THURSDAY, SEPTEMBER 21, 1916.

CALCULATIONS FOR FLYING MACHINES.

The Design of Aeroplanes. By Arthur W. Judge. Pp. viii+212. (London: Whittaker and Co., 1916.) Price 9*s.* net.

AEROPLANE stability is not the only subject in which progress has been retarded in the early stages of aviation. It is not so very long ago that Prof. Herbert Chatley read a paper on the calculation of the stresses in aeroplanes, and at the conclusion up jumped "Mr. I Don't Agree With You" and said he "didn't think" the results would be of any value. The consequence of this system is that a person who is really an inventive genius has to spend the whole of his time in fighting against the opposition and prejudice of people who "*don't think,*" and he can produce original work only when he can get a post-graduate student or assistant to do the whole working of the necessary details.

As a result of this retardation the literature dealing with the strength of the materials used in aeroplane construction and the stresses in their component parts is quite inadequate for the efficient development of aerial locomotion.

So far as this book deals with details of experimental statistics, it fills a distinct want, and it is sure to receive favourable reviews in our engineering journals. But a great deal of the subject-matter is nothing more or less than boiled-down mathematics, and the process of boiling down has in some instances been conducted in rather an amateurish way; moreover, the book contains statements that are certainly misleading, if not worse, for they cannot be correct if read as they stand.

In the first place a large amount of space is taken up in the appendices with tables for the conversion of units and things of that kind, but no tables are given for use in logarithmic calculations. Now it will be seen that almost all the formulæ quoted in the book, whether empirical or theoretical, involve products and powers rather than sums and differences, and for the efficient use of these formulæ a working knowledge of the use of logarithms is indispensable. The author may tell us that the class of mechanic for whom this book is written does not know how to use logarithms; if that be the case, the sooner he learns the better. He would then be spared an immense amount of time in turning over pages and pages of tables and possibly not finding what he wants at the end. The practice of mixing up tables of mere results of arithmetical operations with tables of experimental data cannot be too strongly deprecated.

The treatment of such matters as moments of inertia is on the whole fairly satisfactory, but it would be better if the author had stated the theorem of parallel axes *in words,* besides giving the formula on p. 113. Experience in teaching elementary students shows that it is very difficult to get them to interpret even the simplest formula in a verbal statement.

The graphic method for constructing a curve the area of which represents the first or second moment of a given plane curve about a given axis is very suitable for teaching purposes, though for actual working an alternative representation could be obtained more easily by the use of a cubical parabola.

In connection with the relative merits and demerits of monoplanes and biplanes, statements are made on p. 31 which are on the face of them at variance with elementary considerations of common sense. We are told that a monoplane possesses a lower head resistance, due to the absence of separate struts, ties, etc., and that it possesses relatively smaller moments of inertia about the axes of symmetry. But it is surely obvious that the use of superposed planes renders it possible to reduce both the framework and the span with the same lifting area. If Mr. Judge's statements are true of actual machines, it must be as the result of circumstances other than the difference between the one-decker and the two-decker type of wings, and this should be explained; otherwise the statements are calculated to mislead.

There must, however, be something much more seriously in error in the statement of the "Bird Flight Data" quoted from Dr. Magnan's conclusions on p. 33. In the seventh line we are told that the total length of a bird in centimetres is equal to the cube root of the total weight in grams; in other words, that the relation between length and weight is the same as in a cube of water. Further, the area of the body is equal to the square of its length. In the next formula but one we are told that the weight of the wings in grams is 197 times the total loaded machine weight in grams. After this follow statements that the chord of the wing at the centre is 2·36 times, the length of the tail 2·6 times, and the real length of the body 5·9 times the cube root of the weight, which has already been stated as equalling the total length of the bird!

While, therefore, the present book is to be welcomed as a step in the right direction, it will be seen that the subject still requires further revision. Had it not been for the discouragement which Prof. Chatley's early efforts received as the result of "discussions" consisting in expressions of premature opinions based upon insufficient data, we do not doubt that by now Mr. Judge would have been handling the subject on more strictly scientific lines. G. H. B.

PALÆOLITHIC MAN.

Men of the Old Stone Age: Their Environment, Life, and Art. By Prof. H. F. Osborn. Second edition. Pp. xxvi+545. (London: G. Bell and Sons, Ltd., 1916.) Price 21*s.* net.

PROGRESS in the study of prehistoric man has been so remarkable during the last few years that the demand for a rapid succession of more

or less popular treatises on the subject is not surprising. Most of the original memoirs are in technical language in serials that are not generally accessible, and it is natural that critical summaries by those who have taken part in such research should be widely welcomed. The curiosity of the intelligent public, however, is so eager for satisfaction in many matters which are still beyond the pale of scientific knowledge that there is ever a temptation to make a book successful by pandering to this taste. Probabilities and possibilities which have been judiciously considered in scientific memoirs, and rightly used as tentative hypotheses, run the risk of being quoted as established facts; while unique, isolated discoveries tend to be treated as if they were sufficient for the absolute determination of their mutual relationships and could be used for definite conclusions.

We venture to think that Prof. H. F. Osborn has sadly failed to resist this temptation in his new handsome volume on the "Men of the Old Stone Age," which has reached a second edition in America within six months of its original publication. In every respect it is in strange contrast with such works as Huxley's well-known "Man's Place in Nature," which Prof. Osborn curiously omits both from his historical sketch and from his valuable bibliography of the subject. We are definitely told that modern geology "has firmly established eight subdivisions or stages of Pleistocene time—namely, four Glacial, three inter-Glacial, and one post-Glacial," which can be recognised in America as well as in Europe. We learn with equal certainty that Piltdown man is "four times as ancient as the final type of Neanderthal man," while Heidelberg man is nearly twice as ancient as the Piltdown man, "according to our estimates." The gravels in which Galley Hill man was found "are by no means of the geologic antiquity of 200,000 years assigned to them by Keith," but "lie within the estimates of post-Glacial time—namely, from 20,000 to 40,000 years." In fact, the dates of the successive stages in prehistoric man's progress are so exactly given and so often repeated that they cannot fail to deceive the unwary reader, who must feel especially impressed by their precision when he notes Prof. Osborn's warning that the odd 1900 years of the Christian era must be added to each statement when he desires to reckon time from the present day.

Prof. Osborn has, indeed, attempted with great labour to present a connected story which is distinctly premature, and will give the ordinary reader an exaggerated idea of the value of the conclusions already reached in prehistoric research. With the aid of several industrious compilers, whose services he acknowledges, he has produced a most useful and up-to-date compendium of the facts, with references to the original papers on which his statements are based. Each section is also most profusely and beautifully illustrated, often with original photographs which were made on a tour through France and Spain. We feel, however, that the collected materials have not been used with sufficient scientific discretion and adequate literary skill to produce a satisfying result. We would only add that for those to whom much of the text may prove difficult reading, the illustrations with their legends will still be a source of instruction and delight, while the excellent chapters on later Palæolithic art will be particularly appreciated. A. S. W.

THE NATURAL HISTORY OF HAWAII.

Natural History of Hawaii: Being an Account of the Hawaiian People, the Geology and Geography of the Islands, and the Native and Introduced Plants and Animals of the Group. By Prof. W. A. Bryan. Pp. 596. (Honolulu: The *Hawaiian Gazette* Co., Ltd.; London: G. E. Stechert and Co., 1915.)

THE suspicion that is awakened by the somewhat typical "American" puff that Prof. W. A. Bryan allows himself in the preface to the "Natural History of Hawaii" is dissipated when the book itself is read, and the author is to be congratulated on having produced a book that is at the same time readable, useful, and trustworthy. It gives the reader a very good general idea of the geology, geography, flora, fauna, and ethnology of the group, and it will be of especial value to residents who take an interest in the local natural history. There is a very large number of photographs, some of which are on too small a scale to be of any real use, while the details in others are lost on account of ordinary photographic, instead of orthochromatic (or similar), plates having been used. The voluminous indices are of great practical use.

The section on the people is disappointing in some respects; for example, it is futile in a popular book to say that "North, South, and Middle America, as well as Papua, Malay, China, Japan, and India, have each in turn been declared the cradle" of the Polynesian race, as the uninformed will be led to suppose that any of these alternatives is possible. We know more on this subject than the author admits to be probable. In view of the recent investigations into the problems of Polynesian ethnology, Prof. Bryan might have alluded to Dr. H. Allen's "Study of Hawaiian Skulls" (*Trans. of Wagner Free Inst. of Sci.*, Phil., v., 1898, p. 1), where a dual element in the population is demonstrated, though the conclusions thereon are possibly erroneous.

In dealing with the flora and fauna the author never loses sight of the problems of distribution; thus not only are the characteristics of the seashore, lowlands, and mountains described, but the variation that occurs from island to island and the significance of this are duly noted. In the case of the land snails, for example, great variation may occur, not only in different valleys, but in parts of the same valley, so that the Hawaiian group is a famous field for the student of variations.

Another good feature of the book is the careful manner in which native species are distinguished

from introduced species. Those who read the early reports by Dr. Perkins, of the British Association Committee, will remember how rapidly the endemic insects were being replaced by foreigners which had been introduced accidentally; this book deals with a further phase of that sad drama. We all know how successful the Americans of the United States have been in dealing with the problems of economic entomology, and in Hawaii this experience has proved most beneficial, for not only have the enemies of pests been acclimatised, but in the importation of insects to combat the spread of the injurious Lantana we have, we are told, "the first example in the world of the introduction of insects to prevent the spread of a plant." If one more grumble may be permitted, we would like to express surprise that any scientific man should adopt the popular but erroneous spelling for coconut; but to avoid an unpleasant concluding sentence it may be pointed out that all through the book there are occasional references to the ethnological aspect of certain plants and animals which are of interest to the ethnologist.

COLLOID-CHEMISTRY.

A Handbook of Colloid-Chemistry. The Recognition of Colloids, and their General Physico-chemical Properties. By Dr. Wolfgang Ostwald. Translated by Prof. M. H. Fischer. Pp. xii+278. (London: J. and A. Churchill.) Price 12*s.* 6*d.* net.

IT is stated in the preface that this book has passed through three large editions in Germany. We are inclined to think that such success was due more to the fact that it was first in the field as a general treatise upon a subject which was attracting widespread interest than to intrinsic merit. The ideas especially of the general theoretical portion are superficial, and the writing loose, words being mistaken for ideas. It is stated more than once, for instance, that the colloid state is independent of chemical composition. Taken literally, the statement is merely foolish. How foolish two examples will suffice to show. Azomethane, one of the most remarkable of colloid substances, loses its colloidal properties if a single hydrogen atom of its complex molecule is replaced by a halogen. Gold, silver, and platinum readily form colloidal solutions in solvents which contain a replaceable hydrogen atom, while the base metals form such solutions in hydroxyl-containing solvents. The author, however, does not really mean what he says. His many pages on the subject show that the thesis he is actually defending is the quite harmless one that for every substance some other substance can probably be found with which it will form a colloidal mixture.

The colloidal state is, to use Bredig's happy phrase, a microheterogeneous state of matter. It is the great merit of Picton and Linder that they made this clear. Dr. Ostwald characterises the different parts as "phases," and speaks of colloids as multiphasic systems. This is an unfortunate use of the word "phase," which Gibbs defined as a portion of matter "uniform throughout, not only in chemical composition, but also in its physical state." Probably the last thing we can claim for portions of matter of microscopic, and especially ultramicroscopic, dimensions is that they are physically homogeneous throughout. The misuse of the word "component" on p. 36, where it is confused with "phase," is probably an error of translation.

The least satisfactory part of the book is the section on surface energy. Here the author, by a series of unsound analogies, introduces unnecessary confusion in a region which Gibbs, Rayleigh, and van der Waals had reduced to order. The part dealing with special properties of colloidal solutions, such as molecular weight, viscosity, osmotic pressure, etc., gives, on the whole, a clear account of the work which has been done.

OUR BOOKSHELF.

The Practical Principles of Plain Photo-micrography. By George West. Pp. xii+145 +plates viii. (Dundee: University College, George West, 1916.) Price 4*s.* 6*d.* net.

IN this book plain and practical directions are given for the preparation of photo-micrographs with the use of powers up to a $\frac{1}{4}$-inch objective. The author very rightly insists that the beginner should commence with low powers, and as he gains experience proceed step by step to the use of the higher powers. A feature of the book is its "common sense": the tyro is not bewildered by a mass of details and scores of chemicals and solutions, but just a few are chosen and fully described which the author has used and found suitable, and throughout directions are given for the adaptation of simple apparatus to the end in view.

After a few pages of general introduction the subjects of microscope and powers, illuminants, colour screens and camera are dealt with; then follow sections on photo-micrography with a landscape camera, without a camera, and with a vertical camera. Next the details of the making of a photo-micrograph from beginning to end are given in dialogue form in the Sandford and Merton style, a method of instruction which personally we do not care for, but which enables the author to give many "tips."

The book is illustrated with two plates showing arrangement of apparatus and six other plates, each with two figures, reproductions of photo-micrographs of various objects. These are described in the text, and a very full table is given of all the details respecting them—nature of the object and its staining, lens, illuminant, screen, plate, exposure, developer, etc. These should be very useful, giving the beginner just the information he wants. Finally, lists of necessaries, photographic formulæ, books on photo-micrography (which might have been priced with advantage), and an index complete the book.

