THURSDAY, OCTOBER 5, 1911.

A ZOOLOGICAL TRIBUTE.

Festschrift zum Sechzigsten Geburtstag Richard Hertwigs (München) geboren den 23. September, 1850, zu Friedrich, i.H. Erster Band, "Arbeiten aus dem Gebiet der Zellenlehre and Protozoenkunde." Pp. v+674+49 plates. Price 110 marks. Zweiter Band, "Arbeiten Morphologischen, Biologischen und Deszendenztheoretischen Inhalts." Pp. iii+624+30 plates. Price 70 marks. Dritter Band, "Experimentelle Arbeiten." Pp. iii+308+20 plates. Price 50 marks. (Jena: Gustav Fischer, 1910.)

THE three volumes before us represent one of the most remarkable tributes ever paid to a professor of zoology. We refer not merely to their size and weight, which have unfortunately hindered us from reviewing them more promptly, but to their high standard of workmanship and to the cordiality with which the various authors recognise indebtedness to their master for inspiration and instruction, for precept and example. It is true, of course, that those who have joined in this "Festschrift" to their highly esteemed teacher are now strongly marked individualities, ploughing their own furrows; yet it would be less than fair not to see that the diversity of contributions is correlated with the diversity of gifts in Richard Hertwig himself. For he has worked along many lines of zoology, and always with signal success—with a carefulness, thoroughness, and thoughtfulness which we should not presume to praise were they not reflected so clearly in the volumes which it is our business to-day to review. He has dealt with Protozoa and Metazoa, with morphology and physiology, with the most minute intricacies of the cell, with the big questions of sex and reproduction, and with the general problems of evolution. The congratulations of NATURE to Richard Hertwig, as one of the big international educationists in zoology of recent years, may be, through the reviewer's fault, a little belated, but they are none the less sincere. We wish for him many years of pleasant work, judiciously mingled with as much holiday as he can enjoy.

But how are we to review three enormous volumes with 1600 pages and a hundred plates? Perhaps the most useful way is the objective one of giving a rapid inventory of the treasures of this great Festschrift.

W. T. Howard leads off with an account of a peculiar kind of nuclear budding which occurs in the "depressed" cells of some tumours. It represents a reversion on the part of these cells to a primitive type of division common among certain Protozoa (such as Podophrya, according to Hertwig), and the author also suggests that the degeneration and extrusion of nuclear buds followed by mitosis of the mother nucleus is, in principle, comparable to the maturation division of egg cells. M. Popoff describes in various cells of Muscidæ what Hertwig called the formation of chromidia—the extrusion of chromatin from the nucleus into the cytoplasm. This colonisation of the cytoplasm by nucleoplasm seems to bear a relation to the functioning of the cell; thus the chromidia may be distributed along lines of diffusion currents. The author points out that what have been described as mitochondria, chondriomites, chondriokonts, pseudochromosomes, ergastoplasm, and so on, are simply phases of chromidia. Prof. Vlad. Růžička has studied in *Bacterium nitri* the relations of chromatin and of plastin to the life of the cell, and finds that these two substances tend to be distributed respectively in areas of active and of reduced metabolism. In a paper with very striking illustrations, Th. Moroff describes what goes on inside the large Radiolarian Thalassicolla, the nucleus of which can be seen easily with the naked eye. The vegetative and reproductive phases are contrasted, and an account is given of the formation of isospores and anisospores. The author discusses such points as the significance of nucleoli, which are interpreted as forms of chromidia.

C. Clifford Dobell gives an account of his study of an interesting blood parasite, Hæmocystidium, discovered by Castellani and Willey in a Ceylon Gecko. He describes the schizogony and the formation of gametocytes, and contrasts the genus with the malarial organism, Plasmodium, to which it is closely akin. Hubert Erhard shows, in reference to the cells of the bile-duct in the snail, and of the epididymis in the white mouse, that the "trophospongia" of Holmgren is really a chromidial apparatus of nuclear origin. In regard to the epididymis he brings forward strong evidence that the secretion is due to the activity of the chromidia in the cytoplasm. In the next study Julius Schaxel describes the oogenesis of the well-known jellyfish Pelagia. He lays emphasis on the interesting give and take between nucleus and cytoplasm; from nutritive material supplied by the cytoplasm the nucleus forms chromatin, part of which is emitted from the nucleus into the cytoplasm to form physiologically important "kineto-chromidia." The history of the chromosomes in the larval salamander is the subject of a study by Karl Camillo Schneider—a kind of study which is difficult for those who have not a clue to the labyrinth of the nucleus. We may, however, point out that according to the author each chromosome of the nucleus in the prophase before division is bivalent, being composed of two "elementary structures" or "Mites," which are spirally coiled! In following the history of these spirals Schneider has found strong corroboration of Boveri's theory of the individuality of the chromosomes. In the next paper Paul Buchner gives a redescription—more penetrating than ever—of the spermatogenesis and oogenesis, the maturation and fertilisation in Sagitta.

E. A. Minchin describes *Malpighiella refringens*, a new amœboid parasite which he found in the malpighian tubes of the rat-flea (*Ceratophyllus fasciatus*), in which he was studying the transmission of *Trypanosoma lewisi*. It occurs principally in two forms—an amœboid form with a single nucleus, and an encysted form with four nuclei. In the next paper we are brought back again to chromidia, for Alexander Issakowitsch describes these on the marginal gland cells of Porpita, and shows that they play an essential part in the production of mucus. Then follows an interesting study by Rh. Erdmann, dealing with

Amoeba diploidea, which he kept at a temperature far above the normal. Nuclear degenerations and disturbances ensued, the culture became quite asexual, and sooner or later died off. In short, a state of "facultative apogamy" was experimentally induced, and the result afforded indirect evidence that part of the utility of the sexual process is to counteract "depressions" and disturbances of the cellular functions. Max Hartmann describes from the gut of a Termite a new representative of the very remarkable Protozoa known as Trichonymphidæ. He is inclined to make the family into a class comparable to Ciliata, but one almost hopes that this is going too far. Very remarkable they certainly are, with their males and females and young stages, their fission and gametogeny, their unique "head-organ" (probably a complicated blepharoplast), and their compound or "polyenergid" nucleus. Another interesting Protozoon, *Trypanosoma rotatorium*, Grube, from the frog, is redescribed by W. Lebedeff. It is remarkable for its striking polymorphism, for four principal forms occur. Another interesting parasite, a species of Lankesteria which lives in the food-canal of Turbellarians in Lake Baikal, is described by B. Swarczewsky. An account is given of the formation of gametes, their conjugation, the development of sporocysts, and of the life-history in general.

Very prominent in more ways than one is the description which Max Jörgensen gives of the growth of the ovarian ovum in Proteus. It occupies nearly 200 pages, and it is illustrated by twenty-three beautiful plates of cytological details. The author tells us all sorts of wonderful things, *e.g.* how the chromatin in the second stage of growth becomes pulverised, how the chromidium helps in the reconstruction, how the remarkable "lamp-brush" chromosomes arise, how the nucleoli migrate and what they do (probably serving as reservoirs for certain products of metabolism, and furnishing ferments which are useful in plasm-growth and yolk-formation. A most interesting account is given of the conditions of ooplasm-growth and of yolk-forming, and, in general, of the marvellous interactions between the different members of the cell-firm.

The second volume begins with a paper by J. P. Schtschelkanowzew on the internal and external male organs of Chelifer and Chernes. Among other interesting points the absence of a tail in the ripe spermatozoa may be noted. A discussion of the affinities of the Chelonethi leads to the conclusion that they are most nearly related to the Urotricha or Holopeltidia. Bruno Wahl deals with the classification of two families of Turbellarians, Dalyellidæ and Umagillidæ, which include a number of interesting and, in part, parasitic forms, such as Graffilla, Anoplodium, and Syndesmis. There seems to be some puzzle about *Graffilla parasitica*, which is abundant inside Tethys, for Wahl could find no trace of male gonads. Great interest attaches to the fine account which Sergius Kuschakewitsch gives of the development of the gonads in the edible frogs. It is a fine study in the origin and differentation of gonads, but it is also welcome in connection with experiments on sex-determination. The author contrasts the ovary and the testis stage after stage. There seems to be a remarkable lability in the details of the development, and the differences seem to depend partly on the locality and partly on the degree of ripeness of the eggs when they are fertilised. Confirmation is given of Hertwig's conclusion that over-ripeness of the ova results in a great preponderance of males. Philipp Lehrs takes us to a different kind of zoological problem in his discussion of a new species of Lacerta from Lebanon. He compares it with other mountain lizards, and shows the interest of it in binding together the Neo-Lacerta and Archæo-Lacerta species. C. Sasaki relates how he has almost cleared up the life-history of a rather famous aphis—*Schlechtendalia chinensis*—which makes galls on *Rhus semi-alata* in Japan and China. The galls are used in dyeing and tanning—they are rich in tannin, and in former times they served the Japanese women as a tooth-powder for blackening the teeth. Sasaki has succeeded in finding the wingless mother-insect, the fundatrix, who sets the ball a-rolling. Wingless females, parthenogenetic and viviparous, come and go; at length winged females appear which lay eggs, containing well-advanced embryos that soon hatch out. But no males have been seen, and we have a glimpse of a possibly continuous Parthenopeia.

R. Goldschmidt devotes a hundred pages to a searching account of the minute structure of the glia, the nerve-fibres, and the ganglion cells in the common threadworms of horse and man. He devotes particular attention to the neurofibrils, only, however, to rob them of their supposed nervosity, for he strongly maintains, with Apathy and others, that neurofibrils simply represent cellular skeleton. Goldschmidt has made in previous memoirs such a thorough analysis of the nervous system of Ascaris that he has the cells all numbered, and, as it were, ticketed. It is extraordinary indeed to read that "cell 26 of the internal lateral cephalic ganglion is present only in the males"—a fine instance, on the one hand, of penetrating analysis, and, on the other, of the penetrating nature of sex. O. Steche takes us to the open sea with his interesting study of the Portuguese man-of-war. He has introduced order into what he calls the "perplexing Wirrwar" of zooids, by discovering the law of budding. What is even more important, he shows how the development of the huge pneumatophore that projects above the waves has reacted on the architecture, leading to a great shortening of the stem and a giving up of the usual budding-zone. Incidentally, he mentions that Physalia has great power of regenerating lost appendages—a capacity which other Siphonophora are not known to possess.

In the next paper Harry Marcus makes another contribution to the much studied problem of the architecture of the head. He deals with Hypogeophis, one of the Gymnophiona, and discusses the "neuromerie, mesomerie, dermatomerie, and branchiomerie" of the head, which has at least nine segments. Adjoining this important, but highly technical contribution, there is a practical study by Schwangart, an authority on vine diseases. He deals with the deadly "Traubenwickler," caterpillars of two species of Tortricidæ, the

ravages of which are nothing short of calamitous. In 1906 the loss in the Pfalz alone was estimated at six millions of marks. After discussing the life-history and habits, and the natural enemies of the caterpillars, as well as a variety of chemical, mechanical, and physical methods of dealing with the pest, the author gives an interesting account of their infection with a pathogenic mould, a species of Cordyceps. Ernst Stromer takes us back to ancient days in his discussion of the phylogeny of the Dipnoan stock, a subject raised by his very interesting discovery of teeth of both Protopterus and Lepidosiren in the Lower Oligocene of Egypt.

Plate's contribution to the Festschrift is an expanded version of the inaugural lecture which he gave in entering upon his duties as professor of zoology in Jena. He deals with the laws of inheritance in their relation to general evolution-theory. He has been breeding mice and has found not a single fact against the Mendelian theory. But he does not think that the selection theory has lost any of its importance. Some of his analyses of current conceptions are very interesting; thus he distinguishes seven forms of germinal variation, five kinds of atavism, and several kinds of correlation.

The third volume begins with observations by Arnold Lang on the heart-beats of hibernating snails. As the temperature falls the beats become fewer and fewer, but even at $-3°$ C. they were still observed. A heart that can beat fifty times a minute in summer may only beat 2·36 times a minute at a temperature of 2·65° C. in February. In the next study Karl von Frisch takes us out to brooks and streams, and inquires into the colour-change of the trout and the minnow. It is many years since Pouchet demonstrated the importance of the sympathetic system in this connection, but von Frisch has already in this "vorlaüfige Mitteilung" got further into the business. He has shown that there is in the anterior end of the medulla oblongata a special centre, the stimulation of which makes the fish lighter, *i.e.* makes the chromatophores contract. He has also found the place where the nerve-fibres that control the chromatophores pass out of the spinal cord into the sympathetic, in which they extend forwards and backwards.

By means of ingenious experiments, especially on bicephalous Planarians, Paul Steinmann has shown, for Triclads, that the nature of what is regenerated, *e.g.* whether a head or a tail, depends, not on the line of cutting, nor on the adjacent tissue, but on the regenerating organism as a whole. Even distant parts of the regenerant have their "organising" influence on the regenerate. Another paper dealing with regeneration is by Gustav Wolff, who reports on the continuation of his studies on newts. He has previously shown that the regeneration of the lens takes place apart from nervous stimulus, but now he shows that in the regeneration of the hind limb a nervous factor is indisputable. He makes much, for instance, of the remarkable fact that when an abnormal limb, say one with only two toes, is cut off, the regenerated limb has also only two toes. There is a very interesting historical reference to a forgotten paper by T. J. Todd, who directed attention, in 1823, to the influence of the nerve in the regeneration of the newt's leg.

An investigation of a very different type is that of W. F. Ewald on the contraction of the adductors in freshwater mussels. He has discovered a special "tonus-current," and gives a definition of the "tonic muscle-contraction." It is not oscillatory or discontinuous, but a persistent process, both in its mechanical and its electrical aspects. Albrecht Bethe deals with the equilibration of aquatic animals, discussing those with statocysts and those without, those the construction of which gives them an automatic stability, and those "labile" forms that keep themselves in a particular position by a coordination of movements. In some young fishes there is at first an automatic determination of the position, and the coordination is subsequently acquired. O. Maas has studied the peculiar involution-processes which occur in various sponges when they are starved or kept without sufficient lime salts. By passing into a resting stage, comparable to gemmules, the sponge may survive the disadvantageous conditions and exhibit subsequent revivification. One of the interesting general results is the corroboration of the view that sponges are essentially diploblastic. Th. Boveri has studied the developmental potencies of Ascaris-blastomeres in cases where the normal type of cleavage has been departed from, either as the result of double fertilisation or in consequence of centrifugal rotation. He gives the *coup de grâce* to the hypothesis of differential nuclear division.

F. Doflein takes us into the open-air again with his very interesting—though admittedly preliminary—study of the behaviour of two prawns, species of Leander, common on the Riviera coast. He discusses their fine coloration and its changes; the different kinds of chromatophores and pigments, red, blue, yellow, and white; their behaviour when feeding, when cleaning themselves, and so on; and the reactions to diverse stimuli.

This remarkable tribute, a credit alike to the genial professor and his school, ends with an interesting study of the awakening of the hibernating hedgehog. Whether automatically, or by "pulling itself together," the hedgehog warms itself up, and that rapidly. The chemistry of this, according to Tanzo Yoshida and Ernst Weinland, is that a rapid combustion of glycogen occurs, and that fat serves as an accessory fuel to the vital fire.

THE AGRICULTURAL DEVELOPMENT OF EGYPT.

Text-book of Egyptian Agriculture. Edited by G. P. Foaden and F. Fletcher. Vol. ii. Pp. viii+321–878. (Cairo: National Printing Department, 1910.) Price 9*s*.

IN the agricultural development of a country two lines of attack have always to be followed: investigations are made with the objects of discovering the best crops to grow and the best methods to follow; and the cultivator—who is generally constitutionally conservative—has to be persuaded that the

new methods really are an improvement on the old. Egypt, old as she is, has to adapt herself to the changed economic conditions of the world, and the problem before her agricultural advisers is fundamentally the same as in new countries, though in its details more complex.

The book before us is the second volume of the complete work, the first having been reviewed in these columns about eighteen months ago. It deals with individual crops, with farm pests and farm animals, and its object is to present the student with a general summary of the work done, and the information collected and sorted out, by the experts attached to the various agricultural institutions in the country. The writing of each section of the book has been entrusted to one man, generally one who has done much work on the subject, so that the volume consists of a detached series of contributions. It is therefore extremely useful for the expert who can evaluate the various chapters, but it has not quite the organic unity desirable for a student's text-book. Indeed, it is, in any case, rather large for an elementary student, and the editors will probably find advantages in drawing up an abridgment of the whole work for general use, leaving these larger and more authoritative volumes for the advanced student.

Cotton is at present the crop to which the Egyptian looks for profit, and where it can be grown everything else is made subsidiary to it. If the land will grow cotton every two years so much the better; but Mr. Cartwright, who has charge of this section, enters a wise caution against overcropping:—

"Egypt depends on the quality of its staple for its position in the cotton world. This quality of staple is intimately bound up with the fertility of the land, and any loss of the second will almost certainly be accompanied by deterioration in the first."

A common rotation is cotton, berseem, wheat; berseem being the Egyptian clover (*Trifolium alexandrinum*), which keeps up the supply of humus in the soil, thus counteracting the effect of the extremely rapid decomposition going on.

The wheat is mainly of the durum type. Red, white, bearded, and beardless varieties can all be found, and the samples are usually very mixed in quality. Wheat forms an important crop in basin cultivation; indeed, the red wheats from the Upper Egypt basins are considered the best type. In Lower Egypt wheat is grown under irrigation as a winter crop.

In Upper Egypt sugar cane is often the basis of the rotation instead of cotton, the course being sugar cane, sugar cane, berseem, followed by doura, wheat with or without doura; sometimes, however, the cane is only grown one year, and the wheat is replaced by a bare fallow. The two great classes of cane in general cultivation are Beladi, for long the commonest grown, and Roumi, now replacing the older class because of higher producing capacity. Ordinarily the sugar obtained is 10 to 15 per cent. of the weight of the cane, about 2·5 per cent. being molasses. Doura or maize is an extremely useful crop for the fellah. Its thinnings supply a large quantity of green food for his cattle when "keep" is scarce; its grain supplies him and his family with food; moreover, it responds well to liberal treatment.

Fungoid diseases are ably dealt with by Mr. Balls, who has, on the whole, a very cheerful account to give of the cultivator's lot.

"The immunity of the important cultivated plants from disease induced by fungi is most remarkable; berseem and maize, although grown in enormous quantities, are practically free from disease; wheat only bears rust-pustules commonly after the flowering period; and although cotton is inhabited by four common fungi, it is yet attacked by them at such times as to be but little affected thereby."

But Mr. Balls will not leave the cultivator to be lulled into a false sense of security: this happy immunity, he insists, is not entirely due to climatic conditions, although it is in part; thus the high temperature is unfavourable to fungi, and the unvarying character of the climate enables the pathologist to know exactly what to expect.

On the other hand, insect pests are numerous and do a good deal of damage. Mr. Willcocks, who writes this section, inclines to the belief that they are more or less indigenous. Their life-histories are being steadily worked out and remedial measures designed. But it is not always easy to apply remedies in practice. The psychology of the cultivator counts for much, and Oriental fatalism is a bar to the taking of active precautionary measures. The cultivator always hopes that Providence, or at least Government, will do something, but does not himself do what the Western man would do at once.

Perhaps the cotton boll-worm is the most serious pest, but the cotton worm (*Prodenia littoralis*), the small green cotton worm (*Caradrina exigua*), and the cut worm (*Agrotis ypsilon*) also do harm, not only to cotton, but to other crops as well.

Farm animals are dealt with by Mr. McCall. The native cattle are described as races of *Bos indicus*, but have not undergone artificial selection and improvement, like the European races of *Bos taurus*. It is considered that some very fine strains could be produced by proper breeding.

The book concludes with tables of useful statistics and some good illustrations of live stock. Altogether it will be found very helpful to all who are interested in Egyptian agriculture. E. J. R.

THE PROPAGATION OF ELECTRIC CURRENTS.

The Propagation of Electric Currents in Telephone and Telegraph Conductors: a Course of Post-Graduate Lectures delivered before the University of London. By Prof. J. A. Fleming, F.R.S. Pp. xiv+316. (London: Constable and Co., Ltd., 1911.) Price 8*s.* 6*d.* net.

THIS book is an elaboration of lectures which the author has given in the Pender Laboratory to telegraph and telephone engineers. The immediate and practical object of the book is to show how by a scientific treatment of the problem of electric wave propagation higher speed in telegraphy and better articulation on long telephone lines may be obtained. The problems

involved are, however, fundamental to all electrical engineering, and thus the usefulness of the book is by no means limited to the class of readers for which, to judge by the title, it has been written. The phenomena of electric wave propagation play an important part in long power-lines, and much of what the author has to tell us about the waves in telephone cables may, with some obvious modifications, be directly translated into the domain of heavy electrical work. Problems connected with propagation are most easily treated by the use of the symbolic method, and although Heaviside, Steimetz, Pupin, Kennelly, and others have for some years used this method in their publications, the majority of electrical engineering text-books still ignore it. Electrical engineers will therefore feel grateful to the author for having given them in his book a very clear and readable exposition of the treatment of electric problems by complex quantities. This is done in the first chapter. Then follows a chapter on wave propagation generally. The subject is introduced by the investigation of sound waves in air. In this way the main principles of such an investigation are established by reference to a problem with which all engineers are more or less familiar, and this is a material help to the more complicated problems of magnetic and electric waves, which are treated next.

