate in standard between those of the seven or eight years of the elementary school and the traditional four-years' liberal arts college course. The rapid and continuous growth which has characterised secondary education in the United States since 1890 has radically altered the purposes of the teaching which the high schools are called upon to provide. Whereas in that year less than four per cent of the population of the appropriate ages (14-17) were enrolled in the high schools, the percentage had risen in 1926 to 47, and there has been a simultaneous rapid growth in racial heterogeneity and the complexity of the social order. Experiments in the reorganisation of the high school have been going on all over the United States, and one-sixth of all the public high schools could in 1926 be classed as 'reorganised', the commonest feature of reorganisation being a 'junior high school' embracing usually the seventh and eighth of the old elementary school grades with or without the lowest grade of the ordinary high school. Simultaneously with this downward extension of the high school has come an upward extension by the addition of 'junior colleges' offering two years of advanced work. Dr. Cooper's contention is that for the average child a secondary school organised under a 4-4 plan, allotting the first unit to the period of early adolescence and the second to that middle adolescent period in which intelligence normally reaches its climax, would prove most beneficial.

## Calendar of Patent Records.

October 6, 1825.—An early example of ' caterpillar ' traction for road vehicles, consisting essentially in the employment of an endless chain passing round the wheels on each side of the wagon, to enable the wagon to travel over rough ground, was patented on Oct. 6, 1825. It was the invention of Sir George Cayley (1773–1857), known to-day as one of the greatest of aeronautical pioneers.

October 6, 1886.—Hovis bread dates from the patent granted to Richard Smith, miller, of Stoke-on-Trent, on Oct. 6, 1886, for a process in which the bread is made from a mixture of three parts of white flour with one part of the wheat germ which has been partly cooked by subjecting it to the action of superheated steam.

October 7, 1839.—An important method of protecting tempera painting to render it washable is described in the specification of the patent granted to F. G. Spilsbury and others on Oct. 7, 1839. The tempera is applied to the surface by a careful preparation of chondrin size, and the painting when finished is washed over with a solution of alum or acetate of alumina, which renders the size insoluble in water.

October 7, 1847.—The plate-glass known as ' Hartley's ' or ' Rolled ', made by ladling the molten glass from the melting pot to the casting-table and rolling it out into large thin sheets, was patented on Oct. 7, 1847, by James Hartley of Sunderland, and first manufactured in the same year by Messrs. Chance Bros., of which firm Hartley for some time was a member.

October 7, 1852.—Dr. Augustus Waller appears in the patent lists as the inventor of a means for measuring the quantity of alcohol in brandy, wine, beer, or other liquor, which he patented on Oct. 7, 1852, but his most important invention—the cardiograph, which records the movements of the heart at any moment, was not patented.

October 8, 1890.—The Hornsby-Akroyd oil engine was a development of the engine invented by H. Akroyd Stuart and patented by him and C. R. Binney on Oct. 8, 1890. It was the first commercially successful engine to have the ' hot bulb ' system of ignition, and was the forerunner of the so-called ' semi-diesel ' engine. Its chief feature was that the hot-bulb was connected to the engine cylinder by only a narrow opening, and whilst the liquid fuel was injected under pressure into the hot-bulb and vaporised, the air was drawn into the cylinder and was not mixed with the vapour in the correct proportion to form the explosive mixture until the proper moment for the explosion.

October 10, 1826.—A metal wheel, designed so that the spokes of thin rod or wire should be in tension, was patented by Theodore Jones on Oct. 10, 1826. The patent was upheld in the courts in an action for infringement, and was extended for seven years in the names of Gabriel Riddle and Thomas Piper, to whom the patent had been assigned.

October 11, 1867.—The first Remington typewriter was made under the United States patent granted to C. Glidden and Latham Sholes on Oct. 11, 1867. (Cf. Calendar of Patent Records, Aug. 11.)

October 12, 1815.—The keel of the first steamboat to be built in Germany was laid down in June 1816 by an Englishman, J. B. Humphreys, who was granted a Prussian patent for ten years on Oct. 12, 1815. The *Prinzessin Charlotte* was employed on the route Berlin-Charlottenburg-Potsdam, but was not successful. The first commercially successful steamship to be built in Germany was *Die Weser*, which was begun in the autumn of 1816 and started working in the following May.

## Official Publications Received.

BRITISH.