The book is well printed and the reproduction of the plates excellent, the price is exceedingly moderate, and we can recommend the work as an excellent one for the beginner.

Tunbridge Wells and Neighbourhood. Edited by H. R. Knipe. Pp. 207. (Tunbridge Wells: Pelton, 1916.)

THIS volume is a welcome addition to the series of local surveys which owe their origin to the annual congress of the South-Eastern Union of Scientific Societies. The series was begun by the "Survey and Record of Woolwich and West Kent," which was published in commemoration of the twelfth congress of the Union, held at Woolwich in 1907; and later surveys have been issued in connection with the congresses held at St. Albans, Hampstead, and Bournemouth. The present volume makes a notable addition to the series, despite the fact that, owing to the war, it has been brought out under special difficulties.

The South-Eastern Union of Scientific Societies is heartily to be congratulated on these surveys. They are all of them confessedly provisional; but if they are made the basis of patient and continued work, and if they open out beyond the biological and archæological fields to the civic and sociological fields as well, they will mark a great step forward in the much-needed development of regional survey. Two lines of development readily suggest themselves: that each year all the affiliated societies in the area in which the annual congress of the Union is to meet should map out in good time the contributions already available for a local survey and the ground which still requires to be surveyed; and that, after the annual congress has met, further work should be organised and the results printed at intervals uniformly with the congress volume, and so be readily incorporated.

There is always an abundant demand for guide-books of the popular and familiar kinds, but we see no reason why many towns and districts should not gradually provide themselves and their visitors with regional surveys, progressively developing in scope, exhaustiveness, and accuracy, and forming guide-books of a higher and a more intelligent order. Mr. Knipe and his collaborators are to be heartily congratulated on having provided the first draft of such a guide-book for Tunbridge Wells and neighbourhood. C. H. G.

Through South Westland. A Journey to the Haast and Mount Aspiring, New Zealand. By A. Maud Moreland. Second Edition. Pp. xviii +222. (London and Melbourne, Christchurch, Wellington and Dunedin: Whitcombe and Tombs, Ltd., n.d.) Price 6*s.* net.

THIS entertaining description of a five weeks' riding tour in South Island, New Zealand, gives an excellent impression of the character of the country traversed and much information as to the kindly disposition of the inhabitants. Both the text and the beautiful photographs with which the volume is provided will interest students of the geography and natural history of New Zealand.

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.*]

Life Assurance Tables.

YOUR article in NATURE for July 6, pp. 383–4, quotes me correctly "that life assurance business has been based upon mortality tables which represented the expectation of life under the relatively unhealthy conditions which existed a half-century ago"; and then, a few sentences later, the article makes the above quotation credit me with saying that the mortality tables were *published* "a half-century ago"—which I did not say.

Your article explains that the mortality table published in 1901, now in use by the assurance companies (of Great Britain?), is based upon mortalities observed by sixty assurance companies under the relatively unhealthy conditions which existed during the thirty years 1863 to 1893—that is, from more than "a half-century ago" (fifty-three years) to twenty-three years ago, *an average of thirty-eight years ago.* It is within the last thirty-eight years that the great advances in preventive and curative medicine (excepting vaccination) have been made.

The American Experience Table was compiled by Homans in the year 1868, and was based chiefly upon the mortality data of the Mutual Life Insurance Company of New York. These data therefore represent the relatively unhealthy conditions which existed in a period of time averaging considerably more than "a half-century ago." As the writers of the article on life insurance in the last edition of the "Encyclopædia Britannica" (p. 666, second column) say, the American Experience Table "is now in wider use than any other for computing the premiums of American companies." It therefore seems that my sentence, quoted in the first paragraph, thoroughly respected the value of understatement. W. W. CAMPBELL.

Lick Observatory, August 7.

Pre-Columbian Use of the Money-Cowrie in America.

IN NATURE of August 10 (p. 488) there was a notice of an article by Mr. C. B. Moore (published in the Journal of the Academy of Natural Science of Philadelphia, 2nd Ser., part ii., vol. xvi.) on the explorations of aboriginal sites in the Tennessee River valley, which raises the interesting question of the provenance of certain cowries found there. These are pronounced by Dr. H. A. Pilsbry, the well-known American conchologist, to be examples of the money-cowrie, *Cypræa moneta,* of Eastern Seas, and they have never been recorded before from an aboriginal mound in the United States. Nor has the species ever been recorded living on any of the shores of the Americas. To account for their presence in the Tennessee mound, Dr. W. H. Dall, another of America's leading conchologists, has suggested that the cowries "may have come off one of Columbus's own ships"!

In the Peabody Museum, Cambridge, Mass., is the dress of a Cree woman, collected by the Lewis and Clark Expedition, 1804–5, on which are four dozen cowries of the dwarf variety *atava* of *C. moneta* (see *American Anthropologist,* 1905, for picture).

Willoughby believes these cowries were sold to the Indians by the Hudson Bay Company in the late eighteenth or early nineteenth century.

Montgomery (Transactions of the Canadian Institute,

1910, ix. (1), No. 20, p. 7, pl. 4, f. 6) records and figures a cowrie found in the Serpent Mound, Ontario. It is a regular *C. moneta*, and it is suggested that "this is probably one from the Hudson Bay Company's stock."

But these suggestions entirely ignore the uses made of the cowrie in America. If Columbus and the Hudson Bay Company really introduced *C. moneta*, as these speculations demand, are we to assume that they also instructed the Indians in certain remarkable ceremonials practised with this shell in Africa, India, and China? Is there any reason for believing that Columbus was even aware of such uses, and if he were, that he should have had the foresight to take *C. moneta* with him, and have devoted the limited time he spent in America in teaching the natives some of the lesser-known elements of Indian and Chinese beliefs?

The money-cowrie is, and has been for centuries, a sacred object among the Ojibwa and Menomini Indians, and is made use of in initiation ceremonies of the Grand Medicine Society (see Hoffman, Bureau of Ethnology, 7th Annual Report, 1885–86 (1891), and 14th Annual Report, 1892–93 (1896); also NATURE, January 27, 1916, for abstract of paper by the writer).

The tradition among the Indians is that the original sacred shell came through a particular hero-god, who acted as intermediary between the Great Unknown and the Indians, and founded their Medicine Society.

The initiation ceremonies consist of much dancing and the shooting forward by the medicine men of their medicine bags containing the sacred cowries. Mystic powers are attributed to the shells, and it is firmly believed that if they be swallowed by the medicine man, all he is obliged to do to transfer his power to the medicine bag is to breathe on it, the mysterious power and influence being then transmitted by merely thrusting the bag towards the desired object or person. At initiation ceremonies the magic influence is shot at the candidate's breast, and the cowrie—the symbol of life—is supposed to enter his heart; he becomes unconscious and falls forward on his face. The chief medicine man then raises the candidate's head slightly from the ground, and a sacred cowrie drops from the candidate's mouth.

The same shells are used apparently at baptismal ceremonies of the Ojibwa (see Greenwood, "Curiosities of Savage Life"). There is the same dancing and shooting forward of the medicine bags, and after much facial contortion each medicine man spits out two shells.

The essential part of these ceremonies is the supposed death and survival of the candidate, and it is remarkable how closely the prevailing idea of the cowries being connected in some strange manner with resurrection and resuscitation agrees with the ancient Chinese belief as evidenced in the ceremonial use of money-cowries in obsequies of the dead. In pre-Christian and later times cowries were used in China, in association with rice, for stuffing the mouth of the dead. Wild rice, it might be added, also enters into the ritual of Ojibwa and Menomini ceremonies.

Manchester Museum. J. WILFRID JACKSON.

Notice of Possible Suspension of the Rules of Nomenclature in the Cases of Holothuria, 1758, vs. Physalia, 1801, and Bohadschia, 1833, vs. Holothuria, 1791.

IN accordance with the requirements prescribed by the International Congress of Zoology, notice to the zoological profession is hereby given that on or about October 1, 1917, the undersigned proposes to recommend to the International Commission on Zoological Nomenclature that the rules be suspended in the following cases:—

Holothuria, Linn., 1758 (type *physalis*), vs. *Physalia*, Lamarck, 1801 (type *pelagica*). The effect of suspension will be to retain *Physalia* as generic name for the Portuguese man-of-war.

Bohadschia, Jaeger, 1833, vs. *Holothuria*, Bruguière, 1791. The effect of suspension will be to retain *Holothuria* for the sea cucumbers.

The motion for suspension includes the following points:—

(1) Suspend the rules in the case of the generic names in question.

(2) Permanently reject *Holothuria*, 1758, type *physalis*.

(3) Validate *Physalia*, 1801, type *pelagica* (syn. *physalis*, 1758).

(4) Accept *Holothuria* as dating from Bruguière, 1791, despite the existence of *Holothuria*, 1758 (if rejected).

(5) Said suspension is not to be construed as invalidating any specific name.

The grounds for suspension will be:—(*a*) A strict application of the rules in these cases will result in greater confusion than uniformity, because (*b*) the cases involve a transfer of generic names, almost universally accepted in the sense given above since 1791 (for *Holothuria*) and since 1801 (for *Physalia*), to genera in other groups in connection with which they have been used by only a very few authors during more than 100 years.

The undersigned cordially invites zoologists to communicate, not later than September 1, 1917, to him or to any other member of the Commission, either their approval or disapproval of the proposed action.

C. W. STILES,
Secretary to Commission.

Office of Secretary to International Commission on Zoological Nomenclature, Smithsonian Institution, Washington, D.C.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

THE first report of the Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research was published in full abstract in the issue of NATURE for September 7, and has probably already been read by all who are interested in this important matter. It will therefore be unnecessary to refer in detail to the contents of the report, but it is essential to consider it in its broad aspects and thoughtfully to estimate its bearing as a contribution to the subject of much discussion and contention in the past two years.

One feature of the report is the degree to which it repeats much that has been said and written by British scientific men, engineers, and practical manufacturers in the public discussions which have taken place on this subject during the past twenty-five months or more, but without carrying the matter forward by the prescription of practicable remedies for recognised defects. The arguments for and against various actions are weighed with an air of detachment which gives to it rather the character of an interesting essay than the authoritative decisions of a committee possessing executive power. The public has, without doubt, looked

forward to this first report of a committee of eminent scientific men for a masterly, comprehensive, and effectual treatment of the whole subject which would at least outline the strategy of the campaign. The report gives us, however, a more or less tentative discussion of the problem, and sums it up with the rather vague statement that its solution depends upon the largely increased supply of competent researchers, and, secondly, upon a hearty spirit of co-operation among all concerned.

As regards actual achievement, the Council has found that the conditions imposed by the war made it difficult to deal with the problem of assisting pure scientific research effectually, and therefore decided to give science in its applications to industry precedence. Here again, however, obstacles were encountered, and the Council has therefore limited its action to affording financial assistance to about twenty researches which were suggested or begun by engineering or professional societies. It has also expended about 6000*l.* in securing the assistance in certain researches of about forty persons not taken up with other war-work.

In addition to this, there have been established certain Standing Committees on mining, metallurgy, and engineering. A section of the report is occupied with the discussion of the attitude of industry to scientific research, but we think most experienced manufacturers would say that the analysis of the subject does not go deeply enough into the difficulties on the commercial side. The causes which have been at work in retarding or preventing the manufacturer from availing himself more completely of scientific research are very complex, and not by any means due to sheer lethargy or want of foresight. The problem of fostering and encouraging scientific industry is, in fact, a very much less simple one than that of promoting scientific research, although the two act and react on each other in several ways. There would be no difficulty, apart from the present abnormal war-time conditions, in finding men of ability to take up scientific research as a life-work provided only the inducements to it are made sufficiently great, any more than exists in the case of other professions. So long, however, as the pursuit of original scientific investigations remains a blind-alley occupation, or is only capable of being followed in the leisure moments of other work, such as teaching, or by men of independent means, so long will it fail to attract a large number of young men of ambition and ability to its pursuit.

What is required is the formulation of a scheme by which men who have decided or proved talents for pure scientific research can be enabled to devote themselves to it as a life-work with just as much opportunity for reasonable or exceptional emoluments as in other professions. It is said that if scientific abilities were properly utilised in industry such positions would be forthcoming, but having regard to present conditions we are in a vicious circle. If pure scientific research is of national importance, then it behoves the nation to make its pursuit possible as a profession apart from any connection with industry. It is, therefore, much to be regretted that the Council has not been able to formulate even in outline some more definite proposals with this end in view. The establishment of scholarships or temporary engagements at 150*l.* a year or so does not meet the case. There must be the prospect of such permanent and well-paid work as shall induce men of high abilities to take up research work as the business of their lives.

With regard to the relations of industry and science, the report does not furnish recommendations of any very definite character. It is realised by the Council that manufacturers and men of business have not any reluctance to avail themselves of scientific assistance or advice provided they can be shown that expenditure on it is an investment and not a mere speculation. Hesitation to embark on it is not always to be regarded as an indication of disbelief in its utility, but is determined very much by the scale of the business. A small concern, or one of moderate capitalisation, simply cannot afford to wait long for a return on an investment of capital. It must be certain of it within a limited time if it is to continue to exist at all. Moreover, of late years manufacturers have lived in an atmosphere darkened by the clouds of incessant contests with labour, and with the uncertainties arising from legislation directed rather by the interests of parties and politicians than by any serious attempts to support the staple industries of the country. Hence they have been compelled to take short views, and not launch out into enterprises which might bring them no appreciable return. Until these deep-seated difficulties are cleared away, it is therefore futile to reproach the individual manufacturer or manager with his backwardness in availing himself of scientific research.