In the third chapter we come to the general case of an infinitely long cable having at one end impressed on it an alternating e.m.f. It is this case which is of interest not only to the telephone engineer, but also to the designer of a power-line. By making use of the symbolic methods outlined in the first chapter, the author shows how the current gets weaker as we proceed from the home end, and how at the same time the phase angle between e.m.f. and current increases. He distinguishes thus between an "attenuation factor," which applies to the real part, and a "phase factor," which applies to the imaginary part of the complex quantity. In telephony the attenuation factor is not of paramount importance, since the ear is able to appreciate even very weak sounds, provided their general character as determined by the sequence of the waves of different frequency remains the same. But this is just the condition which in an ordinary telephone cable only exists if its length is moderate. The phase factor is different for each wave-length, and thus the longer the line the greater is the distortion in the arriving waves. A moderate amount of distortion the human ear is able to analyse, in the same way as we are able to recognise a person's face from a caricature if the distortion of the true features is moderate, but on very long lines the attenuation and phase factors have so altered the character of the waves that the ear is no longer able to analyse them, and telephony becomes impossible.

This refers to an ordinary cable in which there is little inductance, but much capacity. The author shows that the old rule according to which the product of capacity and resistance was considered, the important item on which clearness of speech depended, is wrong, and that, as was first pointed out by Heaviside, the condition for perfect transmission is equality between two products, namely, that of capacity and resistance per mile and that of inductance and leakage per mile. In a cable of this kind the velocity of propagation is the same for all frequencies, and consequently all parts of a composite wave travel at the same speed and arrive without distortion, although, of course, attenuated. Heaviside called a cable of this kind a "distortionless cable."

By reference to Pupin's theory it is next shown how an approach to the perfection of such a cable may be obtained by "loading," that is, putting inductances at interyals along the line in series with the conductor. This approach to perfection will obviously be the closer the more it approaches the condition of a uniformly loaded line. This means that the impedance coils must not be too far apart. Eight to nine coils per wave-length is the number theoretically found in an example given of a 90 ohms per mile line, where coils of 0·2 henry every two miles satisfy this condition. In the Anglo-French telephone cable laid by the British Post Office last year the impedance coils have each an inductance of 0·1 henry, and are spaced 1·53 miles apart. The construction of this cable is fully described. There is also a chapter devoted to submarine telegraphy, and another to the study of the propagation of waves of very high frequency along wires. Here, again, the power engineer will find much useful information.

GISBERT KAPP.

MARINE REFRIGERATION.

Cold Storage, Heating, and Ventilating on Board Ship. By Sydney F. Walker, R.N. Pp. vi+269. (London: Constable and Co., Ltd., 1911.) Price 8*s*. net.

THE increasing luxury of modern sea-travel makes the use of cold storage almost a necessity for any but the smallest passenger boats. In the large liners the most elaborate arrangements are used to preserve the food and to keep a continual flow of air at the proper degrees of temperature and dryness through the passenger regions. In this book the author has brought together the general principles which must be used to get such a result, and in the section on cold storage considers the principal methods used to convey the enormous quantity of food now brought to this country in cold storage.

An improvement would be an index, especially to designers and freezer engineers, for whom the book is primarily intended, as it is not easy to find if a reference is made to any particular fitting or arrangement. It is well known, for instance, that there are two distinct methods of treatment suitable for different kinds of food. In one, so soon as the natural heat has gone out, the food is frozen to some degrees below freezing-point, and maintained frozen—but at no particular temperature—until ultimately thawed for use; in the other, the food is never frozen, but is maintained at as constant a temperature as possible a few degrees above freezing-point, and in an atmosphere with a definite degree of humidity. There is no difficulty about the first method, which is used, for instance,

for mutton; but in the latter, used for beef, fish, and fruit, the constancy both of the temperature and the humidity is most important. There are at the present time various devices for maintaining the constancy of these factors more or less automatically, so as to relieve the operating staff from the continual strain of watching gauges, but no reference seems to be made to them.

Again, the advantages of the various methods for producing cold are given, but no attempt at summarising the knowledge so that a marine engineer could easily determine which system would be the most suitable for his particular case.

Considerable attention is paid to the discovery and prevention of faults in the whole storage system, and the advice given would doubtless be of great use to the freezer engineer. In the sections on ventilating and heating, which are clearly to be taken together, the various methods in use are considered in some detail. The author obviously inclines to electrical methods, which certainly have the great advantage that the transference of air and the generation of heat can be far more easily controlled at a large number of points. An interesting calculation is made as to the expense of running electric heating on a large liner, and appears to show that the cost is quite disproportionate to the extra comfort obtained.

There are some curious instances of the inclusion of really extraneous matter, such as the question of ventilation in mines, where the problem is essentially different and the presence of poisonous or explosive gases makes the failure of the ventilation a cause of real danger and not merely of discomfort.

In the heating section also there are a large number of illustrations of electric heaters differing very little, and more suitable to a catalogue. The book is well illustrated, and should find a distinct place in the literature of the subject. F. H.

RADIOGRAPHY.

Disease in Bone and its Detection by the X-Rays. By E. W. H. Shenton. Pp. xii+72+46 figures. (London: Macmillan and Co., Ltd, 1911.) Price 4*s.* 6*d.* net.

MR. E. W. H. SHENTON was one of the first medical men to take up the use of the Röntgen-rays for the purposes of medical diagnosis. His experience extends to more than fourteen years, and thus dates back almost to the time of the publication of Prof. Röntgen's discovery. Mr. Shenton points out in his preface the necessity for skill in carrying out the examinations and in interpreting the results. Many laymen are able to take "clear" X-ray photographs, but only an expert can be sure of taking photographs in the best way for obtaining the maximum diagnostic information. The final words of Mr. Shenton's preface are—

"To the staff of Guy's Hospital I owe more than I can acknowledge here, but for nothing am I more grateful than their attitude towards the whole subject of X-ray work. In my opinion, it has raised radiography from a branch of photography to a branch of practical medicine. As a pioneer I might have had the rough time pioneers look for, but my way has been considerably smoothed by their generous encouragement."

In the diagnosis of diseases and injuries of bones, changes of form or of density are those chiefly concerned, for opacity to X-rays is a function of density. Mr. Shenton makes the helpful general statement that acute bone disease is made evident by increase of transparency, and chronic disease by increase of opacity. He warns us against the common error of mistaking apparent variations in density of bone, due to the condition of the X-ray tube, for actual variations in density. The exposure should be such as to give the greatest possible amount of detail of texture of the bones, and a "very clear" skiagram, where the contrast between the bones and the soft parts is extremely sharp, is usually lacking in detail of bone texture.

Mr. Shenton goes fully into the subject of fracture, and directs especial attention to the subject of "callus," the new material formed around fractures, uniting the fragments. When first formed this callus is entirely transparent to the X-rays. This is a very fortunate fact, as otherwise we should not be able to judge the nature and extent of a bony lesion except just after its occurrence; not for many weeks as we are able to do. The author directs special attention also to the absence of unnecessary callus in fractures treated by Mr. W. Arbuthnot Lane's method of bringing the fragments into accurate apposition by metal plates and screws.

Various diseases of bone—abscesses, tumours, and inflammatory diseases—are described and illustrated, as are also the rheumatic and gouty conditions which affect bones in the proximity of joints. The appearance of the teeth in normal and abnormal conditions is illustrated and described.

The book is full of information, the result of the author's almost unequalled experience. It is beautifully printed in large clear type on art paper, so that the illustrations show to the best possible advantage. A. C. J.

OUR BOOK SHELF.

A Text-book of Elementary Foundry Practice for the Use of Students in Colleges and Secondary Schools. By W. A. Richards. Pp. xii+121. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 5*s.* 6*d.* net.

THAT a text-book of elementary foundry practice should be required for the use of students in secondary schools reads strangely in this country, but indicates how far trade practice is being brought into school curricula in the United States; and this work is by the instructor in forge and foundry practice in the University High School and the University, Chicago. A careful perusal of the book shows that it is the practice of the foundry—and that mainly of moulding—that is treated of, and not the science underlying foundry work. Only hand tools and such moulding as can be done with them are described, and the making of moulds for the production of steel castings is not included.

The author claims that though his book is written for boys in secondary schools, he hopes it may suit the college student, and that it is so plain and practical that it may be used without an instructor. A

series of exercises in moulding is explained in great detail, but wherever the author ventures into the field of the science underlying any portion of foundry practice, his theory is wild and not helpful. He quotes McWilliam and Longmuir with approval (McWilliams and Longair he calls them), but is not in agreement with them when he recommends that the vent wire should be pushed down to the pattern. It is a pity that the author did not leave the science of the subject alone, for it is disheartening to find the student being told that fireclay is almost pure oxide of alumina, that copper and manganese form manganese bronze, copper and phosphorus phosphorus bronze, and like statements.

The main body of the book is, however, devoted to a simply worded and painstaking explanation of a series of exercises in moulding, so selected and arranged as to illustrate as many as practicable of the principles used in the more elementary parts of the moulder's art.

Moxly's Theory of the Tides. With a Chapter of Extracts from Moxly's Original Work. By J. F. Ruthven. Revised and enlarged edition. Pp. 103. (London: J. D. Potter, 1911.)

THIS monograph is an attempt to uphold the claims of the equilibrium theory of the tides as opposed to those of the dynamical theory now generally maintained. It is seldom possible to return to older scientific hypotheses which are of so general a nature and have been superseded, and it is impossible here.

The gist of the matter is contained in a statement by Sir George Airy, which the author quotes on page 72—"Suppose now that the water assumed the form which we have found, and that the earth revolves within its coating of water. This supposition, absurd as it is, is the only one upon which it is possible to apply the equilibrium theory." The author, following Moxly, denies the truth of this statement, and states that the equilibrium theory assumes that it is only the *form* and not the *mass* of the water which is fixed relatively to the moon. But if the form only be fixed (as *must* be assumed), then the particles of water are in relative oscillatory motion, and the tidal wave is a species of oscillation (an idea to which Moxly greatly objected, page 83)—a forced oscillation, the characteristics of which therefore depend partly on the nature of the free oscillations, and the problem is essentially dynamical.

The author seems to labour under some misconceptions of the dynamical theory in thinking, for instance, that it implies impossible ocean currents, and that the tidal crest must be 90° behind the moon (pages 8 and 9).

However, the book is a very clear exposition of the principles of the equilibrium theory, and claims to explain in general terms a number of anomalous tides; but sometimes one fails to see why the same explanation cannot hold good on the dynamical theory. The note on the tides in the Bay of Fundy (pages 88 and 89) is interesting. W. J. HARRISON.

An Introduction to Vegetable Physiology. By Prof. J. Reynolds Green, F.R.S. Third edition. Pp. xxii +470. (London: J. and A. Churchill, 1911.) Price 10*s.* 6*d.* net.

IN the preface to the present edition Prof. Reynolds Green states that he has carried out a careful revision in order to introduce alterations suggested by practical use, and to incorporate such new ideas as have met with approval. Additional paragraphs have been inserted in the second chapter to emphasise the general relations of the individual with its environment, and further explanations are given with regard to perception of stimuli; the recasting of the sections dealing with energy and respiration was prepared for the second edition.

The book has been found particularly useful for the instruction of students up to an intermediate stage. Generally speaking, the author treats his subject so far as facts are established or theories have received acceptance. Therefore the student proceeds along a course that is, for the most part, non-contentious, and his progress is made easy by the careful arrangement and clear presentation of the subject-matter. The value of the book to the advanced student would be increased if references to literature dealing with debatable or more recent arguments were provided; for instance, it would be useful to find a reference to the description of the original experiments concerned with the detection of formaldehyde in leaves.

A History of England for Schools, with Documents, Problems, and Exercises. By M. W. Keatinge and N. L. Frazer. Part i., pp. x+388. Part ii., pp. x+324. (London: A. and C. Black, 1911.) Price 2*s.* 6*d.* each part.

IN addition to its immediate good effect on the pupils themselves, the introduction of laboratory methods of teaching science has had an indirect, beneficial influence on the other work of schools. Practical exercises are becoming a necessary part of courses of study in geometry, geography, and other subjects in which originally boys and girls had little else to do than listen to the exposition of their teachers. The most recent experiment in this direction is the introduction of the "research" method in the study of history, which is, in some schools, done in specially equipped rooms.

This work is a welcome indication of the improvement in teaching history which has taken place in recent years, and it may be recommended to the careful consideration of teachers who believe in securing the active cooperation of their pupils by setting them problems to study by themselves with the view of arriving at conclusions. An excellent collection of documents is provided, and they are intended to supply the apparatus for work which to some extent at least is analogous to that provided in the laboratory in the teaching of science.

Calendar of Papers in Washington Archives relating to the Territories of the United States (to 1873). By David W. Parker. Pp. 476. (Washington, D.C.: The Carnegie Institution of Washington, 1911.)

THIS volume is the first calendar of archive materials in Washington issued by the Department of Historical Research in the Carnegie Institution. It follows upon Messrs. Van Tyne and Leland's "Guide to the Archives of the Government of the United States in Washington." Mr. J. Franklin Jameson, the editor of the series to which this book belongs, says that the interest of historical writers at the present time is greatest in respect of papers which have to do with territories as a whole, especially with their government and their constitutional and political history. Accordingly attention has, in the present volume, been concentrated upon papers of this class.

Lehrbuch der Zoologie für Studierende. By Prof. J. E. V. Boas. Sechste vermehrte und verbesserte Auflage. Pp. x+690. (Jena: Gustav Fischer, 1911.) Price 12.50 marks.

PROF. BOAS'S text-book is so well known—both the original text and the translation—that no description is necessary of the sixth revised edition now before us. The fifth edition was reviewed in NATURE of April 22, 1909 (vol. lxxx., p. 214), and the present issue differs from it only by the addition of a few pages and fifteen new illustrations.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Non-Euclidean Geometry.

MR. FRANKLAND (NATURE, September 7) has raised the old problem of Bertrand's proof of the parallel-axiom by a consideration of infinite areas. This is perhaps the most subtle and the most specious of all the attempted proofs, and this character it owes to the fact that a process of reasoning which is sound for finite magnitudes is extended to a field which is beyond our powers of comprehension—the field of infinity. The fallacy which underlies Bertrand's proof becomes more apparent in Legendre's simpler device ("Éléments de Géométrie," 12 éd., Note ii.). A straight line divides a plane in which it lies into two congruent parts—this, of course, has no real meaning, since we are dealing with infinite areas, but such is the argument—and two rays from a point enclose an (infinite) area which is less than half the whole plane. Hence, if two intersecting lines are both parallel to the same straight line, the area of half the plane can be enclosed within an area which is less than half the plane.

This is the same sort of paradox as the well-known one by which the part is made to appear equal to, or even greater than, the whole. The even numbers 2, 4, 6, . . . form a part of the aggregate of integral numbers 1, 2, 3, . . ., but a (1, 1) correspondence can be established between them, viz. to $2n$ in the part corresponds n in the whole aggregate, and to n in the whole corresponds $2n$ in the part. Hence the part is equal to the whole. And, again, a (2, 1) correspondence can be established between the part and the whole, viz. to $4n$ in the part corresponds n in the whole, while the numbers of the form $4n+2$ have no correspondent. Thus the part is greater than the whole.

Mr. Frankland's comparison of the areas of a circle and a regular inscribed polygon is not quite fair to the polygon. The area of a regular N-gon, as its radius tends to infinity, tends to a finite limit, $\pi k^2(N-2)$, which, of course, tends to infinity as N is increased. The area of a circle is $4\pi k^2 \sinh^2 r/2k$, which also tends to infinity as r is increased. The first he calls a linear infinity, and the second an exponential infinity, and certainly e^x/x^n tends to infinity with x, if n is any finite number. But what is the relation between r and N? If we take the expression for the area of a regular N-gon inscribed in a circle of radius r, and then let N increase, we get a limit $4\pi k^2 \sinh^2 r/2k$, which is the expression for the area of the circle. Again, if in the regular N-gon with infinite radius we inscribe a circle, its area is $2\pi k^2(\operatorname{cosec} \frac{\pi}{N} - 1)$ and this always bears a finite ratio to the area of the N-gon; it is thus an infinity of the same order, if N is increased indefinitely, and the N-gon, the inscribed circle, and the circumscribed circle all tend to the same geometrical limit—the absolute.

The fact that the cuspidal edge of the surface of rotation of the tractrix forms a line of discontinuity in this representation, and that none of the types of surfaces of constant negative curvature exactly images the hyperbolic plane in the properties belonging to analysis situs, appears to be no objection to hyperbolic geometry. An exactly similar difficulty occurs in the representation of elliptic geometry, since there is no continuous surface of constant positive curvature on which two geodesics have but one point of intersection. Geometry has become entirely a matter of postulation; but, at the same time, it is of interest to observe that the non-Euclidean geometries are capable of being truly represented, even within a restricted field, in Euclidean space.

D. M. Y. SOMMERVILLE.

The University, St. Andrews, September 30.

Elements of Comet 1911*f*.

FROM M. Quénisset's observation of September 23, and my own of September 26 and 30, I obtain the following approximate elements:—

$$T = 1911 \text{ November } 12{\cdot}67$$
$$\omega = 123^\circ\ 13'4$$
$$\Omega = 35^\circ\ 36'6$$
$$i = 102^\circ\ 19'8$$
$$\log q = \bar{1}{\cdot}89116.$$

The comet is now receding from the earth and approaching the sun, and there is no reason to expect much increase in brilliancy. The only point of interest is that when at the descending node on December 16 it will be about half a million miles outside the earth's orbit. The difference of the heliocentric longitudes of the earth and comet will, however, be 132°, so that no near approach is possible.

J. B. DALE.

Craigness, New Malden, Surrey, October 3.

Rainfall in the Summer of 1911 and of 1912.

HAS Mr. MacDowall the courage to apply his own experience, to which he refers in NATURE of September 28, to "supply long-range forecasts of months, seasons, &c."? Will he publish in advance a forecast for the winter 1911–12 or for the spring and summer of 1912, such as he considers could have been done for the summer of 1911? Or is it only after the event that he can discover what points in the past have to be considered and in what grouping they have to be compared in order to yield an *a posteriori* "forecast"?

HUGH ROBERT MILL.

62 Camden Square, London, N.W., October 2.

Miniature Rainbows.

WHEN returning one day in August of last year from the Farne Islands to Berwick in a pleasure steamer, I was standing in the bow of the boat, and was much struck by the display of a permanent rainbow in the spray that was thrown up. The rainbow was inverted, the result, presumably, of my position above it. The sea was very rough, and thus the spray was constant.

EDWARD A. MARTIN.

285 Holmesdale Road, South Norwood, S.E.

THE STONE AGES OF SOUTH AFRICA.[1]

THE papers in this volume are a very full and important addition to the work already published by Mr. J. P. Johnson; but it is doubtful whether they bring us any nearer to a solution of one of the most interesting questions connected with archæological or palæontological discoveries in South or Central Africa —namely, the approximate age to which the existence of man can be traced back in South Africa, East Africa, the Congo basin, West Africa, and the Sudan. Though Dr. Péringuey would seem, from one or two phrases, to lean to the theory of a very ancient date for the human colonisation of tropical Africa, he has to admit repeatedly that so far no cogent evidence has been produced in the shape of geological features associated with the finds of human remains or implements to indicate, as positively as is the case in Europe and Asia, the period in the earth's history with which such remains are to be associated.

As our knowledge advances towards perfection, as we become better and better able to read that new Bible, the book of the Earth itself, we may have to revise our estimate of the ages of the hitherto discovered prehistoric, palæolithic, and eolithic human remains in Europe and Asia. Still, there can be little

[1] Annals of the South African Museum: vol. viii., part 1, containing the Stone Ages of South Africa, &c. By Dr. L. Péringuey, with further contributions by Mr. A. L. Du Toit and Dr. F. C. Shrubsall. (London: Printed for the Trustees of the South African Museum by West, Newman and Co.) Price 40*s*.

question within a few thousand years, more or less, of the relative ancientness of the calvarium, the molar teeth, and thigh-bones of *Pithecanthropus erectus* in Java; of the *Homo primigenius* type of lower jaw found near Heidelberg; and of the Grimaldi skeletons, &c. Of course, the mere finding of stone implements

(i) Strandlooper.

(ii) Bushman.

(iii) Hottentot.

Crania from South Africa.

in any part of Europe or temperate Asia argues some degree of antiquity in the specimens, because we know more or less historically the period at which they were abandoned for implements or weapons of metal. But in tropical Africa no such argument can apply, for a few small portions of the continent are still in the Palæolithic, or even Eolithic, Stone age. The south-western extremity of Africa was certainly in the palæolithic age 400 years ago, when Europeans first arrived there; though the Bantu tribes bordering on the Hottentot and Bushman domain had for many centuries before been mining, smelting, and using copper and iron.

So far as the reviewer is concerned, he continues to adhere obstinately to the belief, not as yet shaken by any registered fact, that man is a relatively recent immigrant into Southern Africa, and that Africa in general south of the Sahara Desert and of Somaliland has been much more newly populated by man (almost entirely of the negro subspecies) than has been the case with Asia—the original birthplace of the human species and genus—and with Europe.