Northampton Polytechnic Institute, St. John Street, London, E.C.1. Announcements for the Session 1929–1930 giving Particulars of Evening Classes in Civil and Mechanical Engineering. Pp. 48. Announcements for the Session 1929–1930 giving Particulars of the Evening Classes in Electrical Engineering. Pp. 47. Announcements for the Session 1929–1930 giving Particulars of the Evening Courses in Applied Optics. Pp. 26. Announcements for the Session 1929–1930 giving Particulars of Day and Evening Courses in Applied Chemistry. Pp. 27. Announcements for the Session 1929–1930 giving Particulars of the Day Courses in Applied Optics. Pp. 24+4 plates. Prospectus of the Northampton Engineering College for the Session 1929–30. Pp. ii+41+7 plates. (London.)

Memoirs of the Asiatic Society of Bengal. Vol. 8, No. 7: A Persian Translation of the Eleventh Century Arabic Alchemical Treatise *'Ain aṣ-Ṣan'ah wa 'Aun aṣ-Ṣana'ah*. By Maqbūl Ahmad; to which is annexed a Note on the Chemistry of the Processes given in the Treatise, by Prof. B. B. Datta. Pp. 417-460. (Calcutta.) 1.11 rupees.

London County Council: Hackney Technical Institute. Prospectus and Time Table, 1929–30. Pp. 74. (London.)

The Scientific Proceedings of the Royal Dublin Society. Vol. 19 (N.S.), No. 25: A Study of Fungi found in Milk. By Prof. H. A. Cummins, Violet C. E. Kennelly and M. Grimes. Pp. 311-319+plates 17-18. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 1s. 6d.

Trinidad and Tobago. Minutes and Proceedings of the Froghopper Investigation Committee, Part 16. Pp. 291-341. (Trinidad, B.W.I.: Government Printing Office, Port-of-Spain.)

The Royal Technical College, Glasgow. Calendar for the One Hundred and Thirty-fourth Session, 1929–1930. Pp. 438+xxviii. (Glasgow.)

Proceedings of the Royal Society of Edinburgh, Session 1928–1929. Vol. 49, Part 4, No. 23: On Three Huygens Lenses in the possession of the Royal Society of London. By Prof. R. A. Sampson and Prof. A. E. Conrady. Pp. 289-299+2 plates. 1s. 6d. Vol. 49, Part 4, No. 24: The Action of Salts of Polynuclear Bases on Colloidal Suspensions and on the Electro-capillary Curve. By Dr. J. A. V. Butler and Dr. W. O. Kermack. Pp. 300-312. 1s. Vol. 49, Part 4, No. 25: An Experimental Analysis of the Plumage of the Brown Leghorn Fowl. By A. W. Greenwood and J. S. S. Blyth. Pp. 313-355+4 plates. 5s. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

University of Reading: The National Institute for Research in Dairying. Annual Report for the Year ending 31st July 1928. Pp. 86. (Reading.)

The Electrical Association for Women. What Women Think about Electrical Development in Great Britain, U.S.A., Holland and Germany: being Report of Proceedings of the Fourth Annual Conference held at the North-East Coast Exhibition, Newcastle-on-Tyne, July 10th-12th, 1929. Pp. 32. (London.) 1s.

The Scientific Proceedings of the Royal Dublin Society. Vol. 19 (N.S.), No. 27: The Insect Vectors of the Leaf-Roll Disease of the Potato. By Dr. Paul A. Murphy and Robert McKay. Pp. 341-353. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 1s.

Proceedings of the Royal Irish Academy. Vol. 38, Section C, Nos. 8, 9: Further Notes on the Runic Inscription in Killaloe Cathedral, by R. A. S. Macalister; On some Antiquities discovered upon Lambay, by R. A. S. Macalister. Pp. 235-246+plates 20-25. 1s. Vol. 38, Section C, No. 10: Report on Excavation recently conducted in Killeen Cormac, Co. Kildare. By R. A. S. Macalister and R. Lloyd Praeger. Pp. 247-261+plates 26-30. 1s. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.)

British Broadcasting Corporation. Broadcasts to Schools. Programme, September 1929 to June 1930; Syllabus, September 23 to December 13, 1929. Pp. 36. Speech and Language. By A. Lloyd James. Broadcast Thursdays 2.30 to 2.50 p.m., September 1929 to June 1930. Pp. 24. 1d. Elementary French. Manual No. 4, specially designed for Central Schools, by E. M. Stéphan. Broadcast on Tuesdays, 24 September–10 December 1929, 3.35 p.m.–4.0 p.m. Pp. 28. 1d. Music Lessons. Scholar's Manual 1, by Sir Walford Davies. Broadcast on Tuesdays, 24 September 1929–10 December 1929, 2.30–3.30 p.m. Pp. 44. 1d. Days of Old. By Rhoda Power. Term 1: The Middle Ages; with Illustrations from Contemporary Sources by Elinor Lambert and Others. Broadcast on Mondays, 23 September to 9 December 1929, 2.30–3 p.m. Pp. 32. 1d. Peoples of the World and their Homes. Planned by Prof. H. J. Fleure. Term 1. Broadcast on Fridays, 27 September–13 December 1929, 3.0–3.20 p.m. Pp. 32. 1d. Rural Survey, Term 1, by Charlotte Simpson, Broadcast on alternate Fridays, 27 September–6 December 1929, 2.30–2.55 p.m., and Farming, Term 1, by Dr. B. A. Keen, Broadcast on alternate Fridays 4 October–13 December 1929, 2.30–2.55 p.m. Pp. 36. 1d. Readings and Talks for Secondary Schools. Readings, Mondays, 2.0–2.20 p.m., 23 September–9 December 1929; Talks, Tuesdays, 4.15–4.30 p.m., 24 September–10 December 1929. Pp. 32. 1d. Nature Study, Term 1. By Clotilde von Wyss. Broadcast on Wednesdays, 25 September–11 December 1929 (omitting 2 October), 2.30–2.55 p.m. Pp. 20. 1d. (London.)