The report supplies, however, a large amount of interesting information which shows that, under the pressure of circumstances, many trade associations, originally formed merely to fix prices, regulate production, or battle with labour, are now turning their attention to co-operative scientific inquiry as a means of relieving themselves of difficulties created by foreign monopolies of manufacture. In this effort it is probable also that the Advisory Council and its Standing Committees will perform the very useful function of being a clearing-house for ideas, suggestions, and inquiries, and act as guide, philosopher, and friend to these associations who are thus endeavouring to work out their own salvation. There is only one way in which the British manufacturer can meet the threatened post-war competition, and that is by standing shoulder to shoulder with his fellows against the common foe. Isolated they will be destroyed in detail, but as a phalanx they will prevail. The Advisory Council will, no doubt, fulfil a very important function in being a centre

to which confidential information and inquiries may be directed in the first efforts to establish and conduct that conjoint scientific work which such co-operation of kindred trades will require.

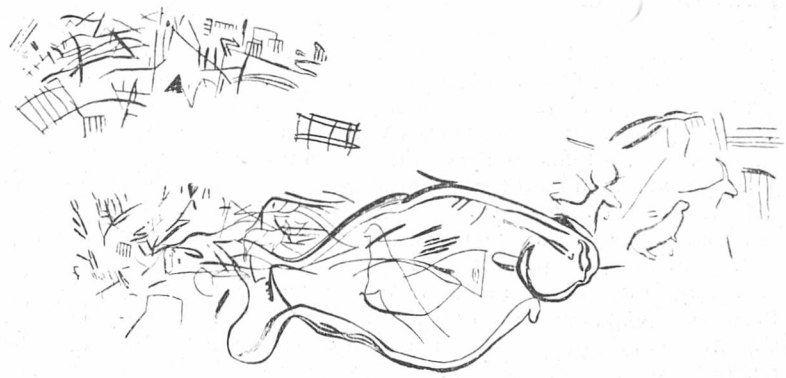
Turning, then, to that section of the report which deals with the sphere of the universities and technical colleges in relation to scientific research, we find the same absence of positive constructive suggestions for reform as in other portions of the report. The defects or deficiencies of our present conditions are pointed out, but the remedies for them only indicated in the most nebulous manner. It is stated with great truth that "the universities can and must be the main sources of research in pure science, the discoveries in which lie at the root of all practical and technical applications." But no definite recommendations are made as to how this output is to be increased.

It should be clearly recognised that effective research work of a high class demands a continuity of effort and time which it is in many cases almost impossible to obtain for university teachers. A man who has to drop his observations or experiments at a critical moment to go off and give a lecture or attend a committee or superintend a laboratory class is not placed under conditions in which the best work can be done. On the other hand, there are many men who are admirable and capable as teachers and as college administrators who have not the gifts of originality which make them shine as investigators. The only way out of this difficulty is to separate the functions more clearly. Every university should have research professorships and chairs, the occupants of which should have as their principal work to enlarge the bounds of knowledge in their particular subject.

The report does not furnish us with any definite proposals for the establishment of such research scholarships, fellowships, or professorships, but confines itself to the enunciation of broad and general aspirations in this respect. The universities will have suffered greatly by the close of the war in the loss of many of their most promising and talented students and teachers whose valuable lives have been given in the service of their country. We have to make provision for the careful cultivation of originality and research power in those who remain or return, and it would therefore have been much to the point if we could have found in this report a carefully-considered programme with this object in view. We think that many who study the report will feel disappointed that it does not contain more definite pronouncements of constructive policy in place of generalities. Much of it has the tone of an able article written for a leading monthly magazine rather than the enunciation of the matured conclusions and decisions on the part of a Government-appointed Committee recording the results of more than a year's consideration of this vital subject. Time presses, and our national position now demands vigorous and well-determined action rather than leisurely and academic discussion of our needs. J. A. F.

THE ART OF THE CAVE.[1]

IN "La Pileta" a further considerable contribution is made to our knowledge of the Jurassic caves of South-west Europe by Abbé Breuil, in collaboration with Dr. Obermaier and Col. Willoughby Verner. The cave, which takes its name from the hill in which it is found, is, with its various corridors, recesses, and "galeries," more than usually complicated, and in fact at certain periods it provides accommodation for a stream and a lake. Wherever the cave opens out to form a chamber, wall paintings are to be seen, and it is these paintings which constitute the chief interest of the cave. The paintings comprise examples of four separate pictorial phases. The earliest are yellow in colour, and consist largely of serpentine forms with an occasional realistic figure of a goat, ox, or horse. The second series in chronological order is red in colour, and here, in addition to animal forms, are to be found various signs or symbols—recurrent dots, lines, spirals, ovoid figures, "claviformes" and "tectiformes." These are followed by a series drawn with charcoal, in which forms of animals naturalistically treated largely predominate, among them, be it noted, in considerable numbers the figures of fish—a new feature in parietal art, as the authors point out. With these are interspersed serpentine forms and schematic figures of animals. It is among these last figures that the authors believe they can recognise figures intended for human beings, and that an attempt has even been made to indicate the sex. The fourth and last series is purely schematic, and comprises geometrical figures with little or no zoomorphic or anthropomorphic suggestion. The vast majority of the figures are pectiniform, the number of teeth and the orientation of the backs of the combs exhibit-



Panneau No. 49, dit du grand Poisson. From "La Pileta."

[1] "La Pileta à Benaojan (Malaga) (Espagne)." Par l'Abbé H. Breuil, Dr. H. Obermaier, et Col. Willoughby Verner. Pp. 65+plates i–xxi. (Monaco: A. Chêne, 1915.)

ing a wide variation. In several cases the combs are combined to form composite figures. In the opinion of the authors the four phases represented extended over a long period, from Aurignacian to Neolithic times. The pictures are, although inferior in execution, closely related to those of Altamira, Niaux, and Font de Gaume, while the signs and symbols follow closely the rock engravings of Portuguese South-east Africa.

The most outstanding feature is the appearance of fish among the animal forms. The fish represented are of the Plaice or Brill family, and form the only instance so far known of fish painted on the walls of a cave, although engravings of fish have been reported from Pindal, Niaux, and "La Gorge d'Enfer." The book is admirably illustrated, and maintains in every way the high level which we have come to associate with the publications of the Institut de Paléontologie Humaine de Monaco. WILLIAM WRIGHT.

BACTERIOLOGICAL RESEARCH IN BOMBAY.

THE report of the Bombay Bacteriological Laboratory for the year 1914, by Major W. Glen Liston, reached this country recently. The report is divided into two parts: (1) that dealing with plague work, and (2) that dealing with general preventive medicine. Statistics are furnished which tend to show that the uninoculated are attacked three times more frequently than the inoculated (against plague). One drawback to the use of plague vaccines is the severe reaction which follows, deterring others from undergoing the operation. It is now suggested, as results of experiments on rats and observations on man, that a small initial dose of 1–2 c.c. should be given, to be followed in a week by a second dose of 2–4 c.c. It appears that there are two other species of fleas of the genus Xenopsylla—viz., *X. brasiliensis* and *X. astia*—besides the originally known species *X. cheopis*, which, however, forms 80 per cent. of the three species concerned. Whether they all transmit plague is a question which must arise. The results of the examination of rats in the laboratory show that both in the case of *M. rattus* and *M. decumanus* there is a rise above the mean in the rate of infection in the latter half of January, whereas the rise above the mean in human plague mortality occurs in the first half of March. The fall below the mean occurs at the same time for both species of rats and for man—viz., in the first half of June. The summit of the infection for *M. rattus* precedes that of *M. decumanus* by a fortnight, while the infection of the latter and the mortality in man reach their maximum at the same time—viz., in the latter half of April.

It is disheartening to see in connection with the prevalence of guinea worm in the town of Ranebennur that years have passed in a fruitless discussion of various plans to improve the water supply of this town. The guinea worm infection is 1·45 per cent. In the village of Desai it is calculated that the extermination of guinea worm would result in a net gain of 219 rupees per annum. Here, as elsewhere, sanitation always means a net cash gain in the end. The nature of rat-bite fever is unknown, but the fact that salvarsan rapidly cures it suggests a spirochæte origin. A "number of cases" came under observation; but why not state the actual number? The report, though short, contains much of interest and evidence of good, sound work.

J. W. W. S.

NOTES.

WE record with deep regret the death on September 16, in his seventy-third year, of Sir Lauder Brunton, Bt., F.R.S., consulting physician to St. Bartholomew's Hospital, and of high distinction by his work and teaching in physiological medicine.

WE regret to see in the *Morning Post* the announcement of the death of Prof. Pierre Duhem, professor of theoretical physics in the University of Bordeaux, and the author of several works of wide interest on the history of natural philosophy and physical subjects.

ONE of the incidental effects of the European war upon America is the stimulus it has given to the adoption of the metric system. Very many American factories now turning out munitions for the Allies are working almost entirely in metric dimensions. Even locomotives are being manufactured in metres and millimetres. "The same thing, in all likelihood," says the New York *Evening Post*, "is taking place in England, which is furnishing munitions for Russia and other of her Allies."

A NEW YORK telegram announces the death on September 18, at sixty-six years of age, of Mr Seth Low, president of Columbia College from 1889 to 1901, during which period the college became Columbia University. Referring to his work for the university, the *Times* says: "He did much by his businesslike administration, his liberality (he personally contributed 200,000*l.* to the fund which enabled it to be removed to its magnificent site on Morningside Heights, New York City), and his especial interest in the department of political science."

THE Sociedad Argentina de Ciencias Naturales, of Buenos Aires, which issues the journal *Physis*, has arranged to hold meetings similar to those of the British Association, every two years, in one of the towns of the Argentine. No scientific assembly of this kind has hitherto been held in South America. The first meeting will be held at Tucuman in the last week of November next, in commemoration of the first centenary of the declaration of the independence of the Argentine Republic in 1816. Tucuman is the busiest and most populous town in the north of the republic. It possesses a university, a Museum of Natural History, of which Prof. M. Lillo is director, two agricultural experiment stations, and other institutions of scientific interest. The Governor of the State, Don Ernesto Padilla, is honorary president of the local committee for the meeting. The president of the whole assembly will be Prof. A. Gallardo, director of the Buenos Aires Museum; and the Minister of Public Instruction will be the honorary president. There will be nine sections, which, with their presidents, will be as follows:—I., Geology, Geography, and Geophysics, M. Enrique Hermitte; II., Palæontology, M. Carlos Ameghino; III., Botany, Prof. C. M. Hicken; IV.,

Zoology, Dr. E. L. Holmberg; V., General Biology, Anatomy, and Physiology, Prof. J. Nielsen; VI., Anthropology, M. J. B. Ambrosetti; VII., Physical and Chemical Sciences, Prof. E. H. Ducloux; VIII., Applied Natural Sciences, M. T. Amadeo; IX., Education in the Natural Sciences, Prof. V. Mercante. The general secretary of the Congress is Prof. M. Doello-Jurado, to whom communications should be addressed at rue Perú No. 222, Buenos Aires.

THE *Morning Post* of September 13 gives a brief account of a ship constructed of concrete with steel ribs, ordered by M. Broström, the Swedish Minister of Marine. The ship appears to be about one thousand tons in displacement, and resembles a large barge It is said that it is proposed to construct concrete ships of from 15,000 to 20,000 tons displacement, and a vessel of 3000 tons is now under construction. Our contemporary is not correct in describing this ship as the first stone vessel ever floated. Thus *Engineering* of June 14, 1912, gives a description and drawings of the first reinforced-concrete pontoon built in this country and used for sludge pumping on the Manchester Ship Canal. This vessel was constructed on the Hennebique system, designed by L. G. Mouchel and Partners, of Westminster, and was 100 ft. long by 28 ft. wide by 8·5 ft. deep; there were four transverse and two longitudinal bulkheads, and a complete installation of steam-pumping machinery. The first reinforced-cement boat appears to have been built by M. Lambot-Miravel in 1849, and was exhibited at the Exposition Universelle of 1855. An early example of ferro-concrete barge-building is the vessel completed in 1906 for M. Grancher, of Aveyron, in France, and employed regularly for sand dredging. Numerous other barges and pontoons of this type of construction have been built for use on the Tiber, Panama Canal, and elsewhere. There are, no doubt, possibilities in the development of ferro-concrete vessels, but we do not expect to hear in the near future of Transatlantic liners built on this plan.

IN the autumn of 1815, the year of Napoleon's final downfall, the Société helvétique des Sciences naturelles was founded at Geneva. It may, however, be called the offspring of two earlier societies, one representing the physical, the other the biological side of science, the older of which dated from 1791, and had thus survived the troubles inflicted by the French revolution. Small at first, it grew rapidly, and among the foreigners who attended its jubilee were Frankland and Tyndall. From the first it was a publishing society, and has now issued a fiftieth volume, in commemoration of its centenary, which was celebrated last year. This consists of reports from leading members of the society, which cover every branch of its work in the past and at the present time, together with short biographical notices of the workers themselves, many of them never to be forgotten by any scientific lovers of the Alps. The result is a very interesting volume, which will also have a permanent value in facilitating reference to the more important papers—and these are not few—which have been published by the Society. It has dealt with almost every branch of natural knowledge, for a mountain chain like the Alps propounds to the physical geologist not a few difficult problems, and as its climatic zones range from temperate to polar regions, it affords successive illustrations of their flora and fauna. The volume, in short, summarises the work of at least three generations of enthusiastic naturalists, workers at geology, physical geography, and meteorology, botany and zoology, past and present, and archæology (among whom we must not forget the earliest investigators of pile dwellings). One of the society's committees has also greatly aided in the systematic study of glaciers. It is interesting to learn that the idea of these having once extended far beyond their present limit occurred independently, in the year of the society's birth, to an engineer, Ignace Venetz, and to a chamois hunter of the Val de Bagnes named Perraudin.