Much interesting palæontological and geological evidence is collected and laid before the reader in chapter vii. (p. 74 and onwards). In this, Dr. Péringuey mentions that a portion of a molar tooth of a mastodon has been found in close proximity to a deposit of palæoliths and fragments of stone, evidently used as human implements, at Barkly West, in Cape Colony. Human implements have also been found in association with the lower jaw of an extinct horse of large size and of the gigantic long-horned buffalo—*Bos* or *Bubalus baini* (a close ally of the *Bos antiquus* of Algeria). But from the rock drawings in Algeria we know that this gigantic North African buffalo not only was contemporaneous with man, but even with neolithic man, and only seems to have become extinct a few thousand years ago. Similarly, in the extremity of South Africa a mastodon, a large horse, and the South African type of gigantic buffalo may have lingered down to quite a late period, since this same portion of the continent contains in a living state at the present day creatures which became extinct in Europe a hundred thousand years ago. (In this portion of his narrative Dr. Péringuey persists in confusing *Hyena brunnea* of South Africa with *Hyena striata* of East, West, and North Africa and Western Asia. I write under correction, but had always believed that *Hyena brunnea* was a very distinct species which hitherto had not been found north of the Zambezi and South Angola, and, though allied to the various types of *striata* far more than to *crocuta*, was nevertheless a very distinct species.)

Some of Dr. Péringuey's deductions are very interesting, especially as combined with the observations of Dr. Shrubsall. One of these would seem to be that the earliest human invaders of South Africa were of somewhat higher culture, of different head-form, and better brain development than the modern Bushman. These people are the now celebrated Strandloopers. At one time it was assumed, on the strength of some very prognathous skulls found in the coast regions of South Africa, that the Strandlooper was more "simian" (if that word may be applied to a very slight approximation towards the basal human type) than the Bushman. This deduction would seem to be wrong. The sub-nasal prognathism in the skulls of the earliest cave-men of Strandlooper types is less than in the Kalahari Bushmen and the Nama Hottentots of to-day, or in the general mass of negroes. One of the Strandlooper skulls, according to Dr. Shrubsall, has a more prominent nose and face than the typical negro, and in some respects recalls the river-bed type of early Europeans. The cranial capacity of these primitive Strandloopers was distinctly greater than either Bushmen or Hottentots, and this feature is present in the oldest skulls. One of these has a cranial capacity of 1600 c.c., while in a female skull of the Bush race from the Kalahari Desert there is a capacity of only 950 c.c.

Moreover, it would seem to be as though there had been a marked degeneration not only in the physical conformation of the pre-Bantu inhabitants of South Africa from the earliest Strandlooper type downwards, but also in the character and size of the stone implements manufactured by these primitive South African peoples.

Dr. Péringuey in some of his remarks (p. 168) would seem to regard the Bushman as not being a primitive race, but an example of retrogression in some directions and a singular advance in others. He puts forward the interesting hypothesis that the ancestors of the Bushman having discovered the potency of vegetable and animal poisons, gave all their attention to the manufacture and shooting of poisoned arrows, and therefore no longer cared to fabricate large stone weapons.

Dr. Péringuey writes as a South African, and South Africans are apt to hold heretical notions regarding the Bantu. One is that there is a Bantu physical type of negro, which is not the case; and the other is that the Bantu languages in their present form are of immense antiquity, and came to Africa from India. The Bantu-speaking peoples of South Africa vary in physical type, just as they do in the rest of Bantu Africa, and do not present any collective difference from millions of other negroes not speaking a Bantu language. As to this language family, I have given at different times reasons which appear to me conclusive for supposing that it cannot have originated in North Central Africa more than some 3,000 years ago. It was brought into existence in the heart of Africa, just like its neighbour Hausa, by the intrusion of some half-white race similar to the Hamite or the Fula.

This book gives interesting illustrations of the steatopygia and peculiarities of the external genitalia of the Bushman race. H. H. JOHNSTON.

CALIFORNIAN TREES.[1]

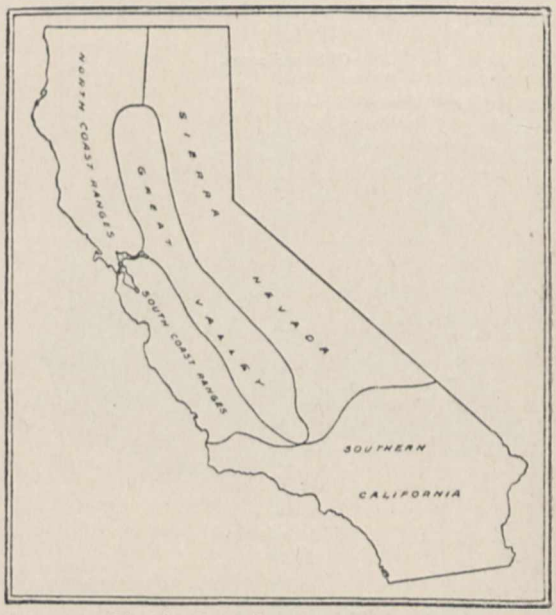
PERHAPS the noblest and most fascinating of all subjects for the writer and student of trees is the sylva of California. The arboreal vegetation of no other area of similar dimensions rivals it in interest or in the size of its individual types. Three trees alone —the two Sequoias ("Big Tree" and "Redwood") and the Douglas Fir—give to it a unique distinction, and they are supplemented by a group of scarcely less wonderful pines, firs, and spruces. Whilst it is the immense coniferous trees that give to the Californian sylva its remarkable fascination, many of the "broad-leaved," or non-coniferous, species are scarcely inferior in interest and distinction. There are, for instance, the magnificent Madroña—*Arbutus Menziesii* —a close ally of the Killarney arbutus, but reaching 125 feet in height, with a trunk 5 feet in diameter; the golden chestnut (*Castanopsis chrysophylla*), its leaves a tawny gold beneath, also over 100 feet high; the Mountain dogwood (*Cornus Nuttallii*), an ally of our Cornelian cherry, but often 50 to 60, sometimes 100, feet high, with its beautiful white involucres 6 inches across. Mr. Jepson, therefore, may well be congratulated on his subject.

To us in the British Isles it possesses an exceptional interest, because most of the Californian trees can be cultivated in the open air in many parts of our country. Nowhere else, indeed, out of California itself, can its coniferous trees be seen to such perfection as in the Perthshire valleys and in various places in the south and west of England and Ireland.

[1] Memoirs of the University of California. Vol. ii., "The Silva of California." By W. L. Jepson. Pp. 480+85 plates+3 maps. (London: T. Fisher Unwin; Berkeley: University Press, 1910.) Price 2*l.* 2*s.* net.

The history of the Californian sylva as known to Europeans strikes one as curiously recent. Botanical knowledge began with the visits of the Malaspina and the Vancouver expeditions. The latter, a voyage of survey organised by the British Government, touched California about 1793. Most of the botanical work accomplished on this journey was done by Archibald Menzies, but he only penetrated a few miles from the coast. David Douglas visited and explored California in the interests of the Horticultural Society of London about 1827, and with him may be said to have commenced the real revelation of its sylva. It was carried on by Nuttall, Fremont, Kellogg, Brewer, Bolander, and others. But even the existence of the "big trees" (*Sequoia gigantea*) was not definitely and authoritatively made known till nearly the middle of the nineteenth century, although hunters and wandering pioneers had previously brought home accounts of marvellous trees—mostly received, however, with the scepticism the stories of such folk obtain.

Among the later investigators of the Californian sylva a foremost place is held by the author of this



The Five Forest Provinces of California.

volume. Only two years ago he published an admirable little book, "The Trees of California," of which the present elaborate work is an amplification. The new volume opens with an interesting essay on the remarkable topography of California, its climate, rainfall, and tree distribution. The two great mountain systems (the Coast Ranges and the Sierra Nevada) enclose a great oval plain known as the "Great Valley," drained by the San Joaquin and Sacramento rivers, which meet about midway, and empty into the Pacific. This region, 400 miles long and averaging about 50 miles in width, is sparsely wooded and weak in number of species. One peculiar characteristic of its scenery is the park-like grouping and disposition of a few species of oak, chiefly the Valley oak (*Quercus lobata*) and the Live oak (*Q. Wislizenii*). They never form forests as the coniferous trees of the foot hills and mountain slopes do, and scarcely anywhere on this central plain does an aggregation of individuals amount to more than what may be termed a grove.

Besides the great valley of the Sacramento and San Joaquin, the author discusses his subject from the point of view of four other great geographical areas:

(1) the Sierra Nevada, the chief sylvan interest of which belongs to the long western slope, where occur the Big Tree groves, the eastern slope being remarkably abrupt; (2) the North Coast Ranges, a region rich in individuals and species, including the Redwood and many others which extend northwards into Oregon and Washington; (3) the South Coast Ranges, which form an interesting area richest forestally on the seaward slopes, where, among others, flourish the Redwood, Douglas Fir, and *Pinus ponderosa*. This region includes the remarkable peninsula of Monterey, where the well-known Monterey cypress of our gardens (*Cupressus macrocarpa*) is endemic; (4) Southern California, where the rainfall is deficient and the arboreal growth confined to mountain valleys and cañons, and where, in many places, the vegetation is of a purely desert character.

Spread over these five forest provinces are the ninety-four species of trees which come under the author's purview. The whole essay, which is one of remarkable interest, is the result, as Mr. Jepson tells us, of nineteen years' travel and study in the field. The only criticism we would make is that the exclusive use of vernacular names renders it impossible to follow the author without a continual and rather irritating reference to the body of the work in order to ascertain what species it is to which he is alluding. Such names as "Interior Live oak," "Santa Lucia fir," convey no meaning to the majority of readers, and their general adoption (which the author is anxious to bring about), as well as the reader's convenience, would have been furthered by a citation of the botanical name as well.

The treatment of the individual species is admirable. A very full synonymy is given, and a copious list of references. After an adequate and not very technical description of the tree, the author discusses its geographical distribution, its history, economic value, and any other matter of interest concerning it. To the Redwood and Big Tree, ten and eight pages respectively are devoted, and the distribution of the latter is shown by two large maps. The book is illustrated by eighty-five full-page plates, many of them reproductions of photographs showing the trees in their native habitats, and, incidentally, characteristic bits of Californian scenery.

Mr. Jepson has the orthodox conception of a species, which is decidedly refreshing after the orgy of species-making his compatriots of recent times have indulged in. As presenting an original and authoritative account of a group of trees of particular interest to arboriculturists in the British Isles, his book may be strongly recommended. W. J. BEAN.

IMPERIAL SURVEYING.[1]

IN response to an invitation sent by the Colonial Office in March, 1909, to the Dominion, Commonwealth, State, and Provincial Governments in the Empire, delegates for the Commonwealth of Australia and the Dominion of Canada met in London in June last to discuss the proposal for establishing some system of reciprocal admission for surveyors between the different portions of the Empire. The question had been raised originally as a resolution submitted by the Government of New Zealand to the Colonial Conference of 1907, at which a memorandum drawn up by the council of the Surveyors' Institution was discussed, and a resolution was adopted affirming the desirability of reciprocity with regard to the examination and authorisation of land surveyors. The outcome of this was that particulars of examinations and other requirements with regard to the authorisation of surveyors were obtained from several Dominions, and were coordinated and compared in a second memorandum by the council of the Surveyors' Institution, in which the desirability of a conference between those concerned was pointed out.

This conference recommends as a first essential the formation of a central board, which would use its influence to keep up a uniform standard of examination, and on which the different Governments of the Empire would be represented. All examination papers set in any part of the Empire under any scheme of reciprocity would be sent to the board, which would direct attention to any questions falling below the standard agreed upon, and would consider any proposals for improving the working arrangements for reciprocity. Further, a syllabus was drawn up for a preliminary examination in English, arithmetic, algebra, plane and solid geometry, plane trigonometry, and mensuration; and for another of more advanced type to be passed after two years' field service, and including practical and theoretical surveying up to secondary triangulation.

Though this may appear a slight basis on which to construct a scheme of imperial reciprocity in this direction, the complexity of the whole subject must be remembered. In the United Kingdom the Ordnance Survey has provided an accurate topographical survey of every portion, though a true cadastral survey indicating all property boundaries does not yet exist, and, according to the recent report of the Royal Commission on the Land Transfer Acts, is not recommended, since therein verbal description of boundaries is preferred, maps being used in all cases, but only for assisting identity. Consequently there is no profession of highly trained surveyors having an intimate knowledge and full experience of the most precise methods of land and earth measurement, nor is geodesy studied at the higher educational institutions as is the case on the Continent. A moderate knowledge of land measurement enables the necessary interpolations and additions to be made to an ordnance map, and a land surveyor's duties are very largely concerned with valuation. The Surveyors' Institution has arranged a special advanced examination in land surveying, but being of no great value at home, and not recognised in a colony, use is not made of it.

In the various colonies the conditions are wholly different, for large areas remain unsurveyed, the demand for the location of property boundaries is urgent, and in many cases the surveyor has no official control points to connect with, but must make his own survey self-contained. It is therefore necessary for the Governments of these colonies to insist upon a high standard of technical efficiency in land measurement, including an acquaintance with geodetic work in all its branches. With such very different conditions existing any arrangement for the free interchange of surveyors must be difficult, and the proposals now put forward may be a first step as providing a guarantee of a certain standard of efficiency which may in some Dominions, Provinces, or States require to be supplemented to qualify for their special certificates.

In the United Kingdom at the present time there is no place where higher surveying and geodesy are regularly taught to those who are already acquainted with the ordinary and more approximate methods, and an improvement in this respect would do much to enable a surveyor in this country, wishing to practise in the colonies, to acquire the additional technical equipment which is required by some of their regulations. But besides the self-governing colonies there are vast tracts administered by the Crown colonies, and in these administration and development are de-

[1] Report of a Conference on the Question of Reciprocity throughout the Empire in the Examination and Authorisation of Surveyors. [Cd. 5776.] (London: Stationery Office, 1911.) Price 2½*d*.

manding both topographical and cadastral surveys as rapidly as they can be prepared. If these are to be both efficient and economical, and if as little as possible of the work done in early stages is to need complete revision at a later date, then those engaged in directing them should have a thorough knowledge of the methods, principles, and requirements of surveying of the highest grade, and not merely a certain proficiency in the simpler classes of topography that is now demanded; but for the acquirement of such knowledge there are not as yet in this country facilities such as exist on the Continent, where numerous chairs of geodesy and precise surveying are to be found.

H. G. L.

FRANCE AND CLASSICAL EDUCATION.

AT the Dijon meeting of the French Association for the Advancement of Science last August the president, M. Ch. Lallemand, delivered an informing and luminous address on the question of modern *versus* classical education. The address should be particularly instructive to English educationists, for the home of the traditional curriculum of our public schools is France, the direct heir of Roman literary culture.

Recently there has been something of a crusade against "modernism" in education, the chief argument being that the French language and French culture are being endangered by the abandonment of what the French call "Latin education," which, like our classical education, is chiefly based on Latin and Greek. But, as will be seen, there is no abandonment, and the crusade is probably no more significant than its predecessor of forty years ago, or the longer-continued counter-crusade against "Latin education." We shall refer to it more fully below.

Science and modern languages were introduced as parallel lines of education, but not as superseding the classical system, under the Second Empire. The growing needs of industry and commerce and the enormous development of science forced this on the nation. This "bifurcation" was continuously successful, though it was at once attacked. A counter-attack on the classical course followed, increasing in vigour towards the end of the century. M. Jules Lemaître put the weight of his great authority into the scale against classics. A similar attack was meanwhile being made in Germany, the Emperor William pronouncing strongly against classical education. From 1882 to 1900 the proportion of German students not learning Latin increased from 9 per cent. to 43. Then in 1902, as the result of a parliamentary commission, came further concessions to the claims of modernism. The resulting system, known as the "quadrifurcation," comprises, besides the general classical course, Latin and modern languages, Latin and science, and the specially "modern" course of modern languages and science.

The system is attacked both by literary and, significantly, by commercial authorities. M. Marcel Prévost says: "The new crop of graduates does not know more algebra, or physics, or modern languages than the old, and of their own language they know less." The chambers of commerce and great financial administrations have complained of the decay of correct writing and spelling, and demand the restoration of Greek and Latin as being indispensable for proficiency in commercial composition. Societies have recently been formed for the protection of French culture and the French tongue.

M. Lallemand disproves the notion that there is *une crise du français*. Recently in China the mandarins complained that young students were neglecting the study of the "characters" under the baneful influence of occidental ideas. When the classical system in France was "uncontaminated" by modernism, the complaint was made that the engineers of the public departments could not write or spell, and a special course was instituted to make this defect good.

Further, statistics show conclusively that if this ignorance of the principles of composition and orthography exists, it is not due to the abandonment of Latin and Greek. As a matter of fact, the number of students taking Latin has steadily increased since 1902. In 1910, of 1875 first-year students in Paris, only 362 had not learnt Latin. Of 646 students leaving L'Ecole Polytechnique between 1906 and 1910, there are 203 "moderns" as against 443 "Latins." Finally, as to the writing question, the Polytechnique examinations in French composition during the last ten years show a considerable superiority on the part of the "moderns"!

As to the alleged decadence of correct writing and calligraphy, M. Lallemand suggests that the increasing congestion of curricula, necessary in view of increasing knowledge, may be a factor. Perhaps in France, as in England, no serious attempt has ever been made to teach the native language. The present writer holds that this defect, together with the retention of Latin and Greek, constitutes the crying evil of present-day education.

M. Lallemand has some good remarks and quotations on the alleged educative virtue of dead languages and on the inconsistent arguments of those who advance it. They might form the basis of a logical inquiry, which is much needed, into the "educative" processes. He also has some penetrating observations on caste-feeling, which has a good deal to do with the recent crusade. The smallest shopkeeper is in favour of Latin, because his son can learn it as well as the son of the noble. If science were the corner-stone of education, the smallest shopkeeper would, on the same principle, vote for science.

A. E. CRAWLEY.

SIR HERBERT RISLEY, K.C.I.E.

BY the untimely death of Sir Herbert Hope Risley on September 30, at the age of sixty, science has lost an eminent anthropologist and India an official of no ordinary ability. Born in 1851, educated at Winchester and New College, Oxford, he joined the Indian Civil Service in 1873, and was posted to Bengal. He was soon transferred to the secretariat, a class of work for which his qualifications were better suited than that of an executive officer. But already he had acquired a taste for ethnological research during a short period of service in Chota Nagpur, where, on the basis of Colonel E. T. Dalton's "Descriptive Ethnology of Bengal," he compiled an account of the interesting hill races, which appeared in vol. xvi. of Sir W. Hunter's "Statistical Survey" of the province, issued in 1875–7. This, with the period spent on special duty as ethnographical superintendent in Bengal, was the only opportunity he enjoyed of obtaining that intimate familiarity with the rural classes which can be gained only by life-long service in their midst.

The results of his researches in Bengal were embodied in his work on the tribes and castes of that province which appeared in 1891. Aided by a band of skilled co-workers, and utilising the materials privately published by Dr. J. Wise in 1883 under the title of "Notes on the Races, Castes, and Trades of

Eastern Bengal," he produced a work of considerable interest and authority, which at once attracted the attention of European scholars. He admitted that this work was only provisional and that it was merely "circulated for criticism"; but he had no opportunity for the preparation of a revised edition. Under the guidance of the late Sir W. Flower he mastered the principles of craniometry, and his receptive mind familiarised him with the general problems of ethnography and their bearing on the special conditions of the Indian races. Appointed director of the Ethnographical Survey in 1901, he suggested a scheme for research which, for reasons of finance, was rejected. On a limited scale it was sanctioned by the Government of Lord Curzon, and is now in progress in certain provinces.

Risley's reputation as an anthropologist must depend upon his account of the Bengal tribes and castes, and the chapters on caste and race contributed to the report on the census of India of 1901, conducted under his supervision. The latter was a remarkable *tour de force*, considering that it was written amidst the pressure of other arduous duties. In this class of work his lucid style and grasp of principles enabled him to present in an attractive form the results of the researches into Indian anthropology and sociology made by his assistants and himself. Had he lived longer he would probably have revised some of the theories advanced in his census report, which, with some modifications, was re-issued under the title of "The People of India." In particular he must have realised that craniometry alone is a slippery foundation for an analysis of the complex of Indian races; that he was mistaken in denying the influence of the Scythian and Hun invasions, particularly in relation to the origin of some of the Rajput tribes; and that his scheme of classification to some extent ignored the influence of environment, and the confusion of groups resulting from long ages of internal war and social disorganisation. But in his skilful account of the caste system and its working his powers of systematisation, aided by considerable literary ability, are fully displayed.

It may be feared that he was unable to complete a work on the people of eastern Bengal, which was announced for publication soon after his retirement from India. But he has left enough to show that, with more opportunity for personal study of the people and more leisure for examination of the material which he had collected, he might have attained a scientific reputation even higher than that to which he attained. Besides his published work, the initiation of the Ethnographical Survey of India is the best memorial of his services to the cause of science.

NOTES.