British Broadcasting Corporation. Talks and Lectures. The Meaning of Ethics. By Prof. W. G. de Burgh. From Daventry 5XX only, Tuesdays, September 24 to October 29, at 8 p.m. (Aids to Study, No. 47.) Pp. 16. 1d. The Village and the Village Craftsman. Arranged in co-operation with the Rural Industries Bureau. Fridays, September 27 to November 1, at 7.25 p.m. (Aids to Study, No. 48.) Pp. 32. 1d. (London.)

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1220 (M. 60): The Age-Hardening of some Aluminium Alloys. By Dr. Marie L. V. Gayler and G. D. Preston. Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research. (A. 51.) Pp. 33+22 plates. (London: H.M. Stationery Office.) 2s. net.

Rubber Research Institute of Malaya. Annual Report, 1928, including Initial Period. Pp. 127. (Kuala Lumpur, F.M.S.) 1 dollar.

Annual Report of the Director of the Meteorological Office, presented by the Meteorological Committee to the Air Council, for the Year ended 31st March 1929. (The Seventy-fourth Year of the Meteorological Office.) (M.O. 318.) Pp. 46. (London: H.M. Stationery Office.) 1*s.* 6*d.* net.

Annual Conference of the Universities of Great Britain and Ireland, 1929. Report of Proceedings. Pp. 59. (London: Universities Bureau of the British Empire.) 1*s.*

Transactions of the Leicester Literary and Philosophical Society, together with the Council's Report and the Reports of the Sections, 1928–29. Vol. 30. Pp. 76+2 plates. (Leicester.)

Melbourne Observatory. Hourly Values of the Magnetic Elements at Toolangi in 1927, observed and reduced under the direction of Dr. J. M. Baldwin. Pp. viii+37. (Melbourne: H. J. Green.)

Indian Journal of Physics, Vol. 4, Part 2; and Proceedings of the Indian Association for the Cultivation of Science, Vol. 13, Part 2. Conducted by Sir C. V. Raman. Pp. 79-193+5 plates. (Calcutta.) 3 rupees; 4*s.*

Department of Agriculture, Ceylon. Administration Report of the Acting Director of Agriculture for 1928. Pp. D26. (Colombo: Government Record Office.) 50 cents.

Ceylon. Administration Report of the Acting Marine Biologist for 1928. Pp. G24+2 plates. (Colombo: Government Record Office.) 75 cents.

Report of the Government Chemist upon the Work of the Government Laboratory for the Year ending 31st March 1929; with Appendices. Pp. 46. (London: H.M. Stationery Office.) 1*s.* 6*d.* net.

Journal of the Royal Statistical Society. New Series, Vol. 92, Part 4, 1929. Pp. viii+487-669. (London.) 7*s.* 6*d.*

Ministry of Health. Report of Departmental Committee on the Training and Employment of Midwives. Pp. 96. (London: H.M. Stationery Office.) 1*s.* net.

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 67, No. 393, September. Pp. 1065-1176+xxxvi. (London: E. and F. N. Spon, Ltd.) 10*s.* 6*d.*

Report of the Progress of the Ordnance Survey for the Financial Year 1st April 1928 to 31st March 1929. Pp. 13+5 plates. (London: H.M. Stationery Office.) 4*s.* 6*d.* net.

Birkbeck College (University of London). The Calendar for the Year 1929–30. (107th Session.) Pp. 242. (London.)

Birkbeck College (University of London). Lord Haldane's Life and the Adult Education Movement: being the first Annual Haldane Memorial Lecture delivered by the Rt. Hon. Lord Justice Sankey, May 14th, 1929. Pp. 23. (London.)