THE *Electrician* was started as a weekly journal in 1861, when telegraphy was almost the only electrical industry. It came to an end in 1864, but was revived in 1878, at a time when the applications of electricity were becoming more numerous, and since then has always occupied a leading place amongst the electro-technical journals. In commemoration of the appearance of the 2000th number, which was issued on September 15, special articles are included in the number dealing with the development of the various branches of the electrical industry, and written by experts. As they touch on the principal events only, they are not too long for the general reader, and should prove of great value to the worker in one branch who wishes to know something of the history of those parts of the industry with which he is not immediately brought into contact. In addition to these historical articles there are others dealing with the present position of affairs in the industry and in the country which deserve careful consideration. Dr. Walmsley, as a teacher, urges the authorities to stop depleting the universities and technical colleges of the engineering and chemical students whose services will be so much needed by the country when the war is over. While on one hand the report of the Committee of the Privy Council for Scientific and Industrial Research expresses the pious hope that "voluntary efforts of manufacturers in friendly union" will succeed in raising the general level of manufacture in this country, on the other we find Mr. Swinburne putting forward the view that the manufacturer should be left to work out his problems in his own way.

IN the September issue of *Man* Prof. Seligman illustrates and describes a primitive form of reaping knife used by the sedentary Arab tribes of northern Kordofan. It can scarcely be called a sickle, consisting of an iron blade, more or less razor-shaped, and having at right angles at each end a small tang, which is thrust into a wooden handle. The blades are said to be made by the Arabised descendants of the pre-Arab iron-working Nuba, who still dwell on the hills which dot the plains of northern Kordofan. In reaping the dura the heads are cut off, with only a few inches of stalk, the stems being left in the ground until thoroughly dry, when they are pulled up and used for thatching, fencing, and other purposes. He remarks that this example may possibly indicate the purpose of a form of stone knife found in Europe in Neolithic times, as in the pile dwellings of Locras, whence comes the specimen now in the Sturge collection.

MR. W. H. D. LE SOUEF has reprinted from the Journal of the Royal Geographical Society of Australasia an interesting paper on "Aboriginals' Culinary Methods and Kitchen Middens." He remarks that, as regards food, little came amiss to them that was not absolutely poisonous. They did not eat any animal or bird they found dead unless they knew how it had been killed, and not even then unless it was fairly fresh, as they objected to meat that was much fly-blown. Slightly tainted meat did not trouble them much; they only cooked it a little more. Some of the mounds at which they used to cook their food are of large extent, as much as 100 ft. in diameter. Unfortunately many of these have been occupied by rabbits, and have thus suffered much injury. As

many of the kitchen middens along the coast are becoming eroded, the author suggests that a photographic record of them should be prepared before it is too late.

IN the Memoirs of the Connecticut Academy of Arts and Sciences (vol. v., 1916, pp. 1–96, plates i.–xxxix.) Dr. G. F. Eaton publishes an exhaustive report on the human skeletons from Indian graves at Machu Picchu, Peru, obtained by the Yale University Expedition of 1912. Most of the burials were in caves, and the mummies seem to have been placed sitting in the contracted position. A large proportion of the skeletons were imperfect, and Dr. Eaton suggests that many deficiencies were caused by accident when the mummies were temporarily removed from their burial places during festivals, in accordance with a well-known custom under the rule of the Incas. Of 164 skeletons collected, no fewer than 109 were certainly of females, while most of the male skeletons represented individuals of inferior physical development. Bronze and bone implements, objects of green chloritic schist, earthenware spindle-whors, and fabrics both of llama's wool and of vegetable fibre, besides a large collection of well-preserved pottery, are also described and figured. The rare articles of post-Columbian or European origin are to be regarded as having been introduced after the original burials.

SINCE the classic work of Gaudry on the late Miocene or early Pliocene mammals occurring in bone-beds at Pikermi, near Athens, discoveries of deposits containing similar mammalian remains have multiplied in eastern Europe. During recent years many have been made, especially in southern Russia, and various preliminary notices of them have appeared. Madame Marie Pavlow has now thoroughly investigated these discoveries, and published the results in a handsome memoir which forms the third and fourth livraisons of vol. xvii. of the *Nouveaux Mémoires* of the Imperial Society of Naturalists of Moscow. A description of the geological formations whence the fossils were obtained is appended by Prof. Alexis P. Pavlow. So far as known, the Russian fauna, with the usual preponderance of Hipparion, is remarkably like that of Pikermi, the only striking difference being the absence of the true Rhinoceros. After describing remains of giraffes, Madame Pavlow discusses a well-preserved skull of Palæotragus, which she maintains is an antelope, not a giraffe, as supposed by Forsyth Major. There are also remains of other well-known antelopes and gazelles, a few fragments of deer, and a fine skull of the large pig, *Sus erymanthius*. Several skulls of a hornless rhinoceros, Aceratherium, closely related to a species found at Maragha, in Persia, are important as making known several growth-stages. The numerous skulls and jaws of *Hipparion gracile* are also valuable for the same reason. Teeth of Mastodon, Dinotherium, and Orycteropus occur, and there are some fragments of Carnivora, including the skull of a large cat related to the American Miocene Pogonodon. Madame Pavlow has already made many welcome contributions to our knowledge of the newer Tertiary mammals of Russia, and she is to be congratulated on the manner in which she has presented the latest results of her researches.

BEFORE the war Russian men of science, and especially biologists, had to send a very considerable proportion of their writings abroad for publication, and the German journals thus became the common medium for much of the best Russian work. Soon after the outbreak of war efforts were made to remedy this state of affairs; of the new journals, Profs. Skimkewitch and Dogiel are editing the *Russian Journal of Zoology*, Profs. Sewertzoff and Elpatiewsky the *Revue Zoologique Russe*, and Prof. Dogiel the *Archives Russes d'Anatomie, d'Histologie et d'Embryologie*. The first number of the latter has just appeared; it contains an article in English by A. Mamimov on "The Cultivation of Connective Tissue of Adult Mammals *in vitro*," and two memoirs in French, one by the editor on the structure of sensory nerve-endings in the beak and tongue of birds, and another by A. N. Sewertzoff on the morphology of the skull and head muscles of Cyclostomes. The excellence of these researches, no less than of the typography and illustrations, is a happy augury of the success of this new journal, on which Prof. Dogiel of Petrograd is to be heartily congratulated. It is of particular interest to note that, in spite of the enormous drain on the Imperial finances, the Minister of Public Instruction, Count Ignatiev, made the publication of this journal possible by a Government subsidy.

IN the Nouveaux Mémoires de la Société Impériale des Naturalistes de Moscou, M. G. A. Belogolovy records some very remarkable experiments on the development of the frog Pelobates. The experiments were undertaken with the view of throwing some light upon the factors that are concerned in bringing about the phenomena of recapitulation in ontogeny. Their significance from this point of view may be regarded as somewhat obscure, but at any rate they have yielded some very curious results, and perhaps it is not too much to say that they have opened up a new field in the domain of experimental embryology and pathology. The author's intention was to rear the embryos as parasites upon adults of the same species, instead of as free-living individuals in their normal aquatic environment. He introduced the eggs into the body-cavity of the adult through an incision in the body-wall, and found that they attached themselves to the surface of the various viscera, etc., and in the course of a few weeks developed into highly abnormal structures, sometimes permeated by blood capillaries apparently derived from the tissues of the adult, through which they derived their nutriment. These results will probably be of interest to pathologists rather than to embryologists, especially from the point of view of those engaged in cancer research. The necessary operation appears to be a very simple one, but the animals treated as hosts to the parasitic embryos remained alive but for a few months, and then only when kept in water. The memoir is well illustrated, the histological features of the parasites being represented in two very beautiful and elaborate coloured plates.

THE *Bull. Imp. Acad. Sci.* (Petrograd, May, 1916) contains the description of a new species, differing in many essentials from other species, of Helicoprion, *Helicoprion clerci*, so named in honour of Onisime Jegorovič Klerk (O. Clerc), president of the Ural Naturalists' Society. Accompanying the description are drawings in natural size of the five fragments found at Krasnoufimsk. So far only two species have been discovered in Russia—*Helicoprion bezsonovi* and another, hitherto undescribed, found by A. P. Ivanov in the Government of Moscow. The well-known American naturalist, C. R. Eastman, directed attention in 1905 to the instructiveness and unexpectedness of certain palæontological discoveries of recent years, pointing out specially Pareiasaurus among the Reptilia, Helicoprion among the Pisces, and Dæmonohelix among the problematical forms. The nature of this last fossil has now been finally settled. Eastman,

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as an ichthyologist, focussed his attention on Helicoprion and allied forms, Edestus and others. Since then the interest in them has not waned, and the literature of the subject grows apace.

THREE valuable essays appear in the Proceedings of the Birmingham Natural History and Philosophical Society, vol. xiv., part 1. The first of these is by Mr. Leonard J. Wills, on "The Structure of the Lower Jaw of Triassic Labyrinthodonts." The author's investigations were based upon fragments of Labyrinthodont mandibles found in the Lower Keuper Sandstone of Bromsgrove, Worcestershire. The author comes to the conclusion that the Stegocephalian mandible helps to bridge over one of the gaps between the fishes and the reptiles. The jaw of the latter can be derived from the Stegocephalian mandible by a fusion or suppression of some of the elements, such as was probably taking place, even in Permian and Triassic times, in the case of the coronoid bones. The second concerns the geology of the eastern boundary fault of the South Staffordshire coalfield. The author, Mr. W. H. Foxall, describes the coal-beds, the Red beds, the Bunter Pebble beds, and the Glacial drift. The third, illustrated by numerous photographs and diagrams, is contributed by Prof. W. S. Boulton, who deals at length with the problems presented by an Esker near Kingswinford, South Staffordshire. The events recorded, the author believes, happened towards the close of "the Ice age, when the ice had ceased to advance; when, indeed, it was melting faster than it could be replenished from the northern Highlands, and the ice-front, in consequence, was slowly retreating northward."

SOME authoritative statement is required to discourage the popular belief that the heavy rains experienced this summer are connected with the bombardment in France and Flanders. In the Meteorological Office Circular, No. 3 (August 21) there is a note on the subject. Experiments to test this hypothesis have been made in Europe, America, Alaska, and Australia, but without result, and there is no evidence of any such influence. Furthermore, the energy of the heavy bombardment now proceeding, even if applied entirely to the removal of the heat required to produce rain, which it is not, would be inadequate for the purpose. Nor must the spells of brilliantly fine weather be forgotten. These occurred while the bombardment was proceeding.

IN an article in the *Geographical Review* for August, 1916 (vol. ii., No. 2), on the pirate coasts of the Mediterranean, Miss E. C. Semple points to the parallel between the hunting grounds of the German and Austrian submarines and those of the ancient and mediæval corsairs. Mediterranean piracy has recrudesced whenever maritime political control is relaxed, and certain localities determined by geographical conditions are the natural hunting-ground of the sea-robbers. The configuration of the basin has always compressed traffic into certain narrow routes. From these routes traffic is unable to deviate, as it can in the open ocean. The nodal points on the routes—that is, where land restricts traffic to a more or less narrow strait—have been especially favourable to pirates. Not only are they more sure of much prey at these points, but they stand a better chance of escape to their lurking places along the indented coasts. The paper is an excellent survey of the physical conditions of the Mediterranean that on one hand favoured legitimate seamanship, and on the other that debased form which manifests itself as piracy.

THE report for 1915 of the director of the Liverpool Observatory, Bidston, shows that the ordinary work of the observatory has been carried out during the past year, while progress has been made in at least one direction. Besides the Milne seismograph, a new instrument, designed by Mr. J. J. Shaw, has been erected to record the tilt produced by the oscillations of the tidal load in the neighbourhood, and is working with good results. The number of earthquakes registered during the year is 195. A small record was obtained of the Carlisle earthquake of October 2, the oscillations of which lasted for a quarter of an hour.

ATTENTION may be directed to the Monthly Record of Meteorological Observations, published by the Meteorological Service of Canada, of which we have received the number for March. It contains in a convenient form the complete meteorological data of some thirty stations in Canada, and also from Newfoundland and Bermuda. The publication contains two maps, one illustrating the total precipitation for the month, and the other the departure from the average temperature for the month. In addition to the stations providing detailed records, there are a large number for which only the monthly means and the extremes are given. There is, of course, a lack of data from the north of Canada. The monthly record contains no discussion of the data.