A MEETING of the International Commission on Mathematical Teaching was held at Milan on September 18–21, Prof. F. Klein presiding. The main subjects discussed were :—(1) The question of rigour in teaching mathematics, especially geometry. It appears that of European countries Italy is the most wedded to rigorous methods, while Germany and Austria stand at the other end of the scale, and admit intuitive methods freely. France and England adopt a middle course, France inclining toward the Italian practice and England toward the German. It was agreed that Euclid does not satisfy modern standards of mathematical rigour. (2) The question of "fusion," *e.g.* of geometry with algebra, of plane with solid geometry, of geometry with trigonometry, of solid geometry with descriptive geometry, of analytical with geometrical conics, of differential with integral calculus. (3) The provision of mathematical instruction for students of such subjects as chemistry, biology, and economics. Such courses were at one time provided in French universities, but are now entrusted to the schools. In other countries there does not appear to be any systematic provision of this kind. The reports issued by the various national subcommissions were presented; of these, the French reports are now complete; eight of the thirty-four English reports have been issued by the Board of Education (Wyman and Co.), and a large amount of literature has been issued by the German subcommittee, whose labours, however, will not be completed for two years more. Arrangements were made for the educational subsection at the International Mathematical Congress to be held at Cambridge (England) on August 22–28, 1913. A full report of the Milan meeting will be published in due course in *L'Enseignement Mathématique*.

THE summary of the weather for the first nine months of the present year, which has just been issued by the Meteorological Office, shows that the temperature for the period was in excess of the average over the entire area of the British Islands, the excess being greatest over England. The rainfall was everywhere deficient, the deficiency amounting to 7·20 inches in the north of Ireland, to 6·71 inches in the Midland counties, and to 6·20 inches in the south-west of England. In the south-east of England, which district embraces London, the deficiency of rain for the nine months amounts to 5·57 inches. Over the north of England the deficiency is little more than 2 inches, and in the north of Scotland it is only 0·05 inch. The largest aggregate rainfall for the nine months is 35·58 inches, in the north of Scotland, the least 11·94 inches, in the Midland counties. Rain fell on 163 days in the north of Scotland, but only on 97 days in the south-east of England. There was an excess of sunshine in the nine months over the entire kingdom, the greatest excess being 334 hours, in the south-east of England. The greatest aggregate duration of sunshine for the nine months is 1799 hours, in the Channel Islands, but it was very little less in the south-east of England, where the aggregate duration was 1720 hours. In the north of Scotland it was only 1116 hours. The summary for September shows that it was only in the English districts that the temperature was in excess of the average. The rainfall for the month was deficient over the entire kingdom, except in the north-east and north-west of England and in the south of Ireland. The sunshine was again in excess of the average over the entire country. At Greenwich the mean temperature for the month was 61°, which is 3° in excess of the average; the temperatures in the early part of the month beat all previous records, both for the absolute readings and for the mean of the period. The total rainfall for the month was 1·34 inches, which is 0·85 inch less than the average, and rain only fell on eight days. The sun was shining for 222 hours, which is nearly 70 hours more than the normal.

SIR THOMAS CROSBY, who has been elected Lord Mayor of London for the ensuing year, is the first medical man to occupy that office (though his term will be the 723rd Mayoralty of the City), and is probably the oldest citizen upon whom the honour has been conferred, his age being eighty-one. He took the degree of M.D. at St. Andrews University in 1862, after being in practice for ten years, and filled the office of president of the Hunterian Society in 1871. He is a member of the Senate of the University of London.

NEW regulations for the sale of mineral acids have now come into force. They have been made by the Privy

Council with the object of preventing the misuse of sulphuric, nitric, and hydrochloric acids. These acids, and also salt of lemon, must now only be sold by retail in bottles, distinguishable by touch from ordinary bottles, and bearing on a label the name and address of the seller, together with the words "Poisonous" and "Not to be taken." Ammonia will also be subject to the same regulations in four months' time.

THE popular science lectures which are given at the Royal Victoria Hall, Waterloo Road, S.E., every Tuesday evening from October to May, will commence on Tuesday, October 10, when Prof. W. Flinders Petrie, F.R.S., will lecture on "Life in Egypt 2000 Years Ago." Other lectures during this month are:—October 17, "The Modern Gun and Armour Plate," J. S. S. Brame; October 24, "Seeing Canada," Miss A. D. Cameron; and October 31, "Mountaineering," Mr. H. V. Reade.

WE notice with regret the announcement of the death, on September 26, of Mr. G. C. Donington, senior chemistry master at the City of London School. Mr. Donington was for a time demonstrator in chemistry at the Central Technical College, South Kensington, and was afterwards successively science master at Highgate School, Christ's Hospital, and Leeds Grammar School before his appointment to the City of London School. He was the author of a laboratory manual entitled "Practical Exercises in Chemistry," issued in 1906, and of a helpful "Class-book of Chemistry," published a few months ago. His death at the early age of thirty-seven will be deeply regretted by many friends and pupils.

AN investigation of the disease known as "sprue" is to be undertaken by the London School of Tropical Medicine. It is hoped that funds to the amount of 1000*l.* will be available for this purpose, of which the Government of Ceylon has provided 750*l.*, and the remainder will probably be subscribed by the Ceylon Tea Planters' Association. It has not yet been decided what representative of the school will undertake the investigation. The disease occurs in Ceylon, Malaya, Indo-China, China, and other districts, and is of considerable importance, causing a large amount of sickness and disability, and in some instances a fatal issue. At present little is known of the causation of the malady.

IT is proposed to erect a memorial to Mungo Park and Richard Lander. A committee has been formed consisting of Lord Curzon, Sir George T. Goldie, Lord Scarbrough, Major Leonard Darwin, Sir Walter Egerton, and Sir Hesketh Ball to take the necessary steps to secure funds for this purpose. Both explorers have been honoured in their native towns of Selkirk and Truro, but no record of any kind exists in the land to which their lives were consecrated and sacrificed. In appealing for support, the committee remarks:—"As the main object of their travels was to discover where the Niger joined the ocean, the most suitable site would seem to be its principal ocean port. It is therefore proposed to erect an obelisk of similar design and dimensions to Cleopatra's Needle on a projecting point of land at Forcados, where it would both attract general attention and serve as a landmark to vessels approaching the port. The total cost is estimated at 2000*l.*, exclusive of the foundations, which it is understood will be undertaken by the Government of Southern Nigeria." Donations may be sent to the honorary treasurer of the fund, Dr. J. Scott Keltie, 1 Savile Row, London.

THE new session of the Royal Geographical Society will be opened on November 6, when Dr. Nansen will read a paper on the Norsemen in America. On November 20 Dr. Tempest Anderson will give a paper on volcanic craters and explosions. On December 4 Sir Alfred Sharpe, until recently Governor of Nyasaland, will deal with the geography and economic development of British Central Africa. On December 18 Dr. T. McDougal, of the Carnegie Institution of Washington, will contribute a paper on American deserts. In the new year Sir William Willcocks will deal with his further researches on the Garden of Eden and its restoration. Dr. Mackintosh Bell, late director of the Geological Survey of New Zealand, will describe an unknown corner of South Island. Mr. Douglas Carruthers will describe, probably in March, his travels in Central Asia. Mr. A. J. Sargent will deal with the commercial geography of the Tyne Basin, and Mr. P. A. Talbot with the journeys in the Central Sudan. In January or February a course of three lectures will be given in the afternoon on the desert of North Africa, by Captain H. G. Lyons, F.R.S. The Christmas lectures this session will be:—on January 5, by Mr. Julian Grande, on "Amongst the Alps"; on January 8, by Mr. W. Herbert Garrison, on "Our World-wide Empire"; and on January 11, "A Lady's Journeys in the Central Sudan," by Miss Olive MacLeod.

A COPY of the first monthly number of the eighth volume of *The South African Journal of Science*, being the issue for August last, has been received. The periodical is the organ of the South African Association for the Advancement of Science, and the present issue is concerned with the Bulawayo meeting of the association held in July last. The presidential address of Prof. P. D. Hahn is printed, and in it he dealt, we find, with the advance in the teaching of science during the last forty years. "There was," he said, "no professorship or lectureship for any branch of science in existence in any of the schools or colleges of South Africa forty years ago, whilst at the present time we have over sixty professors and lecturers appointed to teach certain branches of science in our colleges and technical and agricultural schools." In Section A of the association, concerned with astronomy, mathematics, physics, meteorology, geodesy, surveying, engineering, architecture, and geography, the Rev. E. Goetz was president, and took "weather forecasting" for the subject of his address, which is printed in part in this issue. The South Africa Medal and Fund, which was raised by members of the British Association in commemoration of their visit to South Africa in 1905, were presented to Dr. L. Péringuey, director of the South African Museum, in recognition of his entomological research in South Africa. The fund amounted to 50*l.* The 1912 meeting of the association is to be held at Port Elizabeth.

MR. A. HAMILTON, director of the Dominions Museum at Wellington, New Zealand, has issued a useful hand-list of pamphlets and papers containing information relating more or less directly to the Maori race, supplementing the earlier catalogue published by him in vol. xxxiii. of the Transactions of the New Zealand Institute for 1900. He has excluded from his collection anything which might be called a "book," as these are to be found in various library catalogues and bibliographies. The present list is therefore confined to detached articles, many found only in obscure sources, which supply information on this interesting people. The publication is thus of much value to students of sociology, ethnography, folk-lore, and comparative religion and mythology.

IN his paper issued by the University of London Press on the pronunciation and orthography of the Chindau dialect, one of the Bantu group, spoken in that part of south-east Africa lying to the west of Sofala, Mr. D. Jones, lecturer

in phonetics at University College, has provided a useful addition to our knowledge of African linguistics and phonology. He pleads for the general adoption of the national phonetic alphabet, because, in the first place, it is scientifically constructed on the "one sound one symbol" principle; secondly, because it is not the pet system of any single individual, but was prepared by representatives of a number of European languages; and, thirdly, because it is in more general use than any other existing system and is international. Missionaries engaged in the study of the languages of savage or barbaric tribes, and natives desirous of acquiring the correct pronunciation of English, French, or German, would be well advised to adopt it.

THE second part of vol. xi. of the Annals of the South African Museum is devoted to a continuation of Messrs. Gilchrist and Wardlaw Thompson's descriptions of Natal marine fishes. Five species, including a mullet, are described as new.

As the result of a study of the luminous organs of certain fishes, Mr. H. Ohshima, writing in the Journal of the Tokyo College of Science (vol. xxviii., art. 15, finds that whereas in sharks these structures lack definite numerical arrangement, and are merely diffuse, minute epidermal swellings partially sunk in the cutis, in the Sternoptychidæ they are arranged in a definite order and limited in number, with a complicated structure. Still greater specialisation attends these organs in the Myctophidæ, in which there may be a sexual difference in arrangement. The luminosity in sharks is faint and diffuse.

IN a continuation of his notes on zoological gardens, museums, &c., in the September *Zoologist*, Captain Stanley Flower expresses his admiration of the large size of the paddocks accorded to ungulates in the municipal menagerie at Lyons, which is further notable on account of the large amount of water running through the grounds. This establishment is open free to the public. Admiration is likewise expressed for the site of the new zoological gardens at Munich, which occupy a picturesque position on the Isar, are well timbered and watered, and contain scarped cliffs, bushy coverts, wooded ponds, and open meadows admirably suited for animals of many kinds. At the Naples Aquarium Captain Flower was interested in some living file-fishes (Balistes), which, although healthy at the time of his visit, were not likely to live long, as in confinement these fishes generally die at the approach of winter. They feed on molluscs and crustaceans, the shells of which are cracked so smartly by the powerful teeth that the sound is audible through the glass of the tank.

Biologisches Centralblatt for September 15 (vol. xxxi., No. 18) contains a preliminary account of investigations undertaken by Mr. S. Kowalewsky in regard to sex-determination in animals, the second title of the paper being the capricious determination of the sex in the germ of mammals and birds. Previous theories on the subject are reviewed, notably the opinion that poor nutrition in the female parent is conducive to the production of male offspring, and *vice versa*. Considerable importance appears to attach to this from the circumstance that, according to the author, female fœtuses are found in that portion of the ovary of guinea-pigs and rabbits which receives the greatest supply of blood, males being developed in the less richly nourished area, while where the blood-supply is still poorer the germs are infertile. It is also shown that subcutaneous injection of alcohol leads to a great preponderance of males in guinea-pigs, as does also a poverty of acid. The latter phenomenon seems connected with the fact that in races (such as Tatars and Australians) in which the females arrive early at puberty there is a marked preponderance of males over females.

WE have received two parts (Nos. 27 and 29) of Dr. F. E. Schulze's *Das Tierreich*, now in course of publication by Messrs. Friedländer. In the former Dr. F. Werner deals with the chamæleons (Chamæleontidæ), while in the latter Mr. R. von Ritter-Záhony treats of that remarkable pelagic organism known as Sagitta, and its relatives, which collectively form the group Chætognathi. The chamæleons comprise a much larger number of species than are recognised in the third volume of Mr. Boulenger's British Museum Catalogue of Lizards (1887). In the latter work forty-four species of the typical genus Chamæleon are catalogued, whereas the number is now raised to seventy-four. In 1887 the Malagasy genus Brookia was represented by three species; it now includes seven. A still greater increase occurs in the tropical African Rhampholeon, of which Mr. Boulenger recognised but two species in 1887, whereas the present author enumerates seven. The Chætognathi are classified under six generic headings, one of the genera having been named by the author during the present year; twenty species are included in the type genus, while the other genera contain from one to three. Excellent figures of the structure of these organisms are given, and the diagnosis of the group is clear and succinct, but nothing is said with regard to certain views which have been recently expressed as to the taxonomic position of the Chætognathi.

AN interesting paper on plant-inhabiting mites of a useful nature, contributed by Prof. G. F. Scott-Elliot, appears in the Transactions and Proceedings of the Botanical Society of Edinburgh (vol. xxiv., part iii.). The red spider and other inimical mites are well known, but the beneficial mites, although exceedingly common, have received less attention. Their homes, in the shape of small hollows behind hairs on the undersides of leaves on trees, are termed acarodomatia; they are not confined to dicotyledonous trees and shrubs, as was supposed, but are common on tall herbaceous plants, and the author has found them on the leaves of Solomon's Seal. With respect to their sphere of usefulness, it is asserted that they feed on scale insects, fungus spores, and other pests. The author suggests that with bacteria they help to prepare organic dust particles for the benefit of plants.

THE Quarterly Journal of the Geological Society of London for August is concerned with British zones and fossils. E. S. Cobbold and C. A. Matley respectively describe trilobites and brachiopods from the Lower Cambrian beds of Comley. D. Woolacott directs attention to the brecciation of the Permian rocks of Durham, which may be due to thrusts of Miocene age. H. Bolton brings his intimate knowledge of our Coal-measures to bear on the stratigraphy of the Bristol Coalfield. He finds that the fossils of the marine bands are of no service in marking zones. S. H. Reynolds and A. Vaughan have investigated the Avonian series of Burrington Combe in Somerset in the light of modern research, and now publish work that has extended over several years. The paper concludes with some interesting evolutionary generalisations (p. 389). The Carboniferous system receives further study from F. G. Collins, E. N. Arber, and G. C. Crick in a paper on the Culm of the Exeter district. The Lower Culm-measures are regarded as equivalent to the Midland Pendleside series. The name Culm thus becomes misleading, especially from a Continental point of view (see p. 399).

Finally, A. Wade describes Silurian rocks from near Welshpool, including some of igneous origin.

A MAP by the Edinburgh Geographical Institute, showing the density of population in Scotland as given by the census of 1911, appears in *The Scottish Geographical Magazine* for September. The method of Bosse is employed in calculating the density values, in which all uninhabited country and all urban districts and towns of 10,000 inhabitants and upwards are left out of account. Comparing it with the map setting forth the results of the 1901 census, the areas of densest population show a marked increase in spite of the reduced rate of increase of the population as a whole. The south shore of Moray Firth and the neighbourhood of Wick are also areas where population density has increased. These last two areas are connected with the fishing industry, which has improved of late, while the mining and manufacturing industries of the lowland region has drawn people to it.

THE valuable rainfall reports for the German protectorates of (1) Togoland (West Africa) for 1910, and (2) South-West Africa, for two years ended June, 1910, published by Baron v. Danckelman in *Mitteilungen aus den Deutschen Schutzgebieten* (vol. xxiv., part ii., 1911), show that in the first case the amount of rainfall was very favourable; in the coastal and central districts it was a record year, and at most of the stations the wettest since the commencement of regular observations in 1901. In the second case the rainfall for the fiscal year ended June, 1909, everywhere exceeded the average of the last ten years. The excessive amount caused an undue development of injurious insects, malaria, and sickness among cattle. In 1909–10 the amount was generally satisfactory, but not nearly so abundant as in the previous year. Rain is mostly accompanied by thunderstorms; in places thunderstorms frequently occur without rain.

A DETAILED summary of the meteorological observations made at the municipal observatory of the city of Bremen has just been published under the title "Beiträge zur Klimabeurteilung Bremens." The work is in two parts. In the first section the diurnal variations of the various meteorological elements are set out, both for the seasons and for the whole year, but the harmonic coefficients have not been determined. The second section concerns itself with monthly means and extremes, and for purposes of comparison corresponding values are given for Berlin and Frankfurt. The moderating influence of the ocean on the climate of the seaport is very strikingly brought out by this juxtaposition of figures, and the full meteorological statistics which are given for all three towns form a very useful book of reference. The work has been compiled by Prof. W. Grosse, the director of the observatory.

WE have received copies of the valuable meteorological charts of the great oceans issued by the U.S. Weather Bureau for October. The reverse sides of those for the North Atlantic and North Pacific Oceans contain interesting papers by Prof. W. J. Humphreys (1) on the origin of the permanent ocean "highs," and (2) the Aleutian and Icelandic "lows," illustrated by maps. There is a close connection between the positions and intensities of these areas and the weather of adjacent continents; they are the maxima and minima, with closed isobars, in the belts of high and low pressure, or so-called centres of atmospheric action. The subject of the importance of observations in these belts was brought before the International Meteorological Committee at the St. Petersburg meeting in 1899, and at the conference at Innsbruck, in 1905, a resolution of the Solar Commission advocating the establishment of permanent stations in the regions in question was unanimously adopted. Few attempts have been made to explain the origin of the maxima and minima; the author refers to the hypotheses put forward by Ferrel and Angot, and has supplemented them by one of his own. He concludes, *inter alia*, that a maximum ocean "high" must be at that place where the mechanical and thermal causes combine to produce the greatest result, *i.e.* a little to the west of the intersection of the coldest portion of an ocean current with a high-pressure belt.

FROM the observations of Eve at Montreal, Ashman at Chicago, and Satterly at Cambridge, it has been concluded that in each cubic metre of air near the ground there is an amount of radium emanation which would be in equilibrium with 80×10^{-12} grams of radium. This conclusion has been confirmed by observations made at Tokyo by Messrs. Kinoshita, Nishikawa, and Ono, which are described in the June number of the Proceedings of the Tokyo Mathematico-Physical Society. The amount of emanation decreases with distance from the ground, but if a homogeneous layer only 5 kilometres thick be taken as the equivalent of the whole atmosphere, over each square metre, there is an amount of emanation which would be in equilibrium with 4×10^{-7} grams of radium. Half of this breaks up in 3·7 days, and the question arises, how is the supply to be kept up? If it is derived, as it has been thought to be, from the strongly active air which exists in the pores of the soil, it must be possible to show by measurement that a large amount of emanation is exhaled from a square metre of soil. This has just been done by Prof. Joly and Mr. Smyth, who describe their observations in the August number of the Proceedings of the Royal Dublin Society. They find that near Dublin the amount exhaled often exceeds the $2{\cdot}9 \times 10^{-9}$ grams per square metre per hour necessary to maintain the atmospheric emanation.

WITH the year 1910 the *Ergebnisse der magnetischen Beobachtungen* of the Royal Observatory of Wilhelmshaven commences a new series, edited by Prof. Bidlingmaier, the assistant director. The volume extends to forty-five pages, and possesses two charts. It contains an account of the absolute and self-recording instruments. At present the latter consist of declination (D) and horizontal force (H) magnetographs of the Kew pattern by Adie, but a vertical force instrument seems under construction. The methods of observation and reduction, and the base values of the curves, are treated in great detail. One reason for this doubtless is that, following the example of Potsdam, mean values are assigned to every day of the year, which go to 1 γ in H and to 0·1′ in D. Again, following Potsdam, the hourly values represent mean ordinates from sixty minutes centring, not at exact hours of the day, but at half hours. Mean diurnal inequalities are given for individual months, going to 0·01′ in D and to 0·1 γ in H and in the north and east components. Corresponding values are also given in the case of the components for the Fourier 24, 12, 8, and 6-hour terms. The last two pages give vector diagrams for the diurnal inequality for individual months. In the diagrams and diurnal inequalities use is made of all days, whether quiet or disturbed, which probably explains the rather striking irregularities in the diagrams. While the influence of Potsdam example is manifest in the more normal parts of the volume, the treatment of disturbances affords scope for the ventilation of Dr. Bidlingmaier's own methods of treatment.