Heriot-Watt College, Edinburgh. Calendar, Session 1929–1930. Pp. 281. (Edinburgh.) 1*s.*

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1211 (E. 30): The Effective Torsional Rigidity of a Crank. By R. V. Southwell. (I.C.E. 606: T.V.C. 28.) Pp. 17. (London: H.M. Stationery Office.) 9*d.* net.

Department of the Interior. Waterton Lakes National Park, Alberta, Canada. By M. B. Williams. Pp. 45. Jasper National Park. By M. B. Williams. Pp. iv+176. Through the Heart of the Rockies and Selkirks. By M. B. Williams. Fourth edition. Pp. vi+112. Kootenay National Park and the Banff Windermere Highway. By M. B. Williams. Pp. 45. Prince Albert National Park. By M. B. Williams. Pp. 24. (Ottawa: F. A. Acland; London: High Commissioner of Canada.)

Indian Journal of Physics, Vol. 4, Part 3; and Proceedings of the Indian Association for the Cultivation of Science, Vol. 13, Part 3. Conducted by Sir C. V. Raman. 14: A Memoir on the Raman Effect in Liquids. By Dr. A. S. Ganesan and S. Venkateswaran. Pp. 195-280+plates 6-9. (Calcutta.) 2.4 rupees; 3*s.*

Transactions of the Mining and Geological Institute of India. Vol. 24, Part 1, July. Pp. 77+3 plates. (Calcutta.) To Members, 2.8 rupees; to Non-Members, 4 rupees.

Union of South Africa. Department of Mines and Industries: Geological Survey. The Geology of the Country surrounding Pretoria: an Explanation of Sheet No. 1 (New Series). By H. Kynaston. Revised by Dr. L. J. Krige and B. V. Lombard. Pp. 48. (Pretoria: Government Printer.) 5*s.* (including Map).

Southern Rhodesia: Geological Survey. Bulletin No. 14: The Geology of the Gaika Gold Mine, Que Que, S. Rhodesia. By S. C. Morgan. Pp. 42+5 plates. Short Report No. 24: An Outline of the Geology of Southern Rhodesia. By H. B. Maufe. Second edition. Pp. 12+2 maps. (Salisbury.)

Report of the Nineteenth Meeting of the Australasian Association for the Advancement of Science (Australia and New Zealand). Hobart Meeting, January 1928. Pp. xl+707+17 plates. (Sydney, N.S.W.)

Southern Rhodesia. Report of the Director of Native Education for the Year 1928. Pp. 48. Report of the Director of Education for the Year 1928. Pp. 32. (Salisbury: Government Printer.)

Wigan and District Mining and Technical College. Calendar 1929–1930. Pp. 212. (Wigan.)

Annual Report for the Year ended March 31st, 1929, of the Executive Council of the National Institute for the Blind. Pp. iv+56. (London.)

The Scientific Proceedings of the Royal Dublin Society. Vol. 19 (N.S.), Nos. 20-28. 20: A Study of Lactose-Fermenting Yeasts isolated from Milk, Cream and Butter, by M. Grimes and J. Doherty; 21: The Effect of Strong Magnetic and Electric Fields on the Rectilinear Propagation of γ Rays, by Dr. J. H. J. Poole and A. G. Clarke; 22: On the Local Application of Radium in Therapeutics, by Prof. J. Joly—ii: Bi-Radiant Needles; 23: Report of the Irish Radium Committee for the Year 1928 (including Reports by Dr. Walter C. Stevenson and M. R. J. Hayes); 24: Photo-electric Measurements of Illumination in relation to Plant Distribution, by Dr. W. R. G. Atkins and Dr. H. H. Poole—Part 2: Measurements with Portable Galvanometers; 25: A Study of Fungi found in Milk, by Prof. H. A. Cummins, Violet C. E. Kennelly and M. Grimes; 26: The Uranyl Oxalate Method of Daylight Photometry and its Photo-electric Standardization, by Dr. W. R. G. Atkins and Dr. H. H. Poole; 27: The Insect Vectors of the Leaf-Roll Disease of the Potato, by Dr. Paul A. Murphy and Robert M'Kay; 28: The Photo-chemical and Photo-electric Measurement of the Radiation from a Mercury Vapour Lamp, by Dr. W. R. G. Atkins and Dr. H. H. Poole. Pp. 261-364+plates 16-18. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 8*s.*

FOREIGN.

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. Fourth Series (Biology), Vol. 4, No. 2. Pp. 335-471+plates 13-18. (Tokyo and Sendai: Maruzen Co., Ltd.)

Union Géodésique et Géophysique Internationale: Section de Météorologie. Troisième assemblée générale, Prague 1927. Pp. 48. (Cambridge: At the University Press.)