THE value of fique, the fibre of *Furcraea gigantea*, in Colombia is emphasised in a short article in Kew Bulletin No. 7 by Mr. M. T. Dawe, Director of Agriculture in Colombia. It is used for the soles of the native shoes or alpargatas, sacks, girths, ropes, matting, and even for roofing the houses. For the latter purpose the green leaves are used, and the article is illustrated by a photograph showing a cottage thatched with the leaves of fique. Hand-prepared fibre is sold in the Bogotá market at 6*d*. per lb., but by using modern machinery a profit of 19*l*. per ton might be expected if the fibre sold at its present wholesale price of 160 dollars per ton. On export with a selling price of 25*l*.–30*l*. per ton a profit of 5*l*.–10*l*. per ton should be realised.

WITH a view to the ultimate production of a portable dry storage cell, M. Charles Féry has, with the help of his pupil, M. E. Fournier, examined quantitatively the chemical changes which take place in the ordinary storage cell. His results will be found in the January number of the *Journal de Physique*. He finds that neither the simple theory of sulphation of both positive and negative plates first put forward by Gladstone and Tribe, nor the later theories involving the production of an unstable higher sulphate at the positive plate are in agreement with the measurements. In the first place, the amount of sulphuric acid which disappears during the discharge of the cell is half that required by the double sulphation theory. In the second place, the change of weight of the positive plate is much less than it should be according to that theory, and takes place in the opposite direction. His final conclusion is that the reactions which take place during discharge of the cell may be represented by the equation

$$Pb + H_2SO_4 + Pb_3O_7 = PbSO_4 + H_2O + 3PbO_2,$$

or possibly by

$$Pb + H_2SO_4 + Pb_2O_5 = PbSO_4 + H_2O + 2PbO_2,$$

The former involves the production of 15 grams of peroxide per ampere hour, the latter 10·4. In actual practice 12 to 14 grams are produced.

OUR ASTRONOMICAL COLUMN.

THE VARIABLE NEBULA IN CORONA AUSTRALIS.—A somewhat extended investigation of this remarkable object—N.G.C. 6729—has been made at Helwân with the Reynolds 30 in. reflector, and a brief account of the observations, with illustrations, has been given by J. H. Reynolds (*Monthly Notices*, R.A.S., vol. lxxvi., p. 645). The thirty-seven photographs taken during 1914 and 1915 clearly demonstrate that the nebula is variable in form as well as in brightness, and it seems probable that its variability is closely related to that of the variable star R Coronæ Australis, to which it appears to be attached. The appearance is such as might be expected if the nebulous matter was discharged from the star when at its maximum brightness and illuminated by it.

Further particulars are given by Mr. Knox Shaw, who took the photographs. The forms of the nebula can be classified into seven types, ranging from the first, in which the nebula is very bright and attached to the star, to the seventh, where the nebula is very faint and entirely detached. There is, however, no simple relation between the form of the nebula and the magnitude of the star; the nebula is brightest when the star is brightest, but is not always of the same form for a given magnitude of the star. It seems quite possible that the apparently imperfect correspondence between the variations of the nebula and those of the star may be caused by the presence of absorbing matter lying between them and the earth. If this absorbing matter were of varying thickness and in motion, it would naturally complicate the phenomena, but it is not suggested that this is the main cause of the variability.

PROPER MOTIONS BY THE BLINK-MICROSCOPE.—A further report on the use of the blink-microscope (see NATURE, vol. xcvi., pp. 237 and 438) in the detection and measurement of proper motions has been issued by Mr. Innes (Union Observatory Circular, No. 35). The greater part of the report refers to the comparison of eight astrographic plates taken at Greenwich, at intervals approximating to twenty years, and forty-three proper motions of stars ranging in magnitude from 7·1 to 13·5 are tabulated. As an indication of the rapidity of work by this method, Mr. Innes states that the investigation of the eight regions, including the identifications and reductions, occupied only twenty-four hours, although there was no attempt to make a record. Every pair of plates confirmed the impression that the vast majority of stars, bright and faint, are relatively fixed, and the measures were made on this assumption, the numerical work then being very slight. If plates are taken with a view to their ultimate examination by the blink-microscope, Mr. Innes considers that long exposures should be given, as crowded regions are a great advantage. Triple images are unnecessary, and double images are also superfluous if a third plate be available.

THE PERIOD OF U CEPHEI.—A discussion of Wendell's observations of this well-known eclipsing variable has been undertaken by Martha B. Shapley (*Astrophysical Journal*, vol. xliv., p. 51). The observations were made at Harvard during the years 1895–1912 with a polarising photometer, the total number of comparisons being 17,296; they have a special value because the instrument, method of observing, and comparison star were the same throughout this long period. As the light at minimum is constant for about two hours, Wendell observed mainly the steepest part of the ascending or descending branch, and in most cases the time at which the star was at a specified magnitude—say, 8.40—can be determined from the observations with an uncertainty of less than a minute. Variations in the mean phases of both steep branches are apparent, and there is evidence that the variation is not in the duration of minimum, nor due to variability of the comparison star, but a definite change in the light period. When all the observations since the time of discovery in 1880 are considered, it is evident that they are not satisfied either by Chandler's elements (1903) or by those of Wendell (1909). The latter serve best as a working formula at the present time, but would probably predict the minima too early. The variations are apparently very complex, and no attempt has yet been made to obtain an analytical expression for them. Wendell's formula is

$$\text{Min.} = \text{J.D. } 2407890{\cdot}3007 + 2{\cdot}4928840d.\,E$$

with zero phase at the midpoint of minimum light. The mean magnitude at minimum is 9·14, and at maximum 6·81.

MR. JOHN ANGELL.

ON September 9 there passed away in the person of Mr. John Angell a figure notable in the educational world of Manchester. He was born in London in 1824, and in his early educational career was chemical assistant to Prof. Thos. Graham, F.R.S., professor of chemistry in University College, London, and was hon. secretary to the Birkbeck School Committee, whose school was the first established in Great Britain with the object of demonstrating both the desirability and the possibility of teaching soundly and rationally the elements of science as leading everyday subjects in the ordinary day school. In 1852 he accepted an appointment at the Salford Mechanics' Institute as head of the Boys' School established therein, and five years later became the organiser of the day and evening classes of the Manchester Mechanics' Institution, then established in a new and commodious building in that city, where he remained for twelve years, resigning his position in 1869 to accept the senior science mastership in the Manchester Grammar School, then under the vigorous direction of Mr. F. W. Walker, afterwards master of St. Paul's School, London. Mr. Angell remained at this post for eighteen years, during which period he greatly raised the reputation of the school by his energetic and intelligent teaching of science, especially in the subject of physics. He was an enthusiastic disciple of George Combe, whose teaching, as exhibited in his work, "The Constitution of Man," as he said, "completely revolutionised the course of my life." He was an ardent and enlightened exponent of the "Socratic" method of instruction, which he applied with much success in the courses he gave in chemistry, physics, and physiology to day and evening pupils during his career at the Manchester Mechanics' Institution. In 1868 the Institution was visited by a French Imperial Commission appointed to visit and report upon secondary education in England and Scotland. In its report it has nothing but praise for the methods of teaching in use. "If he selects a reagent, it is because some pupil suggested it; if he obtains a gas in his analysis, he has already caused his students to predict its nature. . . . 'My object,' as this excellent teacher told us, 'is to train the intellect through the study of science.'" His work as a teacher received the approval of such men as Drs. Joule and Angus Smith, and Profs. Clifton, Williamson, and Roscoe. He ceased his duties as a teacher in 1887, but continued his keen interest in scientific subjects in association with many of the literary and scientific societies of Manchester of which he was an active member almost to the day of his death at the ripe age of ninety-two. He was the author of many once widely used science textbooks.

AURORA AND MAGNETIC DISTURBANCES OF AUGUST 27, 1916.

WITH reference to the aurora reported by Mr. W. F. Denning at Bristol on August 27, between 2 and 4 a.m. G.M.T. (NATURE, August 31, p. 551), the Director of the Meteorological Office notes a report received from Mr. J. Ernest Grubb, observer at Seskin, near Carrick-on-Suir, Co. Waterford, Ireland, that aurora was visible there on the night of August 26 between 10.5 and 10.40 p.m. G.M.T. The greatest display noted by Mr. Grubb occurred about 10.25 p.m., when streamers from N.W. to N.N.E. stretched to within 20° or 30° of the zenith. The light was sufficiently brilliant to illuminate the interior of a room facing W.N.W.

At Eskdalemuir, Dumfriesshire, in spite of a cloudy sky, auroral glow in the N.W., was reported by the observer at 9 p.m. on August 26 and 1 a.m. on August 27. The magnets at Eskdalemuir and Richmond (Kew Observatory) were considerably disturbed, especially at the former station. The full amplitude of the disturbance there in the north and vertical components cannot be assigned, owing to the limit of registration being passed, but the range in each element considerably exceeded 400 γ ($1\gamma \equiv 1 \times 10^{-5}$ C.G.S.), and in the west component it was fully 300 γ. At Kew the ranges of the horizontal force and vertical force were approximately 250 γ and 200 γ respectively. Declination at Kew had a range of 27′, the most rapid movements occurring early on August 27; the extreme easterly position was reached at about 2.5 a.m., and the extreme westerly at about 2.35 a.m.

A notable feature, especially at Eskdalemuir, was the "sudden commencement," introducing the storm at about 7.45 p.m. on August 26. Its oscillatory character was particularly well shown in the north component, a very rapid fall of 11 γ preceding a rapid rise of 100 γ. After this commencement the horizontal component at Eskdalemuir and Richmond (Kew Observatory) remained above its normal value until about 10 p.m., when it fell below normal and remained so, while oscillating considerably, during the rest of the disturbance. The depression in the horizontal component at Kew Observatory at 6 a.m. on August 27, when the storm was nearly over, exceeded 100 γ. An interesting feature in the vertical force curves at Eskdalemuir towards the end of the storm after 6 a.m. on August 27 is a series of oscillations of short period, averaging about 4·6 minutes, which recall a similar phenomenon observed there in the storm of November 5-6, 1915.

THE display of Aurora Borealis on August 26–27 was observed by Dr. John Satterly in Canada. Writing from Jackson's Point, Lake Simcoe, Ontario, Dr. Satterly says that on August 26 the whole northern sky from horizon to zenith was illuminated for several hours. On the horizon there was a strong yellowish glow with streamers radiating upwards. Arcs of light encircled the zenith, and flickering bands and patches of colour were seen in middle altitudes. The smallest newspaper headlines could be read at 11 p.m. On August 28 the northern lights were feeble, but at 10.30 p.m. (Eastern time) an immense riband of light, practically a complete semicircle, spread across the sky. It extended from the east and rose a few degrees south of Jupiter, threaded Pegasus diagonally, cut Cygnus, passed through Lyra to the north of Vega, and dipped down through Hercules to the west. Stars in their apparent rotation passed across it, so that the band was fixed relatively to the earth. The arc intersected the Milky Way at about 60° or 70°, very nearly at the zenith; it was much brighter and narrower and more definite than the Milky Way. No portion of the arc appeared in the northern sky. At 11.15 p.m. the western half faded away gradually, and at 11.30 p.m. the eastern half vanished.

THE SAKURA-JIMA ERUPTION OF JANUARY, 1914.

PROF. OMORI has recently published a second valuable memoir on the eruption of Sakura-jima, which occurred on January 12, 1914.[1] The volcano lies in Kagoshima Bay, in South Japan, a few miles to the east of the city of Kagoshima. Until the last eruption Sakura-jima was an island. It is now connected by a lava-stream with the east side of the bay. The part of the bay lying to the north of Sakura-jima ranges in depth from 70 to 107 fathoms, and is apparently of the same origin as the deep lakes which are found behind the sea-coast volcanoes of Usu-san and Tarumai-san.

Displacements of the Ground.—Soon after the eruption it was noticed that the sea-level had undergone an elevation relatively to the adjoining coast. At high tides the low districts at the south end of Kagoshima were flooded. Along the north-west and north coasts of Kagoshima Bay the rise of the water was still greater, embankments and stone walls being damaged and extensive rice-fields devastated. The amount of the sea-level elevation was nearly a metre at Kagoshima and two metres or more in Sakura-jima. The apparent sea-level elevation was greatest at the end of 1914, after which it began to decrease.

Prof. Omori attributes this change to the depression of the ground in the neighbourhood of Sakura-jima in consequence of the great eruption. This depression was revealed with greater precision by a renewal of the Military Survey levelling of the district and of the levelling along the railway lines near Kagoshima Bay. Prof. Omori has represented the results on a map on which are drawn the curves of 50, 100, 300, and 500 mm. depression. The curves of 300 and 500 mm. run close to the coast of the northern portion of Kagoshima Bay. The axes of these curves, which are directed north and west respectively, intersect in a point lying off the north coast of Sakura-jima, and Prof. Omori regards this point as indicating the centre of the area of greatest depression of the ground. The total depression-volume within the 100-mm. curve is 1·35 c. km. The aggregate volume of lava flows and pumice and ash ejection during the recent explosion is about 2·2 c. km.

It is important to notice that the point of maximum depression, which probably coincides with the principal centre of the lava reservoir, lies, not under Sakura-jima, but in the region between it and the active volcano of Kirishima.

The triangulation surveys of 1898 and 1914 also reveal considerable displacements, both horizontal and vertical, in Sakura-jima, while the coast of the island is everywhere depressed. Three points in the interior have been raised 0·14 and about 9·7 and 10·4 metres. The horizontal displacements in the north-west of the island vary from 2·04 to 3·62 metres towards the south, and in the west and north by amounts from 1·08 to 4·52 metres towards the north and north-east. The north and south portions of Sakura-jima have thus been displaced outwards in contrary directions.