THE experimental study of vortex rings has in the past been qualitative rather than quantitative; but, according to

the Journal of the Franklin Institute for September, Dr. E. F. Northrup, of Princeton University, has so materially improved the apparatus used in their production that accurate observations of them may now be made. A coloured ring of liquid is projected from the opening in the front of a metal box by a blow struck by an electro-magnet on the back, and travels through a transparent liquid, which gradually decolourises the projected liquid. If the box is pointed slightly upwards, the issuing vortex ring is reflected on reaching the surface of the liquid, the angle of reflection being apparently equal to that of incidence. By the use of two liquids of different densities in the observing tank, refraction may also be shown. While, however, the actual matter of the vortex ring is carried forward into the second liquid if the density of the latter is greater than that of the ring, this is not the case if the ring is denser than the liquid into which refraction is about to take place. By projecting molten paraffin wax into cold water, solid rings can be obtained. A subsequent number of the Journal will contain photographs of rings in a variety of conditions.

WE have received from the authors, Messrs. H. R. Hamley and A. L. Rossiter, a copy of a paper on the magnetic properties of stalloy, reprinted from the Proceedings of the Royal Society of Victoria. The remarkable magnetic properties of stalloy—essentially an iron-silicon alloy containing 3·4 per cent. of silicon—have already been investigated very fully in this country, principally by methods involving the use of a wattmeter; the present research emanates from two Government research scholars working in the University of Melbourne, and the methods used are entirely different, since they depend upon Prof. T. R. Lyle's method of tracing out the wave-forms. This application of Lyle's method is interesting, and it is satisfactory to find that the results substantially confirm those obtained by the wattmeter methods.

THREE interesting equilibria are discussed in the Memoirs of the College of Science and Engineering of the Kyoto Imperial University, the third volume of which is now being issued. In the case of sodium acetate dissolving in acetic acid solutions of different strength, the complete equilibrium diagram for 20° C. plotted by R. Abe shows the existence of three salts having the formulæ

$NaC_2H_3O_2,3H_2O$; $NaC_2H_3O_2,C_2H_4O_2$, and $NaC_2H_3O_2,2C_2H_4O_2$.

In the case of sodium and potassium carbonates dissolving in water at 25° C., Y. Osaka finds that the only double salt which can exist in contact with its solution at that temperature is the salt $Na_2CO_3,K_2CO_3,12H_2O$. In the case of the system water, ethyl alcohol, ethyl ether, studied by S. Horiba, physical methods of analysis were adopted, the composition of the phases being determined from measurements of density, refractive power, and viscosity. The critical composition at which the two phases become identical was found to be: water 40 per cent., alcohol 28·4 per cent., ether 31·6 per cent., for a temperature of 25° C.

SOME months ago attention was directed in these columns to a paper by Flint in *The American Journal of Science*, in which he claimed to have separated, by fractional precipitation of tellurium tetrachloride, a portion of the tellurium with an atomic weight so low as 124·32. This method of resolution had already been tried some years previously by Baker and Bennett, but without success. In view of the results recorded by Flint, Prof. Baker repeated his experiments in collaboration with Prof. Vernon Harcourt, and found once more that no resolution could be effected by this method. In describing their experiments in the Journal of the Chemical Society, these authors explain the probable origin of the anomalous results of the American observer. In recovering the tellurium which they had used, they noticed that an orange-coloured precipitate was formed from material that had previously been quite white. This yellow precipitate was found to be tellurium trioxide, which had been produced by the oxidising action of hydrochloric acid previously exposed to bright sunlight, and thereby contaminated with chlorine. A basic nitrate prepared from the trioxide and analysed by Flint's method gave (on the assumption that the tellurium was present as dioxide in the form $2TeO_2,HNO_3$) an atomic weight so low as 118·31, instead of the normal value 127·54. There can be little doubt, therefore, that the low figures given by Flint were due to oxidation of the material, and not to any resolution of the element.

THE City of Paris depends upon its supply of fuel, food, and other commodities to a large extent on the traffic carried by water, the quantity brought into the city by this means of transport being greater than by the railways. Ever since the formation of the Manchester Ship Canal, the question of rendering the Seine between Rouen and Paris navigable for sea-borne vessels has been in agitation. The serious inundations that occurred in the lower parts of Paris about a year ago again directed attention to the condition of the river, and a commission was appointed by the Minister of Public Works to report on the matter. Recently this commission has presented its report. The question of making the river navigable for sea-borne vessels, and making Paris a seaport, is not, however, dealt with, the commission being of opinion that the present conditions of traffic can be considerably improved by the works proposed for dealing with the prevention of overflow and inundations. The widening and deepening of the channel in some parts where required, and the construction of a new channel across the bend between the Rivers Marne and Seine below Paris, proposed by the flood commission, would be of great service to the traffic. A large sum of money has already been expended in enlarging and improving the locks and the channel between Rouen and Paris, and boats carrying more than 200 tons can navigate the waterway.

COMMENTING on the wreck of the naval airship at Barrow on September 24, *The Engineer* for September 29 believes that had this vessel survived a few months longer even the Admiralty officials responsible for her inception would have become convinced that the airship in general is a hopelessly impracticable affair. The vessel will in all likelihood be repaired; indeed, even already there is news to this effect. Sufficient has not yet been done, our contemporary supposes, to justify the official abandonment of the whole idea. *Engineering* of the same date is more sympathetic, and considers that it would be a mistake to attach too much importance to the accident. The airship is still, like the aëroplane, in an experimental stage; and the Admiralty airship must be regarded as a great practical experiment, in which the results of trial and error, when carefully analysed, must yield important lessons. The material used for the outer envelope proved of high resisting quality, only yielding when there was abnormal tension. The duralumin girder-work proved very ductile and of great tensile strength against the racking stresses set up. The material of which the ballonets are made, as supplied through the War Department, has all along been a source of uncertainty and of little accidents, and the facts point to the cause of the collapse being due to the rupture of a gas-bag when the vessel was being drawn out of the shed.

OUR ASTRONOMICAL COLUMN.

DISCOVERY OF A THIRD-MAGNITUDE COMET (1911g).—Yet another object is added to the list of recently discovered comets. On September 28 M. Beljawsky, at the Simeis Observatory, saw a third-magnitude comet, of which the position at 17h. 8m. (Simeis M.T.) was

R.A. 10h. 43m., dec. 8° 15′ N.

This position lies in Leo, about half-way between χ and ρ Leonis, and rises just before dawn.

A further observation, secured by Dr. Strömgren at Copenhagen on September 29, 17h. 12·7m. (Copenhagen M.T.), gave the position of the new comet as

R.A. = 10h. 52m., 59·8s., dec. = 8° 57′ 49″ N.

According to telegrams published in *The Daily Mail*, this object was observed at the Greenwich Observatory at 16h. 30m. on Monday morning; it has a very bright tail, which shows up well on the photographs. At the same hour on Sunday morning it was seen at the Royal Observatory, Edinburgh, and its magnitude, soon after rising, was estimated as 3·0. The observers there describe the tail as curved and fan-shaped, and state that it could be traced for a distance of 2°.

Beljawsky's comet is the seventh comet to be discovered this year, and so will take the designation 1911g.

BROOKS'S COMET, 1911c.—Brooks's comet is now an object of general interest, and in a clear atmosphere shows a tail even to the naked eye; on Sunday last, at Gunnersbury, with a pair of ordinary opera-glasses, there was no difficulty in seeing a filmy appendage, which stretched for some 2° or 3° in a north-easterly direction.

Writing from Malta on September 20, Mr. C. Leach said the comet had been visible to the naked eye for some time, but no tail was seen until September 16; on the two succeeding nights he saw, without optical aid, some 3° or 4° of tail quite easily, and concluded that its brightness was increasing.

A number of observations are recorded in No. 4526 of the *Astronomische Nachrichten*. Prof. Nijland publishes some measures of magnitudes which suggest an oscillation in the brightness of the comet, and M. Esclangon records the phenomena observed during the occultation of a 10·5-magnitude star by the comet on August 17. From 10h. 1m. 0s. to 10h. 1m. 12s. (Bordeaux M.T.) he was unable to separate the star from the well-defined but slightly fainter stellar nucleus of the comet. Although he could detect no change of brightness while the star was passing through the nebulosity forming the coma, he noticed a distinct diminution of the star's light as it passed behind the nucleus.

QUÉNISSET'S COMET, 1911f.—Several observations of comet 1911f appear in No. 4526 of the *Astronomische Nachrichten*, where the discoverer and M. Baldet describe the object as being of magnitude 7·5, round in form, having a nucleus, and showing the hydrocarbon-cyanogen spectrum.

In the *Comptes rendus* for September 25 they give further details of the discovery, and briefly describe their photographs. Short exposures (34 mins.) on September 23 showed a round head and traces of a tail, while the spectrograms showed the blue band of the "Swan" spectrum and the cyanogen band at λ 388. On September 24 exposures of 2h. 9m. were possible, and a tail 1° long, in position angle 322°, was clearly visible on the direct photographs; the comet was sensibly brighter, and was suspected to be visible to the naked eye, its estimated magnitude then being 6·5. The spectrum was much denser, and in addition to the bands showed a fairly strong continuous radiation.

A set of elements and an ephemeris, based on observations made on September 24, 25, and 26, are published by Dr. Ebell in a supplement to No. 4527 of the *Astronomische Nachrichten*. The elements give November 12 as the time of perihelion passage, and the following is taken from the ephemeris:—

Ephemeris 12h. (M.T. Berlin).

1911		α (true) h. m.	δ (true) ° ′	log r	log Δ	mag.
Oct.	4	15 20·7	+52 30·5	0·0304	9·9839	6·7
,,	5	15 22·8	+50 35·6			
,,	6	15 24·7	+48 42·9			
,,	7	15 26·4	+46 52·6			
,,	8	15 28·0	+45 4·8	0·0103	0·0026	6·7
,,	9	15 29·4	+43 19·6			
,,	10	15 30·7	+41 36·9			
,,	11	15 32·0	+39 56·8			
,,	12	15 33·1	+38 19·3	9·9903	0·0252	6·7
,,	13	15 34·2	+36 44·4			

CALCIUM VAPOUR IN THE SOLAR ATMOSPHERE.—Continuing his discussion of Mount Wilson observations of the movements and condition of calcium vapour over sun-spots and other special regions of the solar surface, Mr. C. E. St. John arrives at some valuable conclusions regarding the conditions obtaining in the solar atmosphere, in No. 2, vol. xxxiv., of *The Astrophysical Journal*; only a very brief summary of the principal results can be given here. In most sun-spots the calcium vapour is descending at from 0·68 to 2·2 km. per second, but over the penumbræ that vapour which produces the bright K_2 line appears to be in vertical equilibrium. Over flocculi a very doubtful upward motion of this emitting vapour is suggested, but in both cases the absorbing vapour descends as it does over the general disc. Both absorbing and emitting vapours appear to participate in the occasionally occurring rotary motion around spot umbræ, but the former have the greater velocity; this is also true for the inward radial motion of vapour across the penumbræ, and the combinations of the two produce the vortical motions converging on the umbra. Large masses of relatively cool calcium vapour high above the chromosphere, that is to say, projected prominences, are held responsible for the abnormal absorption line sometimes splitting or bordering the K_2 bright lines. In addition to the general circulation, there appear to be local systems in which emitting vapour rises around the flocculi, and, flowing across the penumbra, descends into the umbra of the spot. The apparent changes of intensity in the bright K_2 line, at the sun's centre and limb, is shown to be probably no more than a contrast effect. The differences and changes in the intensities of the K_1, K_2, and K_3 lines, and hence the different results obtained for various levels in the sun's atmosphere, find a possible explanation in the modifications of the radiation coefficients by several agencies.

ELEMENTS AND DESIGNATIONS FOR RECENTLY DISCOVERED MINOR PLANETS.—The usual list of elements and numbers for minor planets recently discovered is published by Dr. Cohn, of the Berlin Astronomisches Rechen-Institut, in No. 4521 of the *Astronomische Nachrichten*. It includes twenty-three asteroids discovered in 1909, 1910, and 1911 at the Königstuhl, Taunton, Vienna, and Teramo Observatories, and the final number given is 714.

THE MASSES OF SPECTROSCOPIC BINARIES.—An interesting paper in which Dr. Ludendorff discusses generally the masses of different classes of spectroscopic binary stars appears in No. 4520 of the *Astronomische Nachrichten*. *Inter alia*, he shows, from the study of twenty-five binaries of the spectral classes Oe5 to B8, that they have combined masses two or three times as great as have the twenty-six systems of classes A to K stars which he considered.

PUBLICATIONS OF THE U.S. NAVAL OBSERVATORY.—A number of works recently received from the U.S. Naval Observatory includes the following:—Vol. vi. of the Publications describes the equatorial observations of the satellites of the major planets, made during the period 1893–1907. It also contains a number of miscellaneous observations, an account of the transit of Mercury observations in 1894, and a list of the Naval Observatory publications. In the introduction to the part dealing with the equatorial observations there are some excellent plate illustrations of the various instruments employed. Vol. vii. is a catalogue of 23,521 stars in the Washington zones for which the observations were made in 1846–52, and are reduced to epoch 1850.

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AGRICULTURE.

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ANTHROPOLOGY.

George Allen and Co., Ltd.—Bushman Folk-lore, W. I. Bleek and L. G. Lloyd, illustrated with numerous specimens of Bushman drawings, with preface by Dr. McCall Theal. *Macmillan and Co., Ltd.*—The Golden Bough: a Study in Magic and Religion, Dr. J. G. Frazer, new edition, in six parts, part iii., The Dying God.

BIOLOGY.

George Allen and Co., Ltd.—Birds and Beasts, C. Lemonnier, translated by A. R. Allinson, translated; The Life of the Bee, M. Maeterlinck, illustrated. *D. Appleton and Co.*—A Text-book of Heredity, Prof. W. E. Castle. *Edward Arnold.*—The Horse: its Origin and Development, combined with Stable Practice, Col. R. F. Meysey-Thompson, illustrated; The Life of a Tiger, S. Eardley-Wilmot, illustrated; and new editions of Scottish Gardens, the Right Hon. Sir H. Maxwell, Bart., illustrated; and A Book about Roses, the late Very Rev. S. Reynolds Hole, illustrated. *Baillière, Tindall and Cox.*—Fungoid Diseases of Plants, Prof. J. Erickson. *A. and C. Black.*—Sea-fishing, C. O. Minchin, illustrated; The Grammar of Science, Prof. Karl Pearson, F.R.S., third edition, part ii., Biological, illustrated; Talks about Birds, F. Finn, illustrated; Peeps at Nature, edited by the Rev. C. A. Hall, illustrated:—(1) Wild Flowers and their Wonderful Ways, Rev. C. A. 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(der ganzen Reihe Bd. xiv.), Heft 3, Beiträge zur Kenntnis der Cephalopoden der norddeutschen unteren Kreide. I. Die Belemnitiden der norddeutschen unteren Kreide. 1. Die Belemniten des norddeutschen Gaults (Aptiens und Albiens), E. Stolley, illustrated; Lehrbuch der Protozoenkunde, Prof. F. Doflein, new edition. *Henry Holt and Co. (New York).*—General Zoology, Prof. E. C. Conklin; Living Plants, Prof. W. F. Ganong; Biology of the Seasons, Prof. J. A. Thomson, American edition; Eugenics, C. B. Davenport; Plant Life and Evolution, Prof. D. H. Campbell; Hertwig's Manual of Zoology, translated by Prof. J. S. Kingsley, new edition; Evolution of Animal Intelligence, Prof. S. J. Holmes; American Woods, Prof. E. C. Jeffrey and L. W. Bailey. *C. H. Kelly.*—Tree Lore, F. G. Heath. *John Lane.*—Some Nature Biographies (Plant, Insect, Marine, and Mineral), J. J. Ward, illustrated, cheap edition. *Longmans and Co.*—Butterfly Hunting in Many Lands, Dr. G. B. 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TWO MINOR AUSTRALIAN GOLDFIELDS AND THE ANTIQUITY OF MAN IN AUSTRALIA.[1]

THE goldfield of Forbes and Parkes is situated about 200 miles to the west of Sydney, where the old rocks of the East Australian Highlands disappear beneath the Black Soil Plains. Low spurs from the Palæozoic rocks project westward into the plains, and wide valleys of alluvium run eastward into the foothills. Gold was found during 1861 in the river gravels at Forbes, near the bank of the Lachlan River, and a gold-quartz lode was discovered in the following year at Parkes, on Gooban Creek, a tributary of the Lachlan. Further leads and lodes were discovered at both localities. Mining on the field has, however, been very irregular in its results. The alluvial deposits at Forbes yielded 212,547 oz. in 1862 and 71,493 oz. in 1863; but since then the output from both fields has varied from 57,851 oz. in 1875 down to as low as 1583 oz. Mining at Forbes has at times ceased entirely, and the field is now almost derelict. In the hope of reviving mining there, Mr. Pittman, the Government geologist of New South Wales, arranged for a geological survey of the field to collect trustworthy evidence as to its past history and determine the most likely directions for future mining. The problem of the field is mainly physiographic; and the work was entrusted to Mr. E. C. Andrews, who has already made his mark as an able physiographer. His interesting report is a valuable contribution to the geology of central New South Wales.

The main gold supply of the field has come from its leads, which are buried river channels containing auriferous gravels. These old river beds lie beneath the alluvium, and their working has been hampered by the excessive water with which they are saturated. Alluvial mining has ceased owing to the difficulty of following the deposits into the deeper ground. The methods of deep-lead mining were developed in Victoria, where, as a rule, the gold is found most abundantly in the deep, central river channels. In the Forbes area, however, for reasons which Mr. Andrews clearly explains, some of the richest patches of gold are on the sides of the buried valleys, and he advances weighty arguments that the deep drifts of the old Lachlan Valley would, if discovered, prove too poor in gold for profitable working.

The lode mines of the field are of two types. The foundation of the area consists of Ordovician and Silurian rocks associated with intrusive andesites and andesitic lavas, and covered in places by some Devonian rocks. To the east are some large areas of granite of post-Silurian, but pre-Devonian or Devonian, age. The gold-quartz lodes are associated with the intrusive andesites or occur along crush-zones. Mr. Andrews concludes that the gold has been introduced into the lodes in solution, and did not come from the igneous rocks, and that where gold has been found in igneous rocks in New South Wales it is of secondary origin.

The report includes one item of anthropological evidence that may prove of unusual importance. Hitherto Australia has remained the one continent on which there is no direct evidence of the antiquity of man. It has often been pointed out that, in spite of the thorough search of Australian drifts during mining operations, no early trace of man has yet been found in them. Mr. Andrews records (pp. 19 and 27) the occurrence of some blackfellows' ovens 18 feet below the surface, and associated with remains of Diprotodon. It is to be hoped that a more detailed account of this discovery will be published. On the theory that the Australian aborigines entered Australia in the north-west, and were specialised for desert existence, as they worked their way across Central Australia, it is in such localities as Forbes, where mining operations expose the drifts on the borders of the central plains, that early remains of the aborigines would be expected. Though under special conditions 18 feet of alluvium might accumulate in a short time, the association of the ovens with bones of Diprotodon appears to indicate that Forbes has yielded the earliest trace of man yet found in Australia. Mr. Andrews holds that the whole series of drifts, of which that containing the ovens is one of the later members, is of post-Tertiary age.

Mr. Andrews's memoir is of great interest and unusual merit. The history of the field, too often neglected in such reports, has been carefully compiled, and the features of the country are graphically described and suggestively interpreted. Considering that the closing of the mines prevented the author from inspecting the old workings, he has collected instructive evidence as to the structure of the lodes. His sections, however, give no strong support to his suggestion that the Silurian rocks have been overthrust on to the Ordovicians. As such memoirs are for the benefit of the mining industry, the less familiar terms, such as miarolitic, might be explained in footnotes. The most serious omission is the absence of heights from the map. The scarcity of altitudes on Australian maps is at

[1] The Forbes-Parkes Goldfield, New South Wales, Department of Mines. Mineral Resources. No. 13. Sydney, 1910 (issued 1911). By E. C. Andrews. Pp. iii+109+map+7 plates of plans and sections.

General Report on Tanami Goldfield and District (North-western Central Australia). By L. C. E. Gee. Pp. 22+map+19 illustrations. (Adelaide, 1911.)

present their greatest defect, which is especially marked in this case, as they are indispensable in the study of deep leads.

The map accompanying Mr. Gee's report on Tanami is also heightless. That report tells a very different story. The field was only discovered in 1900, and the great difficulties in its development are in access and scarcity of water. The locality is 50 miles from the frontier of West Australia, 800 miles from the end of the South Australian railways at Oodnatta, and 696 miles from Port Darwin, on the northern coast. The goldfield was visited by Mr. H. Y. L. Brown, the Government geologist, in 1909, and in consequence of his favourable report and the increased number of prospectors, the Government sent Mr. L. C. E. Gee there as warden and magistrate. Mr. Gee has now furnished a very interesting report on the district, the prospecting mining work, the rainfall, climate, and aborigines, with lists of plants collected and birds observed. In spite of its tropical position, Mr. Gee describes the climate as very healthy. The rainfall observed in ten months was 15½ inches, and a good supply of water is often obtained from wells at about the depth of 150 feet. The surrounding country is called desert, but Mr. Gee describes it as containing much fair and some good pastoral country. The mining results hitherto have done little to fulfil the original expectation that at length a great goldfield had been discovered in South Australia.