Collection des travaux chimiques de Tchécoslovaquie. Rédigée et publiée par E. Votoček et J. Heyrovský. Année 1, No. 8, août. Pp. 417-466. (Prague: Regia Societas Scientiarum Bohemica.)

United States Department of Agriculture. Circular No. 75: The True Cricket, a Serious Cotton Pest in California. By E. A. McGregor. Pp. 8. (Washington, D.C.: Government Printing Office.) 5 cents.

Conseil Permanent International pour l'Exploration de la Mer. Bulletin statistique des pêches maritimes des pays du nord et de l'ouest de l'Europe. Rédigé par D'Arcy Wentworth Thompson. Vol. 17, pour l'année 1927. Pp. 72. 2.75 kr. Rapports et procès-verbaux des réunions. Vol. 58: Tables des matières de Vol. 1-65 et liste des publications de circonstance avec table alphabétique des matières (finissant avec le 1er avril 1929). Pp. 58. 2.25 kr. (Copenhague: Andr. Fred. Høst et fils.)

Instituts scientifiques de Buitenzorg: "'s Lands Plantentuin." Treubia: recueil de travaux zoologiques, hydrobiologiques et océanographiques. Vol. 10, Livraison 4, juin. Pp. 403-517+plates 11-15. (Buitenzorg: Archipel Drukkerij.) 2.50 f.

Publications of the Astronomical Observatory of the Warsaw University. Vol. 4. Pp. iii+95. (Warsaw.)

Bulletin of the National Research Council. No. 51: Radioactivity; Report of Committee on X-Rays and Radioactivity, National Research Council. By Prof. A. F. Kovarik and Prof. L. W. McKeehan. Second printing, with Additions and Corrections. Pp. viii+203. (Washington, D.C.: National Academy of Sciences.) 2.50 dollars.

Memoirs of the College of Science, Kyoto Imperial University. Series A, Vol. 12, No. 4, July. Pp. 203-226+3 plates. (Tokyo: Maruzen Co., Ltd.) 1.30 yen.

Japanese Journal of Mathematics: Transactions and Abstracts. Vol. 6, No. 2, July. Pp. 173-249. (Tokyo: National Research Council of Japan.)

Proceedings of the Imperial Academy. Vol. 5, No. 7, July. Pp. xv-xvi+263-305. (Tokyo.)

Journal of the Faculty of Agriculture, Hokkaido Imperial University, Sapporo, Japan. Vol. 23, Part 4: Arbeiten aus dem Institute für Gerberei-Wissenschaft. Mitteilung 5: Über gerbende Stoffe und ihre Beurteilung. Von Prof. Dr. G. Grasser und Sun Tau. Pp. 127-150. (Tokyo: Maruzen Co., Ltd.)

The Danish *Dana* Expeditions, 1920–22, in the North Atlantic and the Gulf of Panama. Oceanographical Reports, edited by the *Dana* Committee, No. 4: Les poissons apodes appartenant au sous ordre des Nemichthydiformes. Par Prof. Louis Roule et Léon Bertin. Pp. 113+9 planches. (Copenhagen: Gyldendalske Boghandel; London: Wheldon and Wesley, Ltd.) 18*s.*

Publication of the Netherlands Geodetic Commission. Theory and Practice of Pendulum Observations at Sea. By F. A. Vening Meinesz. Pp. viii+95. (Delft: J. Waltman, Jr.)

Ministry of Public Works, Egypt: Physical Department. Helwan Observatory Bulletin, No. 34: Magnetic Declination in the Nile Valley for the Epoch 1930·0. By P. A. Curry. Pp. 2+1 plate. (Cairo: Government Press.)

Ministry of Agriculture, Egypt: Technical and Scientific Service (Botanical Section). Bulletin No. 90: A Preliminary Note on some New Strains of Uppers. By C. H. Brown. Pp. 10+44 plates. (Cairo: Government Press.) 5 P.T.

The Carnegie Foundation for the Advancement of Teaching. Twenty-third Annual Report of the President and of the Treasurer. Pp. vi+166. (New York City.)