[1] "The Sakura-jima Eruptions and Earthquakes." II. Bull. Imp Earthq. Inv. Com., vol. viii., 1916, pp. 35–179. The first memoir was noticed in NATURE, vol. xciv., p. 289; see also vol. xcii., pp. 716–17.

Moreover, displacements of 0·53 to 0·95 metre along the west coast of Kagoshima Bay converge with those in the west and north of Sakura-jima towards an elliptical area which agrees roughly with the area of greatest depression.

Propagation of Sound-Waves.—Prof. Omori divides the sounds which accompanied the eruption into three groups: (1) the early sounds heard from about 10 a.m. to the afternoon of January 12; (2) the strong detonations from 6.30 p.m. on January 12 to 6 a.m. on January 13; and (3) the much weaker sounds of the after-explosions for about ten days following the great eruption. All these sounds were heard within two entirely detached areas, and it is remarkable how similar these areas are in form and to some extent in magnitude. The area which includes the volcano extends in each case in an easterly direction, the mean radius of the boundary being 111, 114, and 102 km. for the above three classes of sounds. The second area lies to the north of the other, and is elongated from west to east, the mean radial distance of its central line from the volcano being 195, 177, and 196 km. The width of the silent zone was 40–50 km. for the strong detonations and about 108 km. for the after-explosions, the axis of the silent zone, in both cases, being at a distance of about 120 km. from Sakura-jima. The greatest distance to which the detonations were heard is about 500 km. (or 310 miles) towards the north-east, but the air-vibrations were strong enough to shake houses and doors for about 85 km. farther in the same direction.

C. DAVISON.

THE BRITISH ASSOCIATION AT NEWCASTLE.

SECTION E.

GEOGRAPHY.

OPENING ADDRESS (ABRIDGED) BY EDWARD A. REEVES, F.R.A.S., F.R.G.S., PRESIDENT OF THE SECTION.

THE surveying equipment of the pioneer explorer of early days, say, of from twenty to sixty years ago, usually consisted of a sextant and artificial horizon, a chronometer or watch, prismatic compass, boiling-point thermometers, and aneroid. With the sextant and artificial horizon the astronomical observation for latitude and longitude were taken, as well as those for finding the error of the compass. The route was plotted from the compass bearings and adjusted to the astronomically determined positions. The latitudes were usually from meridian altitudes of the sun or stars, and longitudes from the local mean time derived from altitudes east or west of the meridian, compared with the times shown by the chronometer, which was supposed to give Greenwich Mean Time.

The sextant, in the hands of a practical observer, is capable of giving results in latitude to within 10″ or 20″, provided it is in adjustment, but the difficulty is that the observer has no proper means of testing for centring and graduation errors.

The great drawback to the sextant for survey work is that it is impossible to take accurate rounds of horizontal angles with it, since, unless the points are all on the same level, the angles must be too large. It is essentially a navigator's instrument, and nowadays has been almost entirely superseded by the theodolite for land-surveying.

As regards the longitude, the difficulty was always to obtain a steady rate for the chronometer, owing principally to the unavoidable oscillations and concussions met with in transit. Formerly it was customary to observe lunar distances for getting the Greenwich Mean Time instead of trusting to the chronometers, but these, even with the utmost care, are very unsatisfactory.

In more recent years the occultation of a star method of finding the Greenwich Mean Time superseded almost entirely the lunar distance, but all these so-called "absolute" methods of finding longitude are fast becoming out of date since the more general introduction of triangulation and wireless telegraphy.

Heights of land were usually obtained by the boiling-point thermometer or aneroid.

This, then, was the usual equipment of the pioneer. With such an outfit the greater part of the first mapping of Africa and other regions of the world was carried out, with results that were more or less trustworthy according to the skill of the explorer and the time and opportunities at his disposal.

In recent years considerable improvement has been made in the instruments and methods of the geographical surveyor; the introduction of the invar tape for the measuring of the base lines, the more general application of triangulation, the substitution of the theodolite for the sextant, the use of the plane-table for filling in the topographical details of the survey, the application of wireless telegraphy to the determination of longitudes, these and other improvements have all tended to greater accuracy and efficiency in geographical and topographical mapping, so that in many respects the rough approximate methods of the earlier explorers are fast being superseded by instruments and methods more in keeping with modern requirements in map-making.

Still, the principle underlying all surveying is the same, and the whole subject really amounts to the best and most accurate methods of measurement with a view of representing on a plane, on a greatly reduced scale, the leading features of a certain area of the earth's surface in their relatively correct positions; and so it resolves itself into geometrical problems of similar angles and proportional distances. This being the case, it is clear that it becomes in the main a question of correct angular and linear measurements, and all the improvements in survey methods have had for their object the increased accuracy of accomplishing this, together with greater facility for computing the results.

What we do now is exactly what was attempted by the early Greek geometricians and others in ancient times, only we have far more accurate instruments. If, for instance, we compare our modern micrometer theodolite with the old scaph of the Greeks the contrast is striking, although both had the same object in view as regards taking altitudes of heavenly bodies. Many of the old instruments, in spite of their great size, were extremely rough, and the angles could only be read with approximation or to a great extent by estimation, while the theodolite, which is now generally used on geographical surveys, although it has circles of only five inches in diameter, can, by means of the micrometers, be read to 2″ of arc, or even to 1″ by careful estimation. This, when one comes to think of it, is a triumph of refinement, since it really means that we can measure to within about 1/80,000 part of an inch, which is something like the space occupied by 1″ on the arc of a circle of 5-in. diameter. At least this is the theoretical accuracy, but in practice there are, of course, errors in sighting, setting the micrometer wires, and those arising from other sources which have to be taken into consideration.

The continued striving after greater accuracy of measurement applies not only to angular measuring instruments, but to linear distance measurement as well; and the improvements in apparatus for this purpose, could we follow them in detail, would be most interesting. From the rough methods that would suggest themselves naturally to early intelligent men,

to the modern base-line apparatus, and accurately computed sides of a geodetic triangulation, is a far cry, and the advance in this matter is certainly remarkable.

So far what I have said has had chiefly to do with some of the earlier attempts at surveying and map-making, and the instruments and methods by which these have been carried out; and I will now try to give you an outline of what has been done in comparatively recent times, and state briefly the present position of various parts of the world as regards the condition of their mapping and the survey basis upon which their maps depend.

Little by little civilised man, by his daring, his love of adventure, and the necessities of events and circumstances, has penetrated into the unexplored parts of the earth and pushed back the clouds and mists that so long shrouded them from his knowledge, until at the present time the regions that are entirely unmapped are very few indeed, and do not amount to more than about one-seventh of the whole land-surface of the globe, including the unexplored areas of the polar regions, which may be either land or water. Not content with a mere vague acquaintance, he has striven for greater accuracy, and has turned to various branches of science and called them to his aid, in order that he may obtain more correct knowledge and a better comprehension of the earth's features. To enable him to fix with definiteness the position of places upon its surface, map out the various land-forms, and obtain their accurate measurements, he has consulted the astronomer and mathematician. Commencing with the rudest instruments and measuring apparatus, these, as greater accuracy was required, have gradually been improved, until the present-day appliances and equipment of a surveyor are wonders of refinement and delicacy.

I have attempted to form an estimate of the condition of the world's surveys for 1860 and 1916; and, taking the total area of the land-surface of the earth together with the unknown parts of the Arctic and Antarctic regions which may be either land or water, to be 60,000,000 square miles, I have obtained the following results :—

	1860 Sq. stat. miles	1860 Proportion to whole	1916 Sq. stat. miles	1916 Proportion to whole
1. Mapped from accurate topographical surveys based on triangulation or rigorous traverses	1,957,755	= 0·0326 or roughly $\frac{1}{30}$	8,897,238	= 0·1482 or roughly $\frac{1}{7}$
2. Mapped from less trustworthy surveys, chiefly non-topographical	2,017,641	= 0·0336 or roughly $\frac{1}{30}$	5,178,008	= 0·0866 or just over $\frac{1}{12}$
3. Mapped from route traverses and sketches	25,024,360	= 0·4170 or roughly $\frac{5}{12}$	37,550,552	= 0·6258 or little less than $\frac{5}{8}$
4. Entirely unsurveyed and unmapped	30,997,054	= 0·5166 or just over $\frac{1}{2}$	8,350,794	= 0·1391 or little less than $\frac{1}{7}$

These proportions can perhaps be more clearly seen from the following diagram (Fig. 1), on which numbers and tintings have the same significance as on the maps and table.

From the figures here given it is plain that with the same rate of progress as that of the past sixty years or so it would take more than four hundred years more to complete the accurate trigonometrical surveying and topographical mapping of the earth's land-surface, including the parts of the polar regions that may possibly be land—that is, the 60,000,000 square miles which we have taken for this total area; but this will certainly not be the case, since the rate at which such surveys have been carried out has been greatly accelerated during recent years, owing to the rapidly increasing demands for accurate topographical maps, improvements in methods, and other causes, so that it will possibly not be half this time before all the parts of the earth's surface that are likely to be of any use to man as settlements, or capable of his development, are properly surveyed and mapped. There are, of course, regions, such as those near the poles and in the arid deserts, that are never likely to be accurately triangulated and mapped to any extent, and it would be mere waste of time and money to attempt anything of the kind.

From its very foundation the Royal Geographical Society has had a remarkable influence on the surveying and mapping of the earth's surface, and especially those parts of it which have been previously but very imperfectly known or entirely unexplored. I think it must be admitted that this influence has increased as years have gone by, and it is no exaggeration to say that it has done more in this respect than any other body. It is therefore perhaps fitting that I should give some account of what has been accomplished, as it has a direct bearing on route-surveying and mapping by travellers and explorers. It is not only by the awarding of annual medals to explorers whose journeys have resulted in an increase to our geographical knowledge, and the more accurate surveying and mapping of little-known parts, that the society has stimulated and encouraged geographical research, but it has also assisted financially numerous expeditions, and the money thus granted has enabled many a man to carry out his explorations to a successful issue,

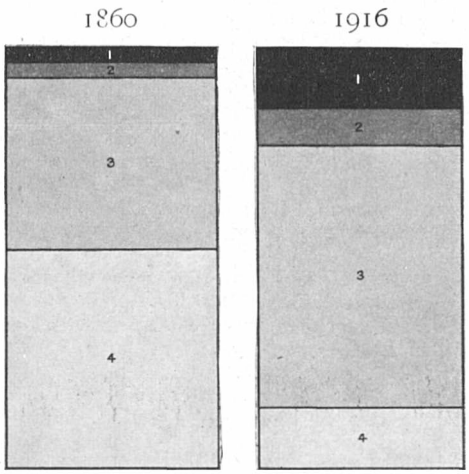

FIG. 1.—Relative condition of world surveys in 1860 and 1916.

which he otherwise could not have done for want of funds. Still more frequently has it been the case that travellers going into little-known parts of the world have been granted loans of surveying instruments which they could not otherwise have taken, and encouraged to do what mapping they found possible. Altogether 331 expeditions have been lent instruments, and about 38,500*l.* have been devoted to grants of money by the society to further geographical exploration and surveying.

There is still another way, by no means the least important, in which the Royal Geographical Society has done much to promote geographical surveying, and that is by providing suitable instruction in the work of surveying for travellers. It is all very well to grant money and lend instruments, but the important thing is to know how to make good use of the money and the instruments so as to take proper advantage of opportunities afforded and to produce the best surveys and maps of the regions visited. In the early days of the society a man had to pick up the requisite knowledge as best he could, but in 1879 a scheme of proper instruction was started at the suggestion of the late Sir Clements Markham, who was then one of our honorary secretaries. This had small beginnings, but in recent years has made rapid strides, until at present

it forms one of the most important parts of the society's work. This course of instruction in geographical surveying, which has now been in existence for about thirty-eight years, was first conducted by my predecessor, the late Mr. John Coles, and, since he resigned in 1900, has been under my charge. Altogether 725 surveyors and explorers have received instruction, without reckoning special large classes of forty or fifty men which during the past few years, until the outbreak of war, were sent to us by the Colonial Office to learn the more elementary parts of compass-traversing and mapping.

Now as regards the future. The demand for properly trained geographical surveyors has been steadily increasing in past years, and is likely to be still greater as time goes on. After the termination of the war there will be much work to be done, especially as regards the surveying of new boundaries, and freshly acquired districts in Africa and elsewhere; and it would be wise to make preparations for this well ahead.

The future surveyor will be in a much better position than his predecessors, not only on account of the improvements in instruments and apparatus for his work, but because, in many parts, a good beginning has been made with the triangulation to which the new surveys can be adjusted. In Asia a considerable amount of new work of this kind has been done over the frontier of India in recent years by the Survey of India, among the more important of which are the connecting of the Indian triangulation with that of Russia by way of the Pamirs, the surveys of Sir Aurel Stein, Dr. de Philippi, and others. The many boundary surveys that have been carried out in Africa, the triangulations of Egypt, the Sudan, East and South Africa, and other parts of the continent are well advanced, and will be of the utmost value to the future surveyor. One of the most important lines is the great triangulation which, it is hoped, will some day run across the continent from south to north, from the Cape to Egypt. Owing to the energies of the late Sir David Gill, this important chain of triangles has already got so far as the southern end of Lake Tanganyika; the part to the west of Uganda, near Ruwenzori, has also been finished, and it now remains to carry the chain through German East Africa and down the Nile Valley. The latter, it is hoped, will by degrees be accomplished by the Sudan and Egyptian Survey Departments, although it may be delayed for some years yet; and the former, which was to have been undertaken by the Germans, it is to be hoped will, after the war, be accomplished by British surveyors, through—not German East Africa—but newly acquired British territory. Running right through parts of Africa that are but imperfectly mapped in many districts, the stations of this triangulation will be invaluable for the adjustment of any network of triangulation for future surveys in the interior, and, indeed, has already been utilised for the purpose.