J. W. GREGORY.

ENTOMOLOGICAL NOTES.

THE U.S. Department of Agriculture is anxious lest the mango-weevil (*Cryptorhynchus mangiferae*), which does so much harm to mango-plantations in other parts of the world, should be introduced into those recently established in Florida. The larva burrows into the seed while soft, where it remains for a considerable period, and is thus carried all over the tropics. In a circular issued by the Bureau of Entomology it is recommended that all mango seeds introduced into America should be opened and examined, and those selected for planting made to germinate under a wire-gauze screen.

The advent between 1900 and 1902 of the sugar-cane leaf-hopper (*Perkinsiella saccharicida*) into the sugar-cane plantations of Hawaii was the beginning of a great calamity which has befallen sugar-growers in four of those islands; for by February, 1903, the insect had spread over the whole area devoted to sugar-culture, and had become so numerous as to constitute a serious pest. Its spread was greatly facilitated by the fact that in those islands only half the crop is harvested at a time, so that there is a continuous supply of nutriment. Moreover, there was an absence of indigenous enemies, although some native species have since taken to preying on the leaf-hopper. The species was introduced from Queensland; and the loss to planters in Hawaii during 1903 and 1904 from this and other insects is estimated at three million dollars. Bulletin No. 93 of the U.S. Bureau of Entomology is devoted to an account of the life-history of the leaf-hopper and the best means of checking its ravages.

In part ii. of the sixth volume of Records of the Indian Museum Dr. J. J. Kieffer continues his description (in French) of the gnats and midges of the family Chironomidæ in the collection of the Indian Museum, naming eighty-seven species as new, the majority of which come from the Oriental region, although others are from the Suez Canal.

Parasitic Hymenoptera from the Transvaal form the subject of a paper by Mr. P. Cameron in vol. ii., No. 4, of Annals of the Transvaal Museum. In a previous paper the author was able to record, from material in the museum, only thirteen local representatives, but, thanks to a collection made by Mr. A. J. T. Janse, he now describes a very large number, some of which represent peculiar generic types, as new. The larval hosts of many of the species are likewise recorded. In this connection it may be noted that the serial quoted suffers from the absence of a table of contents or index to the various numbers.

Mr. J. W. Shoebotham has favoured us with a copy of a paper by himself from the July number of *The Annals and Magazine of Natural History* on spring-tails (Collembola) new to the British fauna, with the description of a new species of Oncopodura, typically from Berkhampstead, Herts. The collection on which the paper is based was mainly made in the counties of Hertford, Buckingham, and Stafford.

Another addition to the British fauna is a coccid taken in ants' nests in Somersetshire by Mr. H. St. J. Donisthorpe, and identified by Mr. E. E. Green, in *The Entomologist's Monthly Magazine* for August, with *Ortheziola rejdovskyi*, a species hitherto apparently known only from Bohemia. At the conclusion of his paper Mr. Green discusses the serial homology of the segments of the antennæ in various members of the Coccidæ.

THE CULTIVATION OF LUCIDITY IN SCIENTIFIC WRITING.[1]

ACCORDING to the reports of examiners for medical degrees, many students seem unable to write an essay or thesis exhibiting any literary quality and style. The fault is not entirely that of the candidates. Whatever subjects they may have learnt at school, the writing of their own language has, in general, not been one of them. Even during their university career the use of the written English language, except as a machine for taking notes or answering examination questions, has not formed any regular part of their course.

The teaching of English is often understood to mean the attempt to teach a literary style by the imitation of good models; but what is really wanted is the power of expressing clearly one's own ideas in one's own language, and this ought now to be within reach of every English-speaking man and woman. The usual methods of teaching English still leave the average boy and girl singularly deficient in the art of saying what they mean on paper, however ready they may be in expressing themselves by the spoken word. This is largely due to the want of systematic practice in writing; moreover, essays are generally criticised by the teacher from the point of view of style rather than in respect of intelligibility. Students should learn to express their own meaning in absolutely clear and intelligible language before they think about the manner in which that language is to be manipulated. A split infinitive is a less important fault than a failure to make the meaning clear. Teachers and examiners of scientific subjects often say of a pupil or an examinee that he evidently understands what he is trying to say, but is merely unable to express his meaning, and then give him full credit for the knowledge and pardon him the failure to express it.

In these circumstances it is not surprising that much scientific writing of the present time is loose and unintelligible in its expression. The remedy is to cultivate the quality of lucidity; this will lay the foundation for a good style.

There cannot be clear writing without clear thinking, and he who learns to write clearly will in the process learn to think clearly. Except in the drafting of resolutions and telegrams, most people have little practice in making their meaning absolutely clear. Letters in the daily papers and many books and memoirs on scientific subjects fail singularly in the quality of lucidity. It would be a good thing if schools and universities had societies which gave their students the same valuable training in the use of the pen which their debating clubs give in the practice of fluent speaking.

In the scientific revival of the nineteenth century the great expositors who wrote with such admirable lucidity led the public to see that the study of science, like that of philosophy, is an education in clear thinking; but now that so much scientific writing is badly expressed, the impression is conveyed that the studies which lead to such loose writing cannot really be conducive to accurate and clear thought. The remedy is in the hands of students themselves, who can, by constant practice in everything that they write and by determination to make their meaning clear, cultivate the essential quality of lucidity before they try to acquire the graces of a good style.

[1] From the introductory address delivered at St. George's Hospital on October 2 by Dr. H. A. Miers, F.R.S., principal of the University o London.

SOME QUANTITATIVE STUDIES IN EPIDEMIOLOGY.

AN account of some quantitative studies in epidemiology has recently been published in the second edition of my book on the "Prevention of Malaria" (Murray), and the Editor of NATURE has asked me to give a general description of them here. The attempts originated in the following manner. Shortly after Anophelines were shown to carry malaria, it was often observed that little apparent correlation could be found between their numbers and the numbers of infected persons in a locality. The observations were always far too scanty to establish any real absence of correlation; but they were used, nevertheless, to support the thesis that the *amount* of malaria does not depend upon the *number* of the Anophelines, and that therefore the proposed anti-malarial measure of mosquito reduction (then very unpopular) was useless. For many reasons a trustworthy experimental investigation would have been very difficult and costly, and it was therefore all the more necessary to examine the subject by a carefully reasoned analysis of the relations which must hold between the amount of the disease and the various factors which influence it. My first attempt in this direction was made in an official report on the "Prevention of Malaria in Mauritius" (Waterlow and Sons, 1908), and fell into the form of a simple difference equation. This was further developed in the first edition of my book already mentioned, and the subject was at the same time ably attacked by Mr. H. Waite, at the instance of Prof. Karl Pearson, in *Biometrika*, October, 1910.

The attempt now referred to aims at extending the reasoning to infectious diseases in general. The object is as follows. Suppose that a given proportion of a population in a given locality at a given moment are infected with some disease. Then we know from experience that the number will not remain fixed, but will vary from time to time and from place to place. The problem is to calculate these variations on the supposition that all the coefficients are known, which, of course, is by no means always the case. The use of the calculation will be (1) to obtain more light regarding the coefficients by comparing calculated with observed results; (2) to obtain quantitative estimates as to how far each coefficient should affect the result; and (3) to improve preventive measures by showing which factors they should be directed against. My studies have been hitherto concerned only with time-to-time variations, and the reader will understand that they require verification and completion by better mathematicians than myself. So far as I can ascertain, the subject has been little dealt with hitherto.

We must first obtain clear ideas on some points. Infectedness is not the same thing as sickness. *Infectedness* begins when the infecting organisms first enter the body of the host (man, animal, or plant), and ceases only when the last of them die out of him or leave him, or when he himself dies. *Sickness* may be quite absent during the whole of this period, or may begin after an "incubation period"; may cease long before or long after infectedness ceases, or may be intermittent. It is therefore merely an episode of infectedness, and one which does not concern us greatly just now. Another episode, and a more important one at the moment, is *infectiveness*, that is, the state of the infected person during which the infecting organisms are able to pass from him to others. The period or periods of infectiveness are always contained within the period of infectedness, but do not necessarily coincide with the periods of sickness. Thus typhoid or diphtheria carriers may be ill for only a week or so, or not at all, but may remain infective for months. In yellow fever, according to good researches, sickness and infectiveness begin together a few days after the commencement of infectedness at inoculation; but infectiveness ceases three days later, often long before the sickness is over. In malaria, sickness and infectiveness are intermittent and not coincident episodes, and may recur for years. Infectedness itself is only the preliminary stage of *affectedness*, which begins at inoculation and does not end until the last trace of the resulting sickness or acquired immunity has vanished. Reinfection often occurs during existing affectedness, and may increase its duration and that of the episodes. Medical treatment may have the opposite effect, and natural immunity and prevention may reduce susceptibility to infection. Lastly, the natural fluctuations of population, due to births, deaths, immigration, and emigration, must be considered, and these may vary in consequence of the epidemic.

Hence many coefficients have to be taken into account; and the principal difficulty lies, I fancy, in arranging for all of them in the equations. The course which I have adopted as being perhaps the best for a beginning is to conceive the matter in the most general terms possible by taking the act of infection as being one of any kind of event, such as accident, death, marriage, bankruptcy, receipt of bequests, insect-bite, &c., which may occur to a population, the various coefficients being at present taken as constant during the period considered. If such an event occurs to a given constant proportion of the population in unit of time, how many affected people will there be in the locality on a given date, on a most probable estimate, and how many of these have been affected once, twice, thrice, &c.? This simple form may be called the problem of *happenings*, and its solution will often be useful in epidemiology, as, for instance, in estimating the most probable frequency of reinfections or of insect-bites. But for some kinds of events, such as marriage, wealth, and infectedness, we must contemplate a continuance of the event in the individual, with a possible reversion to the unaffected class after the cessation of affectedness. Such events may be called *becomings*; and we have now to find the proportion of the population in this condition on a given date.

I will treat the equations as briefly as possible. Consider the following:—

$$\begin{aligned} a_{t+1} &= (1-h)va_t + \mathrm{H}\mathrm{V}z_t \\ z_{t+1} &= \quad h\,va_t + (1-\mathrm{H})\mathrm{V}z_t \\ p_{t+1} &= \quad va_t + \mathrm{V}z_t \quad . \quad . \quad . \quad . \quad . \quad . \quad . \end{aligned} \tag{1}$$

Here a_t and z_t are respectively the numbers of unaffected and affected individuals, and p_t is the total population at the end of t units of time; v and V are respectively the variations in number of the unaffected and the affected due to births, deaths, immigrations, and emigration in unit of time; h is the proportion of the unaffected which become affected, and H the proportion of the affected which become unaffected (to be better defined presently) in unit of time. Thus $1-h$ and $1-\mathrm{H}$ are respectively the proportions which remain unaffected and which remain affected, and a_{t+1} and z_{t+1} are the numbers of the groups after the lapse of one unit of time. The gain of one group is the loss of the other group, and the total population is the sum of the two groups, the factors h and H disappearing in the summation.

If n, m, i, e denote the (constant) nativity, mortality, immigration, and emigration rates among the unaffected, and N, M, I, E the similar rates among the affected, it is correct, I believe, to write $v=(1+n)(1-m)(1+i)(1-e)$, and a similar equation for V. Different symbols are necessary for the two groups, because all the quantities, even the immigration, may differ. We now take the equations in more exact detail, but omitting v and V for the moment. Thus

$$\begin{aligned} a_{t+1} &= (1-h)a_t + (1-h)na_t + (1-h)\mathrm{N}z_t + (1-h)rz_t \\ z_{t+1} &= \quad h\,a_t + \quad h\,na_t + \quad h\,\mathrm{N}z_t + \quad h\,rz_t + (1-r)z_t \\ p_{t+1} &= \quad a_t + \quad na_t + \quad \mathrm{N}z_t + \quad z_t \quad . \quad . \quad . \end{aligned} \tag{2}$$

Here n and N are the birth-rates of the two groups. The second and third columns give the happenings among the births; rz_t is the proportion of the affected which *revert* to the unaffected group in unit of time, and hrz_t the (very small) proportion of these which immediately become reaffected; $(1-r)z_t$ is the proportion of the affected which do not revert, and $(1-h)rz_t$ the proportion of the reverted which are not immediately reaffected. Obviously p_{t+1} is merely the sum of the two groups a_t and z_t *plus* the births that have occurred to both in the unit of time, and the symbols h and r disappear in the summation. The equations are not symmetrical, because, though the progeny of the unaffected are born in this group and belong to it, the progeny of the affected are not born affected, and therefore do not belong to the latter group. I think that this is the better arrangement; but it would be possible

to add a term for affected births, as in syphilis. The first two of the above equations may be written

$$a_{t+1}=(1-h)(1+n)a_t+(1-h)\frac{N+r}{1+N}(1+N)z_t$$

$$z_{t+1}= \quad h(1+n)a_t+\left\{1-(1-h)\frac{N+r}{1+N}\right\}(1+N)z_t \qquad (3)$$

If, now, we restore the mortality, immigration, and emigration rates, that is, affix to a_t in both equations the coefficient $(1-m)(1+i)(1-e)$ and to z_t the coefficient $(1-N)(1+I)(1-E)$, we have

$$a_{t+1}=(1-h)va_t+(1-h)\frac{N+r}{1+N}Vz_t$$

$$z_{t+1}= \quad h\,va_t+\left\{1-(1-h)\frac{N+r}{1+N}\right\}Vz_t \quad . \quad . \quad . \quad (4)$$

which are obviously the same as equations (1) if H is now defined as the value of $(1-h)(N+r)/(1+N)$.

The complete solution of these difference equations is

$$\begin{aligned}(X-Y)a_t&=(a_1-a_0Y)X^t-(a_1-a_0X)Y^t\\(X-Y)z_t&=(z_1-z_0Y)X^t-(z_1-z_0X)Y^t\\(X-Y)p_t&=(p_1-p_0Y)X^t-(p_1-p_0X)Y^t \quad . \quad . \quad . \quad (5)\end{aligned}$$

where

$$\begin{aligned}a_1&=(1-h)va_0+HVz_0 \qquad & z_1&=hva_t+(1-H)Vz_0\\p_1&=va_0+Vz_0 & p_0&=a_0+z_0\end{aligned}$$

and X and Y are the roots of the auxiliary algebraic quadratic equation

$$x^2-\{(1-h)v+(1-H)V\}x+(1-h-H)vV=0.$$

These roots are rational for several particular values of the constants. The most important instance is when $v=V$, that is, when the happening does not affect the normal fluctuations of the population. Here $X=v$ and $Y=(1-h)(1-r)/(1+N)$, and

$$z_t-Y^tz_0=\frac{h(1+N)}{N+r+h-hr}(p_t-Y^tp_0). \quad . \quad . \quad . \quad (6)$$

As Y is in this case less than unity, Y^t diminishes without limit as t increases, and therefore z_t, the number of affected individuals, asymptotes to a fixed proportion of the total population, provided that all the elements remain constant. I call this proportion the *static value*. In disease it gives what is called the *endemic index*, or *ratio*.

In epidemiological applications the symbol z refers, not to sickness or even infectedness, but to affectedness as defined above; and the symbol r does not mean recovery from sickness or infectedness, but reversion to a susceptibility to a fresh happening (inoculation), that is, to loss of acquired immunity. Thus in drawing curves of epidemics we must remember that this last factor may not come into play until long after the commencement of the epidemic, or not at all.

In my book the above equations are treated also in the infinitesimal form, when the integrals become exponential. Thus the second of equations (2) becomes

$$\frac{dz}{dt}=h(p-z)+qz,$$

where $q=V-1-r-N$. If the total population p remains constant, this is easily integrable if h is also constant, or (what more probably happens in epidemics) is a linear function of z, say cz.

Numerous applications are possible; but I have space to refer only to the important case of "metaxenous diseases," that is, to infections common to two species of animals or plants. The same equations apply to both species, but the happening-factor h in one equation must be a function of z in the other equation. We thus have two simultaneous equations to solve, namely,

$$\frac{dz}{dt}=k'z'(p-z)+qz$$

$$\frac{dz'}{dt}=kz(p'-z')+q'z'$$

where the marked symbols apply to one species of animals (say, mosquitoes) and the unmarked ones to the other species (say, man), and k and k' are constants composed of the most probable frequencies of communication between the two species, of infectivity and of natural immunity. Prof. F. S. Carey has referred these equations to Prof. A. R. Forsyth, who thinks that they are not likely to be easily integrable in finite terms; but the most important case is where both z and z' have reached static values, when the differential coefficients vanish. We then obtain at once

$$z=\frac{kpk'p'-qq'}{kk'p'-kq}$$

with the similar equation for z'. In the case of some insect-borne diseases this becomes (reduced)

$$z\{(1-r)fb'f'b'A+rfb'\}=p\{fb'f'b'A-rN'\},$$

where z is the ratio of affectedness among men (say), f and f' the proportion of infective men and insects, b' the frequency of bites, r the reversion rate among the human patients, N' the birth-rate of the insects, and A the ratio of the number of the insects to head of human population. Numerical estimates of the constants in malaria are attempted in the book, and a table of calculated values of A for various values of z and b' are given (as already partly done by Mr. Waite).

The following important laws seem to be established:—(1) the disease (z) will not maintain itself unless the proportion of Anophelines (A) is sufficiently large; (2) a small increase of A above this figure will cause a large increase of z; and (3) z will tend to reach a fixed value, depending on A and the other constants. I doubt whether these laws could have been reached except by such mathematical attempts. The second one is especially important. If A is just at the critical value, z will be zero, or only just above it; but if A is only about double this critical value, a serious epidemic, amounting to about half the whole population, may follow. Yet such a small increase in the number of Anophelines will scarcely be detectable except after very careful study, a fact which easily explains why marked correlation has not always been observed. The same equation shows that, if certain experiments are to be trusted, yellow fever can scarcely be considered an endemic disease of men at all; and it also explains the absence of certain diseases in the presence of capable carriers, and the general phenomena of smouldering epidemics.

The most probable numbers of individuals to which a happening has occurred never, once, twice, &c., can easily be obtained, and are equal to the successive terms in the expansion of $\{(1-h)+h\}^tV^tp_0$ in ascending powers of h. This enables us to estimate the number of persons who have been bitten, or the number of insects which have succeeded in biting never, once, twice, &c., in a given period, and to calculate the average number of bites received or inflicted by each individual. It also enables us to calculate (what I think has not been done before) the frequency of *reinfections*. At present such reinfections are not much considered during the course of an already existing infection, but I estimate that in a locality where half the people are statically affected with malaria no fewer than about 63 per cent. will be infected or reinfected every four months (under constant conditions). In 1898 I showed that birds reinoculated with malaria could exhibit renewed and severe infections.

Lastly, to complete the study, it is necessary to estimate the most probable proportion of affected individuals who are also infected, or infective, or sick at a given moment. This will be the same as the proportion of the average number of days lived during these "episodes" to the average number lived during the whole period of "affectedness," which can be calculated from the special pathological data.

These studies require to be developed much further; but they will already be useful if they help to suggest a more precise and quantitative consideration of the numerous factors concerned in epidemics. At present medical ideas regarding these factors are generally so nebulous that almost any statements about them pass muster, and often retard or misdirect important preventive measures for years.

RONALD ROSS.

RESEARCH IN MEDICINE.[1]

THE object of research is to discover something which was not previously known, or to correct or to confirm some previous observations. There are two methods of research—one by *observation*, the other by *experiment*. In medical research the method by observation is much out of fashion; it is slow, and may be often interrupted for want of material. The imperfection of the material is often very disappointing. The method by experiment (not by any means limited to experiments on animals), on the other hand, is the fashion of the day; it is quicker, less liable to be interrupted, and may yield brilliant results in a very short space of time. But it is a two-edged weapon, and needs to be used, and its results to be accepted, with great caution. Mr. Hunter, who was a confirmed and most ingenious experimenter, said in the course of his evidence at the trial of Captain Donellan:—"I apprehend a great deal depends upon the mode of experiment; no man is fit to make one but those who have made many and paid attention to all the circumstances that relate to experiments."

Let me give you my experience of the two methods in the investigation of cancer. Many years ago there was great confusion in the minds of pathologists and surgeons regarding the differences and resemblances between sarcoma and carcinoma. I made a diligent study of them by observation of the cases at my hospital, the cases at other hospitals, and the cases recorded in the literature of many countries. The research was very long, very tedious, and very disappointing by reason of the small number of cases which were sufficiently recorded to be available for use. The results formed the subject of the Erasmus Wilson lectures thirty years ago, and proved that the life-history of the varieties of malignant disease does not depend merely on their structure, but upon their seat of origin, and that the varieties of malignant disease of every part of the body must be separately studied if they are to be treated with success. Observations of a similar kind have been made by other clinical pathologists, with the result that the most successful operations for cancer at the present time are based on the results of clinical pathology. For no part of the body has this been done with greater success than for the breast. Charles Moore and Mitchell Banks urged the importance of very large operations many years ago; but surgeons fought shy of them, because they lacked that which was supplied many years later by Heidenhain and Styles—a scientific basis. Recently Handley has again added valuable information on the same subject, founded on clinical and microscopical observation.