Sveriges Geologiska Undersökning. Ser. C, No. 346: Studier över Ancylussjöns avlopp. Av Henr. Munthe. Pp. 107+4 tavlor. 3.00 kr. Ser. C, No. 347: Svea ölvs geologiska tidsställning; en pollenanalytisk studie i Ancylustidens geografi. Av Lennart von Post. Efterskrift: Ancylustidens Göta älv. English Summary: The Geological Age of the Svea River. Pp. 132+2 tavlor. 3.00 kr. Ser. C, No. 348: Undersökningar angående det senglaciala havets största utbredning inom Norrbottens län. Av Gösta Santesson. Pp. 13+1 tavla. 1.00 kr. Ser. C, No. 349: Senglaciala strandlinjer och sediment i västra Bergslagen. Av Erik Granlund. Pp. 38+1 tavla. 1.00 kr. Ser. C, No. 350: Södra Storfjället im südlichen Lappland; eine petrographische und geologische Studie im zentralen Teil des skandinavischen Hochgebirges. Von Gunnar Beskow. Pp. 335+2 Tafeln. 5.00 kr. Ser. C, No. 351: Masugnsbyfältens geologi. Av Per Geijer. Summary: Geology of the Iron Ore Fields at Masugnsbyn. Pp. 39+1 karta. 1.00 kr. Ser. C, No. 352: Nyare jordarts- och markreaktionsundersökningar och deras betydelse för jordbruket. Av Simon Johansson. Pp. 16+2 tavlor. 1.00 kr. Ser. C, No. 353: Studier i Ölands myrmarker. Av G. Lundquist. Resumee in deutscher Sprache. Pp. 183+9 tavlor. 3.00 kr. Ser. C, No. 354: Kalirika bergarter inom södra och översikt av den svenska experimentverksamheten för framställning av kaligödselmedel. Av B. Asklund. Pp. 52+1 tavla. 1.00 kr. Ser. C, No. 355: A Deep Boring through Middle and Lower Cambrian Strata at Borgholm, Isle of Öland. By A. H. Westergård. Pp. 19. 1.00 kr. (Stockholm.)

United States Department of Agriculture. Technical Bulletin No. 88: Tobacco Cutworms. By S. E. Crumb. Pp. 179+9 plates. (Washington, D.C.: Government Printing Office.) 35 cents.

Bulletin of the American Museum of Natural History. Vol. 58, Art. 8: Notes on Reptiles from Fukien and other Chinese Provinces. By Clifford H. Pope. Pp. 335-487+plates 17-20. Vol. 58, Art. 9: Nicolas Pike and his Unpublished Paintings of the Fishes of Mauritius, Western Indian Ocean; with an Index to the Fishes. By E. W. Gudger. Pp. 489-530. Vol. 58, Art. 10: An Adult Pug-headed Brown Trout, *Salmo fario*, with Notes on other Pug-headed Salmonids. By E. W. Gudger. Pp. 531-559+plate 21. (New York City.)

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 48: On the Stability of Kármán Vortex Street in a Channel of Finite Breadth, I. By Susumu Tomotika. Pp. 213-242. (Tôkyô: Koseikai Publishing House.) 0.32 yen.

Proceedings of the California Academy of Sciences, Fourth Series. Vol. 18, No. 13: The Escallonias in Golden Gate Park, San Francisco, California, with Descriptions of New Species. By Alice Eastwood. Pp. 385-391. Vol. 18, No. 14: Studies in the Flora of Lower California and adjacent Islands. By Alice Eastwood. Pp. 393-484+plates 33-34. (San Francisco.)

Japanese Journal of Chemistry: Transactions and Abstracts. Vol. 3, No. 4. Pp. 165-215. Vol. 4, No. 1. Pp. 31. (Tokyo: National Research Council of Japan.)

The Philippine Journal of Science. Vol. 39, Nos. 1-4: Filterable Virus and Rickettsia Diseases. By Earl Baldwin McKinley. Pp. iii+416+70 plates. (Manila: Bureau of Printing.)

Smithsonian Institution: Bureau of American Ethnology. Bulletin 89: Observations on the Thunder Dance of the Bear Gens of the Fox Indians. By Truman Michelson. Pp. v+73. 65 cents. Bulletin 92: Shabik'eshchee Village, a late Basket Maker Site in the Chaco Canyon, New Mexico. By Frank H. H. Roberts, Jr. Pp. viii+164+31 plates. 1.00 dollar. (Washington, D.C.: Government Printing Office.)

Forty-fourth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1926-1927. With accompanying Papers: Exploration of the Burton Mound at Santa Barbara, California, by John P. Harrington; Social and Religious Beliefs and Usages of the Chickasaw Indians, by John R. Swanton; Uses of Plants by the Chippewa Indians, by Frances Densmore; Archeological Investigations, II., by Gerard Fowke. Pp. vii+555+98 plates. (Washington, D.C.: Government Printing Office.) 2.25 dollars.

Year Book of the Academy of Natural Sciences of Philadelphia, 1928. Pp. 90+11 plates. (Philadelphia.)

Proceedings of the Academy of Natural Sciences of Philadelphia. Vol. 80, 1928. Pp. iv+640+31 plates. (Philadelphia.) 6.25 dollars.

Museums of the Brooklyn Institute of Arts and Sciences. Report upon the Condition and Progress of the Museums for the Year ending December 31, 1928. By William Henry Fox. Pp. 73+3 plates. (Brooklyn, N.Y.)