The carefully carried out boundary surveys between various countries of South America will be of the greatest assistance in future exploration and survey in the interior of that continent, wherever they are available, while the Survey Departments of Canada and the United States are doing excellent work and extending their surveys far into the imperfectly mapped regions of North America. So, altogether, the surveyor of the future will soon have a good foundation of trustworthy points to work from. It is important to remember that running a chain of triangles across a country, though important as a framework, does not constitute a map of the country; and what is wanted is a series of good topographical maps, based upon triangulation, showing the leading features with sufficient accuracy for the purposes of ordinary mapping, so that on scales of 1 : 250,000, or even 1 : 125,000, there is no appreciable error.

As regards instruments, the astrolabe à prisme is being increasingly used for taking equal altitude observations with most excellent results, but at the present time the 5-in. transit micrometer theodolite, already referred to, is perhaps all that is required for general work. It has now been thoroughly tested and found most satisfactory. As regards smaller instruments, there is the 4-in. tangent-micrometer theodolite, and for rapid exploratory survey, where weight is a great consideration, a little 3-in. theodolite has been found useful.

For base-line measurement the invar tape should be taken on all serious work, and for filling in the topographical features a good plane-table is doubtless the instrument to use. In mountainous regions and in some other special conditions photographic surveying doubtless has a future before it, and in military operations when the photographs are taken from aircraft it has proved itself invaluable; but in ordinary surveying it is, I think, not likely to take the place of well-established methods. The introduction of wireless telegraphy for the determination of longitude is likely to increase in usefulness. Good examples of the work done with it have lately been given in the *Geographical Journal* and elsewhere.

FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE.

Macmillan and Co., Ltd.—The Potato, Prof. A. W. Gilbert and others, illustrated; The Strawberry in North America, S. W. Fletcher, illustrated; A Manual of Fruit Diseases, Prof. L. R. Hesler, illustrated; A Manual of Dairy Products, Prof. W. A. Stocking, illustrated; The Pruning Manual, Prof. L. H. Bailey, new edition, illustrated. *Oxford University Press.*—Agriculture in Oxfordshire, the first of a series of monographs on the English Counties, prepared by the Institute for Research in Agricultural Economics in the University of Oxford, illustrated.

ANTHROPOLOGY AND ARCHÆOLOGY.

F. Alcan (Paris).—Les Races et les Nationalistes en Autriche-Hongrie, Prof. Auerbach. *G. Bell and Sons, Ltd.*—Modern Man and His Forerunners: a Short Study of the Human Species, Living and Extinct, Dr. H. G. F. Spurrell, illustrated; Savage Survivals, J. H. Moore, illustrated. *Cambridge University Press.*—Jataka Tales, H. T. Francis and E. J. Thomas, illustrated; The Ancient Cross Shafts at Bewcastle and Ruthwell, enlarged from the Rede Lecture delivered before the University of Cambridge on May 20, 1916, by the Right Rev. Dr. G. F. Browne, illustrated. *Longmans and Co.*—The Folk-Element in Hindu Culture: a Contribution to Socio-Religious Studies in Hindu-Folk Institutions, Prof. Benoy Kumar Sarkar, assisted by Hemendra K. Rakshit. *John Murray.*—The Ages of Man, C. Sayle; The Lost Cities of Ceylon, G. E. Mitton, illustrated. *Oxford University Press.*—The Drama of Savage Peoples, L. Havemeyer. *Seeley, Service and Co., Ltd.*—Prehistoric Man and His Story, Prof. G. F. Scott Elliot, illustrated.

BIOLOGY.

F. Alcan (Paris).—L'Evolution des Plantes, Prof. N. Bernard; Théorie de la Contre-évolution, Dr. Larger. *D. Appleton and Co.*—The Book of Forestry, F. F. Moon. *E. Arnold.*—Arboreal Man, Prof. F. Wood Jones, illustrated; the Migrations of Fish, Prof.

A. Meek, illustrated. *Cambridge University Press.*—The Anthocyanin Pigments of Plants, M. Wheldale; Algæ, vol. i., Myxophyceæ, Peridinieæ, Bacillarieæ, Chlorophyceæ, together with a brief summary of the occurrence and distribution of Freshwater Algæ, Dr. G. S. West (Cambridge Botanical Handbooks). *Cassell and Co., Ltd.*—An Introduction to a Biology, the late A. D. Darbishire. *Hodder and Stoughton.*—Wild Animal Ways, E. Thompson-Seton, illustrated; The Hunting Wasp, J. H. Fabre. *T. C. and E. C. Jack, Ltd.*—Wild Flowers of Britain through the Camera, a series of 100 plates, selected and described by M. Skene; Wild Birds of Britain through the Camera, a series of 100 plates, selected and described by F. B. Kirkman. *Longmans and Co.*—British Birds, written and illustrated by A. Thorburn, vol. iv. *Macmillan and Co., Ltd.*—Nature in Australasia, for Boys and Girls, Jane Ada Fletcher, illustrated; Around the Year in the Garden, F. F. Rockwell, illustrated. *Methuen and Co., Ltd.*—Secrets of Earth and Sea, Sir Ray Lankester, illustrated. *John Murray.*—What is Instinct? Some Thoughts on Telepathy and Subconsciousness in Animals, C. B. Newland; Recent Progress in the Study of Variation, Heredity, and Evolution, Dr. R. H. Lock, new edition, revised by Dr. L. Doncaster, with a Biographical Note by Mrs. R. H. Lock; Form and Function: a Contribution to the History of Animal Morphology, E. S. Russell, illustrated; Vegetable Fibres, Dr. E. Goulding (Imperial Institute Handbooks); The Study of Animal Life, Prof. J. A. Thomson, new edition, illustrated. *Oxford University Press.*—Three Lectures on Experimental Embryology, Capt. J. W. Jenkinson, illustrated, with a short biographical notice of the author by Dr. R. R. Marett. *Bernard Quaritch.*—The Birds of British Guiana, based on the Collection of F. V. McConnell, C. Chubb, with a preface by Mrs. F. V. McConnell, vol. ii. *Grant Richards, Ltd.*—Insect Enemies, C. A. Ealand, illustrated. *George Routledge and Sons, Ltd., and Kegan Paul and Co., Ltd.*—The Fisherman's Entomology, M. E. Mosely, a Supplement to F. M. Halford's The Dry-Fly Man's Handbook, illustrated. *Whittaker and Co.*—Some Researches in Plant Physiology, Atkins. *John Wiley and Sons, Inc.* (*New York*).—Handbook for Rangers and Woodsmen, J. L. B. Taylor; Modern Propagation of Tree Fruits, Prof. B. S. Brown; A Practical Entomology for Schools, E. D. Sanderson and Prof. L. M. Peairs; Farm Forestry, Prof. J. A. Ferguson. *Williams and Norgate.*—Plant Seeds and Currents in the West Indies and Azores, H. B. Guppy.

CHEMISTRY.

Cambridge University Press.—Chemistry and Technology of Oils and Fats, F. E. Weston and P. J. Fryer; Chemistry of Dyeing, Dr. L. L. Lloyd and M. Fort (Cambridge Technical Series). *Chapman and Hall, Ltd.*—A Method for Identification of Pure Organic Compounds, Dr. S. P. Mulliken, vol. ii.; Manual for the Essence Industry, E. Walter. *Gauthier-Villars and Co.* (*Paris*).—Conférences de Chimie minérale faites à la Sorbonne, M. Guichard, new edition. *Crosby Lockwood and Son.*—Manuals of Chemical Technology, edited by Dr. G. Martin, vol. viii., The Minor Elements: their Occurrence and Industrial Uses, S. J. Johnstone. *Longmans and Co.*—The Right Hon. Sir Henry Enfield Roscoe, P.C., D.C.L., F.R.S.: a Biographical Sketch, Sir Edward Thorpe; Chemistry, Second Stage, F. P. Armitage, with assistance from L. S. Dawe. *Macmillan and Co., Ltd.*—A Text-Book of Thermo-Chemistry and Thermo-Dynamics, Prof. O. Sackur, translated from the German by Dr. G. E. Gibson. *George Routledge and Sons, Ltd., and Kegan Paul and Co., Ltd.*—Chemical Discoveries and Inventions of the Twentieth Century, Sir W. A. Tilden, illustrated. *John Wiley and Sons, Inc.* (*New York*).—A Laboratory Manual of Organic Chemistry for Medical Students, Dr. M. Steel; Laboratory Manual of Bituminous Materials, P. Hubbard.

ENGINEERING.

D. Appleton and Co.—Field Book for Railway Engineers, J. B. Henck; City Planning, edited by J. Nolen. *E. Arnold.*—The Principles of Electrical Engineering and their Application, Prof. Gisbert Kapp, two vols., illustrated. *Cambridge University Press.*—Naval Architecture, J. E. Steele. *Chapman and Hall, Ltd.*—Bridge Engineering, J. A. Waddell, two vols.; Graphics of Machine Design, E. S. Andrews; Power Transmission by Leather Belting, R. T. Kent; Principles of Oil and Gas Production, Prof. R. H. Johnson and L. G. Huntley; Elements of Refrigeration, Prof. A. Greene; The Planning of the Modern City, N. P. Lewis. *Constable and Co., Ltd.*—The Flying Machine from an Engineering Standpoint, F. W. Lanchester (a reprint of the James Forrest Lecture, 1914, including a discussion concerning the theory of sustentation and the expenditure of power in flight); Some Modern Methods of Ventilation, with Special Reference to Public Buildings, R. Grierson, illustrated; Mining and Mine Ventilation, J. J. Walsh, illustrated. *Electrician Printing and Publishing Co., Ltd.*—The Theory of the Submarine Cable, Dr. H. W. Malcolm; Electric Measuring Instruments: their Design, Construction, and Application, Dr. C. V. Drysdale and A. C. Jolley; and new editions of Wireless Telegraphy and Telephony, Handbook of Formulæ, Data, and Information, Dr. W. H. Eccles; Primary Batteries: their Construction and Use, W. R. Cooper; Electric Mains and Distributing Systems, J. R. Dick and F. Fernie; Submarine Cable Laying and Repairing, H. D. Wilkinson; Manual of the Telephone, W. Aitken. *Crosby Lockwood and Son.*—Oil-field Development: a Guide to the Exploration of Petroleum Lands, and a Study of the Engineering Problems connected with the Winning of Petroleum, including Statistical Data of Important Oil-fields, Notes on the Origin and Distribution of Petroleum, and a Description of the Methods of Utilising Oil and Gas Fuel, A. B. Thompson, illustrated. *Longmans and Co.*—Strength of Ships, A. J. Murray, with diagrams; Practical Shipbuilding: a Treatise on the Structural Design and Building of Modern Steam Vessels, A. C. Holms, two vols., new edition. *Methuen and Co., Ltd.*—The Elements of Engineering Drawing, E. Rowarth, illustrated. *Scott, Greenwood and Son.*—Calculations for Steel Frame Structure, W. C. Cocking; Elementary Mathematics for Engineers, E. H. Sprague (Broadway Series of Engineering Handbooks). *Whittaker and Co.*—Oil, Gas, and Petrol Engines, Garrard; High-Speed Internal Combustion Engines, Judge; Electric Traction, Dover; Telegraphy, Herbert, new edition; Modern Milling, Pull; Continuous Current Motors and Control Apparatus, Maycock; Construction of Aeroplanes, Judge. *John Wiley and Sons, Inc.* (*New York*).—Municipal Engineering, A. P. Folwell; Elements of Refrigeration, Prof. A. M. Greene; Mechanical Equipment of Buildings, L. A. Harding and A. C. Willard; Modern Underpinning, L. White and E. A. Prentis, jun.; Applied Mechanics, vol. ii., Strength of Materials, Prof. C. E. Fuller and W. A. Johnston; The Mining Engineers' Handbook, edited by Prof. R. Peele; Valuation, Depreciation, and the Rate Base, C. E. Grunsky, assisted by C. E. Grunsky, jun.

GEOGRAPHY AND TRAVEL.

Cambridge University Press.—The Earliest Voyages Round the World, 1510–1617, edited by P. F. Alexander, illustrated (Cambridge Travel Books); Bengal, Bihar, and Orissa, Sikkim, L. S. S. O'Malley,

illustrated (Provincial Geographies of India). *Macmillan and Co., Ltd.*—In Far North-East Siberia, I. W. Shklovsky (Dioneo), translated by L. Edwards and Z. Shklovsky, illustrated. *John Murray.*—A Holiday in Umbria, with an Account of Urbino and the Cortegiano of Castiglione, Sir T. G. Jackson, Bart., illustrated; Hunting Pygmies, Dr. W. E. Geil, illustrated. *Oxford University Press.*—Historical Geography of the British Dependencies, edited by Sir C. P. Lucas, vol. vii., India, part i., History down to 1861, P. E. Roberts. *T. Fisher Unwin, Ltd.*—Two Summers in the Ice-Wilds of Eastern Karakoram, F. B. Workman and W. H. Workman, illustrated; A Naturalist in Borneo, the late R. W. C. Shelford, edited by Prof. E. B. Poulton, illustrated; Summer Holidays in the Alps, the Rev. Prebendary Durham, illustrated.