I have never engaged personally in experimental investigation on account of the difficulty of doing so thirty years ago. But I have been associated with the Imperial Cancer Research, and in touch with its staff from the foundation of the research, and have been a member of the publication committee of all its scientific reports. It has done nothing on the lines in which observation has been so useful. It has not unfolded the life-history of a single variety of cancer so that we can base our operations on the information. It has not even discovered whether spontaneous cancer of a particular part of the body in the rat or mouse runs a similar course to spontaneous cancer of the same part of the body in the human subject. These problems are not suited for experimental investigation; they are determined by observation. On the other hand, within the space of eight or ten years it has definitely settled a matter of dispute which was discussed and fought long before I became a student, perhaps for centuries. It has proved, beyond the possibility of doubt, that cancer in its early stages is a local, not a constitutional or blood, disease. It is impossible to overrate the value of this knowledge to the surgeon. So long as he believed that cancer is in the blood, and that an operation only removes the local manifestation of it, he was hopeless of the results of his operations, and removed the tumour solely to afford the patient temporary relief. Now he goes to his operation filled with hope that, if the disease is limited and in an early stage, and his operation is well designed and skilfully carried out, it may be quite successful. Thus it will be seen that the two methods, *observation* and *experiment*, have their special values in relation to cancer, that each is supplementary to the other, and that neither is fitted to take the place of the other.

It will be noticed that I have dwelt on the use to which these researches have been put in the treatment of cancer and of the value of them to human beings. You may fairly think these ought to be the immediate objects of all research in medicine, and that researches which are not likely to be immediately useful should be discouraged. But while I freely admit that my sympathy is in favour of this view, I am bound also to admit that it is wholly erroneous. The investigator should be solely interested in discovering the truth, and his attention should not be diverted and his judgment warped by the desire that his research should terminate in a particular manner because that might seem likely to be more useful to medicine and surgery. It is notorious that some of the researches which have seemed to fulfil no useful purpose have yielded the most valuable practical results, while other researches, pursued with a useful end in view, have furnished nothing good. If a utilitarian value were considered essential to research, many young investigators who have later produced the most brilliant work would have been discouraged, so that they might never have persevered in original research. I need only give two illustrious examples, Pasteur and Lister.[1] Their first researches had no utilitarian object. What a lamentable thing it would have been if they had been discouraged from research on that account. The great thing is that young people who are fitted to do so should be encouraged to search. What they search for is of comparatively small consequence. On the other hand, I would not have it supposed that a utilitarian research is derogatory to the dignity of the worker or necessarily damages his *moral*. Sir Humphry Davy deliberately worked out the problem of coal gas and explosions, and invented a safety-lamp at the urgent request of the coal-owners. Pasteur investigated the nature of the Pébrine disease of silkworms at the request of Dumas, and moved by pity at the wretched condition into which the silkworm industry had fallen. He discovered that it depended on a parasitic protozoon, and devised a successful method of stamping it out.

Just a few words on the cost of research. Dr. Leonard Hill[2] pointed out some years ago what great results could be achieved by an able worker with the simplest materials and at the smallest cost, and that fine laboratories and costly apparatus are not essential to research in medicine. All this is very true, just as it is true that David killed Goliath with a stone cunningly hurled from a sling. I do not think David at the present day would sally forth with a sling to oppose a foreign host; and our profession is continually urging on the wealthy public the financial claims of research.

In order to determine whether women are likely to be useful and successful in research, it is necessary to consider the qualities which should be looked for in an investigator—I mean in an investigator who has the sole charge of a research, even though it be carried out in a laboratory where other persons are at work. I am not speaking of an expert assistant or even of a joint investigator.

For (1) experimental research (including experiments on animals) I should set down: dexterity and neatness in manipulation; a knowledge not only of the principles, but of the practice, of aseptic and antiseptic surgery; and certainly humanity, so that the experiments which are necessary should be performed with as little suffering to the animals as possible.

For (2) every kind of research I should look for personal cleanliness; cleanliness of habit; industry, which must be extended to mean continued industry; patience, and a large stock of it; perseverance, and a determination to pursue

[1] From the introductory address delivered at the opening of the winter session, October 2, at the London School of Medicine for Women, by Sir Henry T. Butlin, Bart.

[1] The first researches of Pasteur were on the crystallisation of tartaric acid and its salts. The first researches of Lister were on the contractile tissue of the iris and on the muscular tissue of the skin.

[2] *Brit. Med. Jour.*, 1907, vol. i., p. 060. "Men of science are not made by institutes, money, or apparatus. Helmholtz did his best work on 120*l.* a year, and modelled his inventions out of spectacle lenses and his wife's sewing gear. Faraday did his epoch-making work with bits of wood, glass, and wire. Claude Bernard filled his pupils with enthusiasm in a laboratory little better than a cellar."

the research to the end; extreme care in observation and strict attention to detail; careful recording of observations, which should be done at the earliest possible moment; thorough belief in the importance of the particular research, amounting even to enthusiasm; conscientiousness.

Many of these desirable qualities will at once commend themselves to you; they need no more than enumeration. But you may wonder why I have set down others of them. For instance, what has conscientiousness to do with research any more than it has to do with any other of the affairs of life? Do I mean that an investigator should be honest and not appropriate or use unfairly the work of other investigators? Oh, no! I assume such honesty as this in every investigator. The conscientiousness of which I speak is of the worker to himself and his own work. In this way. A worker has been engaged in a research during many months. He has made many experiments and observations, and they have all gone to prove the correctness of the result at which he has arrived. But there is still one experiment which it would be well to try. He tries it, and curiously it does not turn out quite right. He puts two and two together and they do not make four. And everyone agrees with "The Professor in the Case" that two and two do make four, "not *some* times, but *all* the time." Now is the moment when his conscientiousness should come into play. The temptation is overwhelming to explain the failure by some fault in technique, and to set the result of that experiment on one side rather than to repeat it again and again as he ought certainly to have done. Had he done so it would again have failed, and he would have learned in the end, not that two and two do not make four, but that one of his twos was not a two, and he would have avoided publishing that result of his research which was afterwards discovered to be incorrect by a more careful and conscientious worker. It must always be borne in mind that the mischief of a faulty result does not end with that research, but may be the starting point of a long series of equally faulty results.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

IN his presidential address Colonel Close, the recently appointed Director-General of the Ordnance Survey, raised again the oft-debated question, "What is geography?" His contention that geography, apart from cartography, cannot be treated as a science in itself, but must serve as a common meeting-place and popularising medium for various other sciences, will certainly not be accepted by modern geographers without considerable modification and amplification.

Prof. Herbertson exhibited and explained a new series of thermal maps which he has constructed to show the actual mean temperatures prevailing over the globe instead of the temperatures reduced to sea-level, as indicated on the ordinary meteorological maps. Among other papers on cartography were two by Mr. A. R. Hinks, one dealing with the use of colour on contour maps, and the other with the most suitable projections for atlas maps. Captain Henrici discussed the present state of our knowledge—not altogether satisfactory—of the mean sea-level round our coasts, and arrived at the conclusion that there is no evidence, from the observations made, to justify the belief that mean sea-level is not constant around the British Isles. Captain Henrici also contributed a note on the height of Ruwenzori as determined by him from observations made by Captain Jack. His result is $16,801{\cdot}3 \pm 5{\cdot}3$ feet.

Among the papers on physical geography, two of the most interesting were contributed by Prof. J. W. Gregory and Prof. O. Pettersson. The former showed that while waterfalls have generally been regarded as destructive, they may in certain circumstances be constructive and act as agents of deposition instead of denudation. In support of this he instanced certain waterfalls in Dalmatia, Bosnia, and Herzegovina. In the former country, for example, the Kerka Falls are due to a barrier of calcareous tufa which the Kerka River has built across its valley. Prof. Pettersson discussed the deep-water movements in the Skagerrak, and showed that they occurred when the earth is in perihelion. His theory is that these waves are influenced by the phases of the moon, but still more by its declination and distance from the earth. He also showed that since 1753 the herring fishery on the coasts of Sweden has been most prolific in years of maximum declination and least prolific in years of minimum declination, a result which he attributes to the influence of the movements in the deep water. Captain Rawling gave an account of the British expedition to Dutch New Guinea, and showed some excellent views of the Nassau Range with its precipitous front more than eighty miles in length and from 8000 to 10,500 feet in sheer height.

The work of the section was concluded by an interesting discussion on aëronautical maps. M. Lallemand described the resolutions recently adopted at his suggestion by the Permanent Committee for Aërial Navigation of the Public Works Department of the French Government on the production of an international air-map, and the establishment of marks required by aviators and aëronauts. Captain Lyons followed with certain general suggestions for the construction of aëronautical maps, and in the subsequent discussion several officers of the air battalion and others took part. A full report of this discussion is to be published in *The Geographical Journal*.

MECHANICAL SCIENCE AT THE BRITISH ASSOCIATION.

THE meeting of the Mechanical Science Section of the British Association at Portsmouth, under the presidency of so distinguished a naval architect as Prof. Harvard Biles, was naturally the occasion for a very interesting programme of papers relating to many branches of marine engineering work ranging over a wide field of applied science, and dealing with some of the most important developments which are now engaging the attention of engineers and men of science in this branch of engineering activity.

The programme contained important papers on the rolling of ships, by the president, the gyro-compass, electrical steering and propulsion of ships, and the developments of wireless telegraphy, especially in its relation to naval problems; while in the purely mechanical section the advances in methods of generating motive power were dealt with in a series of related papers on internal-combustion engines and the superheated steam engine. Not only had the members who attended this section an opportunity of hearing these papers and the very interesting discussions to which they gave rise, but all the sections took the opportunity so kindly afforded them by Admiral Sir A. W. Moore of witnessing, from a battleship which carried them into the Solent, a combined attack by numerous torpedo-boats and submarine vessels with as near an approach to the conditions of naval warfare as practicable.

The interest which all members of the association take in the practical applications of scientific discovery to naval matters was manifested by the close attention to the wonderful evolutions and diving performances of the attacking vessels, while the swift and silent attack of the torpedoes, invariably marked by the final dull thud of impact as each one found its mark, gave a thrill of the possibilities of actual warfare not easily forgotten.

Although the proceedings of the section were so largely devoted to naval matters, other subjects of importance also claimed the attention of the members, like the non-stop train, the peculiar corrugations produced on rails by the long-continued passage of trains; while subjects of more general interest were afforded by papers on smoke abatement, and the possibilities of the manufacture of nitrogen products in this country by electric power, a question of great importance in connection with agriculture and the manufacture of explosives.

The discussion between Sections A and G on aërial flight at the Monday's meeting attracted a very large gathering, and has been dealt with in a separate article (September 28, p. 439).

We now turn to a more detailed examination of the papers in their order, and the discussions to which they gave rise. The president's address, on the rolling of ships,

dealt very largely with the question of the effects of the combinations of the natural oscillations of a vessel with the forced oscillations produced by wave systems, which in general produce their most dangerous effects before a permanent *régime* is established. In spite of the labours of previous investigators, the magnitudes of the oscillations produced in this transition period under various conditions are still to a large extent unknown; and Prof. Biles was able to indicate the methods of the investigation he is making for solving these problems experimentally, but owing to an unfortunate illness these were not completed in time for the meeting.

The important paper on the corrugation of tramway rails, which was brought before the section by Mr. Worby Beaumont immediately after the president's address, gave an interesting account of the phenomena observed on rails in service, and also particulars of an experimental investigation by the author on the contact areas between loaded wheels and rails, which enable conclusions to be drawn as to the intensities of the compressions and tensions produced by wheels rolling on rails of differing degrees of hardness. In the discussion which followed, Mr. Alexander Siemens suggested the use of hard metal for the sides of the rail with a softer metal composing the head; he considered that a reduction of speed and weight, and the use of larger wheels, such as the author suggested, were impossible under modern conditions. Sir William White gave particulars of the wear of rollers due to gun fire in turrets, and could not agree with Mr. Siemens's suggestion of a composite rail, while in reply the author defended his proposals. The proceedings on Thursday concluded with a paper on the Anschutz gyro-compass by Mr. Elphinstone, accompanied by a demonstration on a machine which was on view during the remainder of the meeting.

This instrument depends for its action on the precession effect of a rapidly rotating wheel due to the influence of gravity and its movement over the surface of the earth, and this effect is utilised for the purpose of a compass by employing a gyroscope running at 20,000 revolutions per minute, and floating in a mercury bath. The precession effect tends to cause the axis of the rotating mass to lie in the plane of the meridian, and hence true north is obtained. Unfortunately, time did not permit of a discussion on this paper.

The first paper at Friday's meeting of the association dealt with the question of electric drives for screw propellers, and Mr. Mavor advocated the use of steam turbines or internal-combustion engines running at a high speed and coupled to a generator. The current so obtained is used to drive a motor on a slow-speed propeller shaft, and the author claimed for this arrangement a high efficiency of power-generating plant and propeller, with an increased flexibility in the system, which offered great advantages and increased economies beyond those given by existing systems in many kinds of vessels. The president, Sir William White, Prof. Dalby, and others took part in a detailed technical discussion, in which the progress in the design of electric generators and propellers for ships and the uses of the author's system were clearly indicated.

A second paper on electrical steering, by Mr. Haigh, described an arrangement of a constantly running motor operating the steering gear by magnetic face clutches, an arrangement which allows of an extremely sensitive regulation of the rudder with great economy of power, since the motor may, if required, be run from the lighting circuit of the ship. Sir William White in opening the discussion said that he viewed electrically operated steering gears with much favour. The sensitiveness of the control was remarkable, almost too much so for the ordinary quartermaster, who would never let the helm alone, although this incessant movement had no real value in keeping the vessel to her course; as a consequence, it had been found necessary to provide hunting gear to diminish the sensitiveness of electric steering gears. Mr. Hawksley pointed out how very necessary it was still to provide auxiliary hand gear for emergencies.

The next paper, by Mr. T. F. Wall, on the repulsion motor, was essentially mathematical, and after a short discussion upon it by Mr. Haigh, Captain Sankey and Mr. Pollard Digby read a paper on a study of human susceptibility to vibration by aid of an instrument consisting essentially of a small mirror centred on a fine spindle and floating in a mercury bath. When the mercury is set in vibration by any disturbance, it causes the mirror to oscillate and throw a spot of light on a screen. The authors pointed out that the effects of vibration on individuals depend to a large extent on the frequency as well as on the amplitude, and that the perceptive faculty is very variable and often untrustworthy, points also emphasised by Sir William White and Prof. Petavel, the latter pointing out that the association of sound and mechanical vibration had in general a very disturbing effect on individuals.

A paper on some new aluminium alloys, by Prof. Wilson, concluded Friday's proceedings, and in the absence of the author was taken as read.

The section, which met again on Monday, devoted a couple of hours to a joint discussion on aëronautics with Section A, of which an account has been given already, and on its conclusion Prof. Howe gave a very striking demonstration of the recent developments in wireless telegraphy by aid of an aërial running from the top of the Town Hall into the lecture-room. With the aid of a Brown telephonic relay the audience was able to follow the time signals sent out from Wilhelmshaven, and to distinguish these from signals from other stations like that on the Eiffel Tower. In his paper the author dealt very fully with the improvements which have been made to prevent interference, and in a succeeding paper Captain Sankey described a portable wireless plant of the Marconi Company adapted for carriage on horseback, and capable of erection in a few minutes for use up to 100 miles. A short discussion by Profs. Dalby and Howe and Mr. Kilburn Scott concluded the day's proceedings.

On Tuesday three papers dealing with some modern methods of generating power were grouped together for discussion. Mr. Marshall described the special features and merits of the superheated over-type steam engine, Mr. Tookey gave a careful analysis of the costs of power production with suction gas engines, and Mr. Day gave a similar analysis for Diesel engines. The long and detailed discussion which followed was of the greatest interest, and was prolonged much beyond the time originally fixed for its termination. Mr. Rosenthal, who followed with a paper on marine oil engines, dealt with the most recent developments in this important subject; and the discussion, in which the president, Sir William White, Mr. Day, and Mr. Rosenthal joined, was chiefly remarkable in showing how confident these authorities are in the continuance of the supremacy of the steam turbine in naval work for many years to come

An overflow meeting on Wednesday was devoted to three papers of a more general nature and of great interest.

Mr. Kilburn Scott described the manufacture of nitrogen products by electric power, and particularly emphasised the importance he attached to this country's possessing the means for manufacturing all the nitrogen compounds required for explosives, and the danger of depending on foreign supplies in times of war. Sir William Ramsay agreed with the author that it was most desirable to locate factories in the neighbourhood of coal mines, and Sir William White expressed his general agreement with the author's views, although he did not consider that the present impossibility of manufacturing all the essential constituents of explosives in this country was a national danger. Prof. Petavel discussed the efficiency of the electric process, and Mr. Wimperis suggested the utilisation of the waste gases from blast furnaces for the process, and estimated the power available. In the following paper, on smoke abatement, by Dr. J. S. Owens, the fixing of a new standard of smoke emission from factory chimneys was suggested, and an instrument for measuring smoke density was exhibited. After a spirited discussion the final paper of the section was read by Mr. Yorath Lewis, on a new system of continuous transportation for passenger and other train services

The distinctive feature of the system is an endless screw of variable pitch, which enables the speed of passenger carriages to be varied at will, while the energy now lost in stopping trains by brakes is given back to the screw during the retardation, thereby avoiding a large waste of power when stations are frequent. The author enumerated many other advantages of his system, among which were

included the abolition of signalling arrangements, increased mean speed of travelling, and increased comfort due to more gradual acceleration and retardation of the train.

Owing to the late hour only a brief discussion was possible; and a very successful meeting terminated with votes of thanks to the president and vice-presidents.

E. G. COKER.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

NOTWITHSTANDING the comparatively small numbers attending the meeting of the association at Portsmouth, the audiences in Section H, which met under the presidency of Dr. W. H. R. Rivers, F.R.S., were well up to the average, at any rate in the morning sessions. In the afternoons the attendances were sometimes small, owing, no doubt, to the attractive nature of the local arrangements for the entertainment of members. In the circumstances it was thought advisable to abandon the sectional meeting on the afternoon of the naval display, and to adopt the unusual course of holding an evening session. The wisdom of the change was made apparent by the large audience which listened to the postponed papers by Mr. R. R. Marett and Prof. A. Keith.

The papers communicated to the section attained a uniformly high level: some may be counted as of first importance; and it is perhaps not unsafe to say that the discussions on totemism and on the institution of an Imperial Bureau of Anthropology will be of far-reaching effect.

The discussion on totemism, to which the whole of a morning session was devoted, was opened by Dr. A. C. Haddon, who explained that totemism was usually regarded as the association of definite human groups with non-human groups. After citing typical instances, he pointed out that even in Australia there was much variation, and other customs and beliefs might be present. Similar variability also obtained in other parts of the world, so that it had become extremely difficult to frame a definition of totemism that would hold good everywhere. Although it was primarily a social and not a definitely religious institution, in most cases it could not be distinguished from a religious sentiment. Dr. A. A. Goldenweiser remarked that all attempts to characterise totemism by a more or less definite set of features must needs be artificial. Consequently, its distinctive characteristics were not the individual features, but the relation into which they entered. Dr. Graebner, whose paper, in the unavoidable absence of the author, was read by the president, said that every attempt to account for the origin of totemism must first deal with the question whether this institution was a cultural entity, for if it were once conceded that the form of totemism found in different parts of the earth had arisen independently, there could be no justification for the assumption that it had had everywhere the same origin. An examination of the evidence from the South Seas, from Africa, from South and North America, and from Asia would appear to show that this was the case; there were no older forms from which group totemism could be derived. In the older form, in which totems were animals, there was an indefinite and unstable relation of sympathy between man and beast which could be explained simply by certain groups of men and animals having co-existed locally in a region of diversified physical character. Prof. Hutton Webster in his paper on the relations between totem clans and secret societies pointed out that secret societies, although acting as a native police in West Africa and Melanesia, were not consciously devised for this purpose. Investigation revealed the importance of the part played by them in funeral rites, and especially in initiation ceremonies at puberty. These and other features appeared to be closely connected with the structure and function of totemic clans, and he suggested that they had been transferred to the secret society in the course of the disintegration of ancient totemic groupings. In discussing methods of investigation, Prof. E. Waxweiler said that light could only be thrown on the question of totemism by the application of a scrupulously accurate method of analysis, which should be mainly sociological, *i.e.* it should consider the so-called totemic facts as being imposed by the conditions of organised social life amongst men. Further, its starting point should be "functional"; it must search for the social function from which totemism had sprung. Analysing the phenomena of totemism on these lines, it would appear that functionally it was a social device for sanctioning permanent situations, which were considered essential or peculiar in the organisation of the group, wherein individuals, or more frequently groups of individuals, appeared to remain.