### CATALOGUES.

A Catalogue of Miscellaneous Books (Folklore, Witchcraft, etc.; Biography and History; General Literature). (No. 447.) Pp. 32. (Cambridge: Bowes and Bowes.)

East Africa: a Short List of Books relating to Uganda, Kenya, Somaliland, Tanganyika, Portuguese East Africa, etc. Pp. 8. (London: Francis Edwards, Ltd.)

## Diary of Societies.

*FRIDAY*, OCTOBER 4.

DIESEL ENGINE USERS ASSOCIATION (at Caxton Hall), at 6.—G. B. Fox: Indicating Oil Engines.

SOCIETY OF CHEMICAL INDUSTRY (Manchester Section) (at Engineers' Club, Manchester), at 7.—Dr. R. H. Pickard: The Industrial Research Association.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—C. J. Hill: Engineering Experiences on a Tea Estate in Assam.

*SATURDAY*, OCTOBER 5.

BIOCHEMICAL SOCIETY (in Biochemical Laboratory, Cambridge), at 3.—Sir F. G. Hopkins: Glutathione as a Tripeptide.—G. F. Marrian: An Unidentified Saturated Alcohol in the Urine of Pregnancy.—W. M. Wright and C. G. L. Wolf: The Fuchs Reaction for the Diagnosis of Malignant Tumours.—L. H. Stickland: The Bacterial Decomposition of Formic Acid.—J. Needham and D. M. Needham: Phosphorus Metabolism of Developing Echinoderm Eggs.—W. B. Pleass: Cooling and Heating Curves of Solutions of Gelatin and the Influence of Hydrogen Ion Concentration on the Gelling of Gelatin Sols at Various Temperatures.—H. J. Channon and G. A. Collinson: The Acetone-ether Soluble Fraction of the Fat of Blood at Fasting Level.—D. R. McCullagh: The Measurement of Heat Production in Biological Material by Means of a Resistance Thermometer.—*Demonstrations:*—J. R. M. Innes and L. J. Harris: The Histopathology of Hypervitaminosis-D.—D. R. McCullagh: Microcalorimeter.

MATHEMATICAL ASSOCIATION (London Branch) (at Bedford College), at 3.—Dr. P. B. Ballard: A Talk about Modern Methods.

GILBERT WHITE FELLOWSHIP (at 6 Queen Square, W.C.1), at 3.—E. A. Martin: Gilbert White and his Village.

INSTITUTE OF BRITISH FOUNDRYMEN (Lancashire Branch) (at College of Technology, Manchester), at 4.—E. Longden: Presidential Address.

*MONDAY*, OCTOBER 7.

BRITISH PSYCHOLOGICAL SOCIETY (Education Section) (at London Day Training College), at 6.—Dr. E. O. Lewis: The Incidence of Mental Defect in the School Population.

INSTITUTION OF AUTOMOBILE ENGINEERS (British Centre) (at Merchant Venturers' Technical College, Bristol), at 6.45.—Prof. W. Morgan: The Member and the Institution.

SOCIETY OF CHEMICAL INDUSTRY (London Section).—H. A. Sloman: A New Method for the Production of Pure Beryllium Oxide from Beryllium Ores.—R. Taylor: Isolation of Helium from Monazite Sand.

*TUESDAY*, OCTOBER 8.

UNIVERSITY OF MANCHESTER CHEMICAL SOCIETY, at 5.—Dr. F. Challenger: Some Chemical Aspects of Microbiology (Presidential Address).

INSTITUTE OF MARINE ENGINEERS, at 6.30.—E. Berg: Electric Propulsion as applied to Passenger Liners.

ILLUMINATING ENGINEERING SOCIETY (at E.L.M.A. Lighting Service Bureau, 15 Savoy Street), at 6.30.—Report on Progress in Illuminating Engineering.

INSTITUTION OF AUTOMOBILE ENGINEERS (Coventry Centre) (at King's Head Hotel, Coventry), at 7.30.—Prof. W. Morgan: The Member and the Institution.

INSTITUTE OF METALS (North-East Coast Local Section) (at Armstrong College, Newcastle-upon-Tyne), at 7.30.—S. G. Homfray: Chairman's Address.

QUEKETT MICROSCOPICAL CLUB, at 7.30.—E. A. Smith: The Life of the Rock-pools.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY (Chemistry Section) (at Leicester College of Technology), at 8.—R. B. Pilcher: Alchemy in Art and Literature.

*WEDNESDAY*, OCTOBER 9.

INSTITUTE OF METALS (Swansea Local Section) (at Thomas' Café, Swansea), at 7.—J. H. Grant: Chairman's Address.

INSTITUTE OF BREWING (Burton-on-Trent Section) (at Queen's Hotel, Burton-on-Trent).—H. E. Dryden and others: Discussion on Heavy Malts as compared with Light Malts.

*THURSDAY*, OCTOBER 10.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—J. C. Stobart: Mass Methods.

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 6.30.—C. R. Fairey: The Range of Aircraft.

INSTITUTE OF METALS (Birmingham Local Section) (at Chamber of Commerce, Birmingham), at 7.—J. D. North: Metals in Aircraft Structures.

INSTITUTE OF METALS (London Local Section) (at 83 Pall Mall), at 7.30.—Dr. S. W. Smith: Some Factors in Solidification (Chairman's Address).

OPTICAL SOCIETY (at Imperial College of Science and Technology).—T. H. Court and Dr. M. von Rohr: The Development of the Telescope, mostly after Documents in the Court Collection (1675–1830). (Third Paper on the Court Collection.)—Dr. D. S. Perfect: A Chromatic Method of making Null Indications.

*FRIDAY*, OCTOBER 11.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—R. H. Allen: Coal and Coal Cleaning.

LEICESTER TEXTILE SOCIETY (at Leicester), at 7.30.—J. W. Allinson: Colour and Design in Textile Printing.

INSTITUTE OF METALS (Sheffield Local Section) (at Sheffield University), at 7.30.—F. C. Robinson: Some Notes on the Selection of Suitable Metals to Resist Corrosion (Chairman's Address).

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group) (at Chemical Society), at 8.—J. D. Pratt: Rationalisation—its Meaning and Application; with Special Reference to the Chemical Industry.

EUGENICS SOCIETY (at Linnean Society), at 8.—Dr. O. E. Lewis, Dr. Newth, and others: Mental Deficiency.

*SATURDAY*, OCTOBER 12.

MINING INSTITUTE OF SCOTLAND (at Edinburgh).

### PUBLIC LECTURES.

*TUESDAY*, OCTOBER 8.

BRITISH MEDICAL ASSOCIATION, at 4.—Sir Josiah Stamp: Alcohol as an Economic Factor (Norman Kerr Memorial Lecture).

KING'S COLLEGE, at 5.—Dr. J. W. Pickering: Blood Plasma and Platelets. (Succeeding Lectures on Oct. 15, 22, 29, and Nov. 5.)

ST. THOMAS'S HOSPITAL MEDICAL SCHOOL, at 5.—Dr. A. St. G. Huggett: The Physiology of the Fœtus. (Succeeding Lectures on Oct. 15, 22, and 29.)

*WEDNESDAY*, OCTOBER 9.

KING'S COLLEGE, at 5.30.—Rev. Canon C. Jenkins: The Contribution of King's College to the Advancement of Learning during the Century 1829–1928:—Theology and Philosophy.—Dr. F. A. P. Aveling: Personalism: A Psychological Approach to Reality:—Psychology and Psychologies.

*FRIDAY*, OCTOBER 11.

LONDON SCHOOL OF ECONOMICS, at 5.—Prof. R. Thurnwald: The Problem of Evolution in the Social Processes. (Succeeding Lectures on Oct. 15 and 17.)

KING'S COLLEGE, at 5.30.—Sir St. Clair Thomson: Lord Lister: Reminiscences of a House Surgeon.

*SATURDAY*, OCTOBER 12.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Prof. J. R. Ainsworth Davis: Mammoth and Man.

### CONFERENCES.

OCTOBER 4 TO 6.

COAL SMOKE ABATEMENT SOCIETY AND SMOKE ABATEMENT LEAGUE OF GREAT BRITAIN (at Palace Hotel, Buxton).

OCTOBER 10 TO 12.

INTERNATIONAL ASSOCIATION FOR THE PREVENTION OF TUBERCULOSIS (at Connaught Hall, Newcastle-upon-Tyne).

*Thursday, Oct.* 10.—Dr. H. Mess: Tuberculosis on Tyneside: a Sociological Study.

Dr. E. Rist and others: The Factors that produce Pulmonary Tuberculosis.

*Friday, Oct.* 11.—Dr. W. Brand: A Scheme of National Propaganda regarding Tuberculosis.

Dr. A. H. Macpherson: Combined Treatment and Technical Education of Tuberculous Youths.

Dr. T. Beattie and Dr. F. Hewat: The Teaching of Tuberculosis to Undergraduates.

Dr. W. H. Dickinson: The Training of Tuberculosis Medical Officers.

Dr. H. Williams: Methods of Medical Propaganda regarding Tuberculosis.

Dr. W. Guy: Dentistry in Relation to Tuberculosis.