The discussion on an Imperial Bureau of Anthropology was opened by a paper by Mr. J. Gray, who dealt specifically with the anthropometric work which might be carried out under the supervision of such a bureau, and laid stress upon its importance not only to the man of science but to the statesman and social reformer. Mr. T. C. Hodson, in a paper dealing with the ethnographic side of the work, gave an account in outline of the ethnographic and linguistic investigations instituted by the Government in India, the Sudan, and southern Nigeria, and dwelt on the importance of the extension and organisation of such work through a central body as a means of securing sympathetic administration of the affairs of dependent races and of ensuring that they should be trained on right lines to take their place as constituent parts of the Empire. In the discussion which followed the reading of the papers, Prof. J. L. Myres made a detailed survey of the efforts of the British Association at various times to obtain the cooperation of the Government, and expressed a hope that urgent pressure might bring Government departments and public opinion to a sense of the responsibility of this country for a proper record of our own population and of the ways of life of our large masses of native dependents abroad. Prof. Ridgeway recalled the memorials which had been presented to the Government by the Royal Anthropological Institute, and emphasised, by an apt citation of Mr. Crooke's paper on the cow in India, the importance to administrators and commercial men of the information concerning customs and beliefs which such a bureau would make accessible. The Rev. Dr. Bryce explained the organisation of the Canadian Ethnographical Survey, which had been set up as a department of the Geological Survey as a result of the representations made to the Canadian Government by the association at its Winnipeg meeting, and Prof. Hutton Webster gave a brief description of the work of the United States Bureau of Ethnology.

Among the remaining contributions to the proceedings, archæology held first place in point of numbers, although papers of an ethnographical character were more numerous than they had been for the last few years. With one exception, however, these dealt with particular points of research, and were not generally descriptive of a geographical or cultural area. The exception was Captain Rawling's account of the tribes of the Mimika district, of the tribes of the sea coast, and of the Tapiro pygmies encountered by the recent expedition to Dutch New Guinea, which is likely to provide ethnologists with material for discussion for some time to come. Mr. Crooke's paper on the reverence for the cow in India attributed the recent extension of the recognition of the sanctity of the cow, which had existed in a more restricted degree since Indo-Iranian times, to the rise of Neo-Brahmanism. Prof. Hutton Webster's paper on the origin of rest-days proffered an elucidation of Hebrew and Babylonian Sabbatical observances by bringing them into relation with the periods of communal cessation from work and of fasting, as a protective or conciliatory measure, among lower races on critical, usually seasonal, occasions. Mr. Hobley's account of the religious beliefs of the Akikuyu and Akamba of British East Africa dealt, among other matters of belief and ritual, with the *Thahu*, an analogue of the mediæval curse, and its effect on social custom and culture. Major A. J. N. Tremearne described the customs and beliefs of the Hausas in so far as these may be deduced from, or illustrated by, an analysis of their legends and folklore. Dr. C. G. Seligmann raised many points of interest in his important paper on the divine kings of the Shilluk. It is noteworthy that these kings, who trace their descent from Nyakan, a semi-divine founder, are sacrificed ceremonially when they become senile or

ill to avert disaster to men, crops, and animals. Mr. Malinowski's paper on the economic influence of the Intichiuma ceremonies opened up an interesting field of research by suggesting that in the totemic ceremonies of the Australian tribes we may find the educative influence which led man first to overcome the primitive reluctance to systematic, continuous, or periodic organised effort which is the essential feature of economic labour.

In physical anthropology, Prof. C. J. Patten communicated further results of investigations of division of the parietal bone in the crania of certain Primates. A group of papers was offered by Prof. Arthur Keith describing a cranium of Cro-Magnon type from Dartford, a second skeleton from Galley Hill, and fossil bones of man discovered by Colonel Willoughby Verner in a cave near Ronda, in Spain. These papers, in conjunction with a paper by Mr. R. R. Marett on the excavation of caves in Jersey, in which Mousterian implements were found associated with remains of Pleistocene mammals, and human teeth which Prof. Keith regards, on morphological grounds, as belonging to the most primitive human type yet known, gave rise to an interesting discussion on the antiquity of man.

In addition to the paper by Mr. Marett, the archæological papers included three papers on American archæology. These were a short account by Mr. Warren K. Moorehead of the classification of American types of artefacts made by a committee of the American Association and of the Anthropological Society, a description of the paintings in the Temple of the Tiger at Chichen Itza by Miss A. C. Breton, and a comprehensive account of the present position of archæological study in Peru by the same author.

The study of British archæology was represented by papers by the Rev. Dr. Irving on further finds of horse and other prehistoric mammalian remains at Bishop's Stortford; by Mr. T. Davies Pryce on excavations on a Roman fortified post on the Nottinghamshire Fosseway, covering the excavations of 1910 and 1911; an exhaustive summary of our knowledge of prehistoric man in Hampshire, by Mr. W. Dale; and a suggestive paper by Mr. O. G. S. Crawfurd on the early Bronze age in Britain, in which he endeavoured to trace the main lines of communication and indicate the chief centres of population from a study of geographical conditions and the distribution of Bronze age finds. A paper by Mr. A. L. Lewis entitled "Dolmens or Cromlechs," in which the author, as the result of comparative study of a large number of stone monuments, arrived at the conclusion that these were not the work of one race, but rather a phase of culture through which many races have passed, was especially interesting on account of its variance from the conclusion of Prof. Elliot Smith in his paper on the relations and influence of the Egyptians under the ancient Empire. The latter attempted to explain the distribution of megalithic monuments by the hypothesis that they were introduced into European culture by the Armenoid population in Egypt, of which he had found traces. The Armenoid or Celtic peoples who invaded Europe through the Balkan Peninsula, although they had acquired the use of metal from contact with the Egyptians in Asia, did not build megalithic monuments, because they were not acquainted with Egyptian methods of architecture. Egyptian archæology was further represented by papers from Prof. W. M. Flinders Petrie on his recent discoveries of Roman portraits at Hawara, and Mr. G. A. Wainwright's paper on his important discovery of iron beads of pre-dynastic date in unplundered graves at El-Gerzeh.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—The appointments made to the new chairs in the medical faculty in connection with the clinical school at the Royal Infirmary are as follows:—St. Mungo chair of pathology, Dr. John A. Teacher; Muirhead chair of obstetrics and gynæcology, Dr. John M. Munro Kerr; Muirhead chair of medicine, Dr. Walter K. Hunter; St. Mungo chair of surgery, Dr. Robert Kennedy.

MR. A. J. GROVE, 1851 Exhibition scholar, has been appointed supernumerary entomologist to the Indian Agricultural Service at Pusa, under the Indian Government.

THE foundation-stone of a new wing for the applied science department of Sheffield University was laid on September 28 by Judge Denman Benson. The buildings of the applied science department have become crowded, and the Drapers' Company has given 15,000*l.* for extensions. The total cost will be nearly 40,000*l.*, and towards this the sum of more than 8000*l.* is still required.

IT has been reported to the executive committee of Ruskin College, Oxford, that the late Mr. C. S. Buxton, formerly vice-principal of the college, son of Mr. Sydney C. Buxton, President of the Board of Trade, has bequeathed to the college the sum of 5000*l.* unconditionally. It is proposed to name the lecture-room in the new college buildings "The Buxton Hall," and a suitable memorial tablet will be erected.

THE programme of lectures and discussions arranged by the Child Study Society, London, for October–December includes the following:—October 19, "Co-education during Adolescence," Dr. A. Beresford Kingsford; November 2, "Psychology and Grammar," H. Holman; November 9, "Psychology of Speech," Prof. W. Rippmann; November 23, "Psychology of Reading," T. G. Tibbey; December 7, "Psychology of Mathematics," Dr. W. Brown.

AT the Sir John Cass Technical Institute, E.C., tomorrow, October 6, the inaugural lecture of a course on colloids will be given by Mr. E. Hatschek, his subject being "The Properties of Colloids and their Relation to Industrial Processes." On Tuesday, October 10, Mr. Hugh Abbot will give an inaugural lecture on the fermentation industries, entitled "A Review of Modern Practice in the Bottled Beer Trade"; and on Monday, October 16, Mr. J. S. S. Brame will lecture on "Coal for Steam Raising: its Purchase on a Scientific Basis and its Economic Use," being the inaugural lecture of the courses on fuel.

ATTENTION has been directed already (August 10 and September 21) to the new arrangements for the session 1911–12 at University College, London, in the faculties of engineering and medical sciences. The recent issue of the complete calendar of the college makes it possible to add to the information in the note referred to. The organisation of the department of applied statistics is being completed, and it now includes the Galton laboratory for national eugenics and the Drapers' Company biometric laboratory, under the direction of Prof. Karl Pearson, F.R.S. In the faculty of engineering a new lectureship in heating and ventilating engineering has been instituted.

THE Home Universities Committee held a meeting at the University of London on September 29 to arrange the subjects for discussion at the Congress of the Universities of the Empire to be held next summer. Each of the universities of the United Kingdom was represented by its Vice-Chancellor or his deputy, and various representatives from Government offices were also present. The suggestions received from overseas universities in response to the communications sent after the last meeting of the Home Universities Committee, and the report of a preliminary Conference of Canadian Universities, were considered. Some of the more important topics for discussion were decided upon, and the committee appointed a subcommittee to draw up a programme for the consideration of the full committee, which will meet again on November 4. A draft paper of subjects which the committee sent out in November last includes the following topics:—(1) university organisation; (2) universities in their relations to teachers and undergraduate students; (3) universities in their relation to post-graduate and research work; (4) universities in their relation to schools and to other agencies for higher education.

THE regulations for the establishment of a post-graduate scholarship in naval architecture, offered by the Royal Commissioners for the Exhibition of 1851, have just been issued by the Institution of Naval Architects. Candidates for the scholarship must be British subjects under the age of thirty who have passed with marked distinction through

a course of study in naval architecture at one of the following institutions:—the Royal Naval College, Greenwich; University of Glasgow; Armstrong College, Newcastle-upon-Tyne (Durham University); or University of Liverpool. The value of the scholarship is to be 200*l.* per annum, and it may be tenable in ordinary circumstances for two years. The holder will be required to engage in research work at some approved institution at home or abroad where special facilities are available for advanced study in naval architecture, and/or to investigate the development of the shipbuilding industry by attaching himself to some recognised firm or establishment at home or abroad. The results of research carried on by the scholar will be published in the Transactions of the Institution of Naval Architects if the council of the institution deem advisable.

IT is announced in *The Pioneer Mail* that the Secretary of State for India has recently sanctioned the modified scheme proposed by the local government authorities for the establishment of a technological institute at Cawnpore. The original scheme, which was put forward in 1907, on the recommendations of the Naini Tal Industrial Conference, proposed the formation of an institute with a staff of four technological chemists, and four assistant professors, with large laboratories. Financial considerations rendered its immediate introduction impossible, and it became evident that a more modest beginning must be made. The proposals, however, have been framed so as to admit of future expansion, and the new institute will be such that it can be adapted to form part of any more extensive organisation that may be required subsequently. For the present it is proposed to employ a chemist with four assistants to carry on research and to train students. Close to the institute will be a scientific library, which will be shared with the Agricultural Department. One of the main causes which operate against the success of scientific and technical research in India will thus be removed, and the staff of the new institute will be provided with facilities which in India are too rare. The sanction is conditional on funds being available from provincial revenues, but it is to be hoped that no difficulty will be experienced in finding such funds.

THE Department of Agriculture and Technical Instruction for Ireland has issued in the form of a pamphlet an article which appeared in its Journal (vol. xi., No. 4) on "Technical Education in Clonmel," by Mr. Cecil Webb, principal of the Technical and Day Trades Preparatory Schools, Clonmel. Mr. Webb points out that in the towns of the south of Ireland technical education often finds a difficult task, namely, to arrest decay and rekindle hope in a declining and disheartened population. Clonmel presents this problem. After reviewing the history of the attempts in Clonmel to develop a system of technical education, Mr. Webb directs attention to a special feature of the present scheme of instruction in the town. This has been the endeavour to make the work of the school a means of reviving the road carriage-building industry which, when the technical school was started, still existed in Clonmel in a precarious way. A class in coach-building was formed under a well-qualified local carriage-builder. The effect upon the local industry has been very gratifying. The design and construction of cars have greatly improved. At show after show through the country Clonmel cars have carried off the prizes. Their repute has spread, and summer and winter the coachbuilders in Clonmel are now kept busy. Such an effect could only be attained by the technological training which the school provided, being backed by enterprise and perseverance on the part of those engaged in the trade.

IN the recently published "Statistics of Public Education in England and Wales, Part i.," some interesting numbers are given referring to the further education or occupation of pupils above twelve years of age who left secondary schools on the grant list of the Board of Education during the year ending July 31, 1909. The table in which the information is contained is based on data collected by the schools and recorded for each pupil in the admission registers. The total number of such boys and girls was 38,200, and of these 6790, or 17·8 per cent., went to a place of further education; 6048, or 15·8 per cent., became teachers (including pupil-teachers) in elementary schools, or entered training colleges for elementary-school teachers; 11,136, or 29·2 per cent., entered upon some professional, commercial, or clerical occupation; 3356, or 8·8 per cent., entered upon some industrial or manual avocation; 1001, or 2·6 per cent., took up agriculture or some rural pursuit; and of the residue—9869, or 25·8 per cent.—12·8 per cent. remained at home, 2·4 per cent. went abroad, 1·2 per cent. left owing to illness or died, and in the case of 9·4 per cent. the occupation was unknown or unclassified. Another table shows that on January 31, 1910, there were in the secondary schools on the grant list 141,149 pupils, of whom 106,248 were twelve years of age or over. Of these, 23·5 per cent. were twelve and under thirteen; 26 per cent. were thirteen and under fourteen; 23 per cent. were fourteen and under fifteen; 15·7 per cent. were fifteen and under sixteen; 8·1 per cent. were sixteen and under seventeen; 2·6 per cent. were seventeen and under eighteen; 0·8 per cent. were eighteen and under nineteen; and 0·2 per cent. were nineteen and over.

THE Borough Polytechnic Institute authorities have issued a calendar under the title "Higher Education in Central South London," which takes the form of a joint prospectus of the Borough Polytechnic, Morley College, and affiliated evening-school centres. The varied programme of courses of study shows that the wants of every class of worker in the area served by the institute have been considered by the authorities, and met in a very thorough manner. Among other noteworthy departments of the institute may be mentioned the "national" school of bakery and confectionery, which forms a special department. It is managed—subject to the approval of the governing body of the polytechnic—by the Education Committee of the National Association of Master Bakers and Confectioners, which body contributes an annual sum not exceeding 500*l.* Any individual, society, or firm contributing not less than 25*l.* a year may appoint a representative upon the education committee. The London Master Bakers' Protection Society has contributed 50*l.* annually for some years past. A technical day school for boys has been founded for the purpose of affording opportunities for sound preparatory trade training, which will give London boys better chances of becoming skilled workers than they have hitherto had. The governors of the institute feel that the adequate training of bright boys who would be successful in various trades has been almost entirely neglected. They are of opinion that, owing to modern methods of manufacture, there is great need for the preparation of boys for trades on a broad basis, which will enable them to adapt themselves to changing conditions of employment and compete successfully in the industrial world. Boys are trained not to work mechanically, but to think for themselves. A similar trade school for girls has also been provided.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 25.—M Armand Gautier in the chair.—Paul **Appell**: The θ functions of higher degrees.—F. **Quénisset** and F. **Baldet**: The discovery of a comet at the Flammarion Observatory of Juvisy. The comet was noticed in the constellation Ursa Minor on September 23 as a slightly oval nebulosity, about 4′ in diameter, with a central nucleus. (For further particulars see Our Astronomical Column.)—A. **Demoulin**: The R and Ω surfaces.—A. **Blondel**: The influences of deadening the waves in orientation in wireless telegraphy.—M. **Reutter**: The analysis of a resin from an Egyptian sarcophagus. Besides mineral substances, there could be identified fragments of cypress or cedar wood, cedar resin, resins arising from styrax, mastic, Aleppo pine, and asphalte.—Jules **Cardot**: The mosses collected by the Antarctic expedition of the *Pourquoi-Pas?* The collection comprised thirty-four species, and enriched three genera of eleven species (seven of which are new), and two varieties (one new). The flora of the Antarctic region is poor compared with that of the Arctic region.—Paul **Marchal**: The obliteration of sexual reproduction in *Chermes piceae*.—E. A. **Martel**: The construc-

tion of roads and other works in limestone. It is pointed out that limestone is a dangerous material for public works, owing to the infiltration of water into fissures. In constructing roads and tunnels in limestone or dolomite, it should not be forgotten that these pseudo-compact rocks, owing to the existence of water in fissures and pockets, are especially delicate from the engineering point of view: very slight artificial derangement may have very serious effects on the stability of such a rock mass.—Ph. **Négris**: The discovery of the Carboniferous and Eocene formations at Mts. Guiona and Vardoussa, west of Parnassus.

CALCUTTA.

Asiatic Society of Bengal, September 6.—W. **Kirkpatrick**: Exogamous septs of the Gehara section of Kunchhandiya Kanjars. Whatever the social structure of the primæval hordes, the system which requires division into exogamous and endogamous septs and sections has taken on a fresh activity under Brahmanical influence. The exogamous septs of the Geharas are mostly of totemic origin, though an exogamous sept is not always totemic; one can be entirely independent of the other. An exogamous sept may be of local or communal origin, or it may be eponymous, as well as having an occupational origin. In the camp system of "marrying out" practised by the Kanjars and allied tribes of a Gypsy character we are near exogamy in its most primitive form.—Dr. P. T. L. **Dodsworth**: Some notes relating to the classification, habits, and nidification of the ravens of India. The author maintains that the Panjab raven is distinct enough from the Himalayan raven to be regarded as a distinct species, and should not be united with it into *Corvus corax*, Linn. Hume recorded it as different in note and in the sheen of the plumage, and Oates noted it as different in the character and shape of the throat hackles. It is a smaller bird. There is a need for extended observations on the Himalayan raven: (1) To what extent does it show a slight seasonal migration? (2) When does it nest? Mandelli took the eggs in Sikkim on March 5; Stoliczka found the bird building on May 4 at Aktash, and Walton near Kala Tso Lake in Tibet on April 6. (3) Does it habitually nest on cliffs? and (4) in successive years on the same site? (5) What is the number of eggs? (6) Do both birds share in hatching them? and (7) how long do the young stay in the nest? The author adds some observations on the nidification of the plains raven. Five is the usual number of eggs; the nest is built, 18 to 24 feet from the ground, of sticks, lined with rags, sheeps' wool, bits of paper, cows' hair, and grass. Various trees are chosen, such as *Acacia leucophloea*, *Dalbergia Sissoo*, and *Albizzia Lebbek*. When feeding these plains ravens are sociable, but in the breeding season they seem to scatter, and probably many cross into Afghanistan.—J. Coggin **Brown**: Shan and Palung Jew's harps from the Northern States. The Jew's harp used by the Shans and Palungs is distinct from all others in the presence of movable bamboo strips, by means of which the chamber in which the tongue vibrates can be altered and the tone changed in consequence.—R. K. **Bhide**: New and revised species of Gramineæ from Bombay. Diagnosis of the following new grasses:—(1) *Danthonia Gammiei*, from Castle Rock; (2) *Andropogon Paranjpyeanum*, from Castle Rock; (3) *Enteropogon Badamicum*, from Badami; and (4) *Tripogon Roxburghianum*, from Badami. Also a note on the identity of *Woodrowia diandra*, Stapf, with *Dimeria diandra*, Stapf.—I. H. **Burkill** and R. S. **Finlow**: *Corchorus capsularis*, var. *oocarpus*, a new variety of the common jute plant. *C. capsularis*, var. *oocarpus*, a variety distinguished by the elongation of its fruit, is a cultivated plant of south-eastern Mymensingh.—I. H. **Burkill**: The polarity of the bulbils of *Dioscorea bulbifera*, Linn. The bulbils of *D. bulbifera* are capable of growth from any part of their surface, but they grow most readily from the neighbourhood of the scar by which they were attached to the parent stem. If cut into halves equatorially, both hemispheres may put out shoots, and these shoots appear more readily near the cut than remote from it; but they appear in a much more restricted way on the abaxillary half (where almost all arise along the edge of the cut) than on the adaxillary half.—I. H. **Burkill**: Further spreading of *Croton sparsiflorus*, Morung. *C. sparsiflorus*, an alien which obtained an entrance into India by Chittagong, it seems, some fifteen to twenty years ago, and about 1905 reached the banks of the Hughli, and before 1907 had reached Gauhati along the Assam-Bengal Railway, has now reached Narayanganj, in a different direction. It has also appeared newly at many stations along the Assam-Bengal Railway.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part iii. for 1911, contains the following memoirs communicated to the society:—

April 4.—K. **Schwarzschild** and E. **Kron**: The distribution of luminosity in the tail of Halley's comet.

March 24.—K. **Stuchtey** and A. **Wegener**: The *albedo* of the clouds and the earth (measurements made during six balloon voyages).—G. **Hamel**: Contributions to the problem of turbulent motion.

May 13.—G. **Tammann**: Contributions to the thermodynamics of equilibria in systems each composed of a single substance, i.

May 27.—E. **Riecke**: The theory of Michelson's interference experiment.

June 17.—K. **Wegener**: Aërological results for 1910 from the Samoa Observatory.—P. **Furtwangler**: General proof of the partition theorem for *Klassenkörper*.—O. **Müggo**: The structure of magnetite and its transformation into specular iron ore.

July 15.—G. **Tammann**: Contributions to the thermodynamics of equilibria in systems each composed of a single substance, ii.

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