GEOLOGY AND MINERALOGY.

Chapman and Hall, Ltd.—Microscopic Determination of the Opaque Minerals: An Aid to the Study of Ores, Dr. J. Murdoch. *Oxford University Press.*—The Origin and Meaning of some Fundamental Earth Structures, C. F. Berkey.

MATHEMATICAL AND PHYSICAL SCIENCES.

D. Appleton and Co.—The Book of Electricity, A. F. Collins. *G. Bell and Sons, Ltd.*—Arithmetic, F. W. Dobbs and H. K. Marsden, part ii.; Commercial Arithmetic and Accounts, A. R. Palmer and J. Stephenson, part iii., also the complete book; Dynamics: a companion text-book to Fawdry's Statics; Analytical Geometry of the Straight Line and Circle, J. Milne; Arithmetic for Preparatory Schools, T. Dennis; Differential Calculus for Colleges and Secondary Schools, Dr. C. Davison. *Cambridge University Press.*—Collected Scientific Papers, the late Prof. J. H. Poynting; Model Drawing, Geometrical and Perspective, with Architectural Examples, C. O. Wright and W. A. Rudd, illustrated; Physics for Engineers, J. P. Yorke. *Chapman and Hall, Ltd.*—Mathematics for Engineers, W. N. Rose; Ten British Mathematicians of the Nineteenth Century, A. Macfarlane; Engineering Applications of Higher Mathematics, Prof. V. Karapetoff, five vols., part ii., Problems on Hydraulics, part iii., Problems on Thermodynamics, part iv., Problems on Mechanics of Materials, part v., Problems on Electrical Engineering. *Constable and Co., Ltd.*—Atoms, J. Perrin, translated by D. Ll. Hammick, illustrated. *Gauthier-Villars and Co. (Paris).*—Œuvres d'Halphen publiées par les soins de C. Jordan, H. Poincaré, E. Picard, avec la collaboration de E. Vessiot, tomes ii., iii., et iv.; Bases théoriques de l'Aéronautique: Aérodynamique, Prof. N. Joukowski, translated by S. Drzewiecki; Cours d'Hydraulique, Prof. J. Grialou. *Hodder and Stoughton.*—Our Own and other Worlds, J. Hamilton. *Longmans and Co.*—Principles of Electric Wave Telegraphy and Telephony, Prof. J. A. Fleming, new edition, illustrated; Differential Equations, Dr. H. Bateman; Housecraft Arithmetic, T. Mellor and H. H. Pearson. *John Murray.*—David Gill: Man and Astronomer, Prof. G. Forbes. *Oxford University Press.*—The Casting Counter and the Counting-Board: a Chapter in the History of Numismatics and Early Arithmetic, F. P. Barnard, illustrated. *S.P.C.K.*—The Rain Children: a Fairy Tale in Physics, T. H. Orpen, illustrated. *University Tutorial Press, Ltd.*—Advanced Text-Book of Magnetism and Electricity, R. W. Hutchinson. *John Wiley and Sons, Inc. (New York).*—Field Astronomy, Prof. A. H. Holt; Histology of Medicinal Plants, W. Mansfield; Lessons in Pharmaceutical Latin and Prescription Writing and Interpretation, Prof. H. C. Muldoon.

MEDICAL SCIENCE.

F. Alcan (Paris).—Méthode de traitement des fractures, Prof. P. Delbet; La fièvre paratyphoïde, Prof. A. Rathery; Précis résumé de chirurgie de guerre, Drs. P. et J. Fiolle. *W. Heinemann.*—Psychoneuroses in War, M. D. Eder; The Practitioner's Pocket Pharmacology and Formulary, Dr. L. Freyberger; and new editions of The Treatment of Infantile Paralysis, Dr. R. W. Lovett, illustrated; Treatment of Tabetic-Ataxia by the Aid of Gymnastic Exercise, Dr. H. S. Frenkel, revised and enlarged by Dr. L. Freyberger, illustrated; A Manual of Practical X-Ray Work, Dr. D. Arthur and J. Muir, illustrated. *Masson et Cie. (Paris).*—Collection Horizon: Petits Précis de Médecine et de Chirurgie de Guerre:—La Fièvre typhoïde et les Fièvres paratyphoïdes (Symptomatologie, Etiologie, Prophylaxie), H. Vincent and L. Muratet; Traitement des Fractures, Prof. R. Leriche, two vols., tome i., Fractures Articulaires, illustrated; Les Formes anormales du Tétanos, Courtois-Suffit and Giroux. *Methuen and Co., Ltd.*—Crowley's Hygiene of School Life, Dr. C. W. Hutt, new edition, illustrated.

TECHNOLOGY.

Cambridge University Press.—The Development of English Building Construction, C. F. Innocent, illustrated; Architectural Building Construction: a Text-book for the Architectural and Building Student, W. R. Jaggard and F. E. Drury, vol. i., illustrated (Cambridge Technical Series). *Chapman and Hall, Ltd.*—The Canning of Fruits and Vegetables, J. P. Zavalla. *Hodder and Stoughton.*—Automobile Repairing Made Easy, V. W. Pagé, illustrated; Modern Starting, Lighting, and Ignition Systems, V. W. Pagé; The Model "T" Ford Car: Its Construction, Operation, and Repair, V. W. Pagé, illustrated. *George Routledge and Sons, Ltd., and Kegan Paul and Co., Ltd.*—Flour Milling: a Theoretical and Practical Handbook of Flour Manufacture for Millers, Millwrights, Flour-milling Engineers, and others engaged in the Flour-Milling Industry, P. A. Kosmin, translated by M. Falkner and T. Fjelstrup, and revised by E. Bradfield, illustrated; Photography in Colours: a Book for Amateurs and Students of Physics, Dr. G. Lindsay Johnson, new edition, illustrated. *John Wiley and Sons, Inc. (New York).*—Plain and Ornamental Forging, E. Schwarzkopf; Drawing for Builders, R. B. Dale.

MISCELLANEOUS.

F. Alcan (Paris).—Traité de Psychologie, Prof. G. Dumas. *D. Appleton and Co.*—Vocational Psychology, H. L. Hollingworth; Scientific Management and Labour, R. F. Hoxie. *Cambridge University Press.*—Catalogue of Scientific Papers, fourth series (1884–1900), compiled by the Royal Society of London, vol. xv., Fitting-Hyslop; Comptes Rendus of Observation and Reasoning, J. Y. Buchanan; The Psychology of the Organized Group Game, with Special Reference to its Place in the Play System and its Educational Value, M. J. Reaney (The British Journal of Psychology Monograph Supplements). *Cassell and Co., Ltd.*—All About Inventions and Discoveries, F. A. Talbot, illustrated. *Chapman and Hall, Ltd.*—Scientific Spiritualism, Rev. J. Marchant; Handbook to the History of Philosophy, Rev. J. O. Bevan. *Constable and Co., Ltd.*—Practical Surveying, E. McCullough, illustrated. *The Open Court Company.*—The Works of William Oughdred, Prof. F. Cajori; George Boole's Collected Logical Works, vol. i., Ernst Mach's Civilization and Mechanics, Principles of the Theory of Heat, and Knowledge and Error. *Oxford University Press.*—The Idea of God in the Light of Recent Philosophy: The Gifford Lectures in the University of Aberdeen, 1911 to 1913, Prof.

A. S. P. Pattison; Sadoleto on Education, a translation of the De pueris recte instituendis, with notes and introduction, by Prof. E. T. Campagnac and K. Forbes. *Seeley, Service and Co., Ltd.*—Aircraft of To-Day. Lieut. C. C. Turner, illustrated; Marvels of Scientific Invention, T. W. Corbin, illustrated; Marvels of Aviation, Lieut. C. C. Turner, illustrated; War Inventions, and How they were Invented, C. R. Gibson, illustrated; The Wonders of the Submarine, T. W. Corbin, illustrated. *T. Fisher Unwin, Ltd.*—Essays: Scientific and Literary, Dr. A. E. Shipley, illustrated; Hausa Botanical Vocabulary, J. M. Dalziel.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LEEDS.—The urgency in the demand for the training of colour chemists and dyers has led to a reorganisation of this department of the university. The newly appointed head of the department is Mr. A. G. Perkin, F.R.S., who is assisted in the theoretical and practical teaching of colour chemistry by Dr. J. B. Oesch, formerly colour chemist in one of the chief Continental factories, whilst that of dyeing is under the special supervision of Mr. G. H. Frank, Mr. P. King, former chemist to Messrs. Courtaulds, Ltd., and Mr. A. E. Woodhead. In addition to systematic instruction in the above branches of technology, opportunities will be afforded to students of hearing special courses of lectures on "Cellulose" by Mr. C. F. Cross, on "The Distillation of Coal Tar" by Mr. H. P. Hird, and on "Colour in its Relation to Constitution" by Prof. E. R. Watson, of Dacca University.

At the request of British Dyes, Ltd., a laboratory has been set apart for the accommodation of a staff of chemists working on behalf of this firm, and will be exclusively in charge of a member of the university staff. The department is controlled by the Textile Industries and Dyeing Committee of the university, consisting of well-known representatives of both industries. The aim of the newly organised department is therefore to render service to the colour-making and dyeing industries by offering special training in these branches, whilst giving assistance to the enterprise promoted by Government money.

MR. E. A. WOODS, of New College, Oxford, has been awarded a Burney Yeo scholarship for 1916 at King's College Hospital Medical School.

MR. W. NEILSON JONES, late assistant-lecturer in botany at Bedford College for Women, N.W., has been appointed lecturer and head of the department in botany of the college.

THE sum of 300*l.* has been left to the Bristol General Hospital by Dr. W. Barrett Roue to found a scholarship for medical students of the hospital. The scholarship will be known as the "Barrett Roue Scholarship."

BY the will of Sir James Sivewright, whose death was announced last week, legacies are bequeathed of 5000*l.* to Milne's Institution, Fochabers, and of 10,000*l.* to the University of Aberdeen, for the purpose of providing bursaries for students coming from the county of Morayshire.

THE resignation of Dr. R. Armstrong-Jones of the medical superintendency of the Claybury County Asylum was announced in our issue of August 10. To mark the esteem in which Dr. Armstrong-Jones is held by the staff of the asylum a silver tea and coffee service was presented to him by the staff on September 7. Dr. Armstrong-Jones will continue to lecture on mental diseases at St. Bartholomew's Hospital.

THE calendar for the current session of Birkbeck College, London, provides full particulars of the numerous day and evening classes in the subjects included in university faculties of arts, science, laws, and economics. The character of the work accomplished at this institution is well summarised in the final report of the Royal Commission on University Education in London (1913). The commissioners write: "We think that the original purpose of the founder of Birkbeck College and the excellent work that institution has done for the education of evening students who desire a university training mark it out as the natural seat of the constituent college in the faculties of arts and science for evening and other part-time students."

THE prospectus and time-table of the Belfast Municipal Technical Institute for the current session show convincingly the care and thoroughness with which the Technical Instruction Committee of the city has provided instruction in the principles of the arts and sciences which bear directly or indirectly upon the trades and industries of Belfast. The prospectus describing the work of the various departments runs to 384 closely printed pages, and every subject likely to be of service to the men and women engaged in the city's industries seems to be included in the time-table. The day technical college provides instruction in the science and technology of mechanical engineering, electrical engineering, the textile industries, and pure and applied chemistry. The Queen's University of Belfast and the Corporation of Belfast have entered into an agreement whereby the institute is recognised as a college in which students of the University may pursue a course of study qualifying for a degree of the University.

THOUGH the governors of the Royal Technical College, Glasgow, in view of the war, reserve full power to modify the arrangements announced in the recently published calendar for the session 1916–17, they again offer suitable educational facilities for those who wish to qualify themselves to enter upon one of the industrial professions, or to follow one of a number of selected trades. Complete courses of instruction are provided in mathematics, physics, chemistry, the principles of engineering, and other subjects, and in their application to industries and arts. The college is affiliated to the University of Glasgow, and candidates for the degree of B.Sc. in applied science may attend the necessary qualifying courses either in the University or in the college. The University of Edinburgh, too, has recognised the day classes of the college as qualifying for its degree in science. Numerous important firms have expressed their willingness to allow a selected number of their apprentices facilities for carrying out a scheme of college study conjoined with practical work, and some are willing to recognise the time spent in college as part of the apprenticeship period.

NOTHING perhaps could be more opportune to the cause of educational reconstruction than the recent publication by the Board of Education of the pamphlet entitled "The Admiralty Method of Training Dockyard Apprentices." By its system of training the Admiralty has succeeded in providing on one hand a body of leading technical experts in shipbuilding and engineering, and on the other a body of skilled workmen among whom the labour troubles that have so sorely affected employers elsewhere are practically unknown. Moreover, not only have the Admiralty and a considerable proportion of the larger shipbuilding and engineering firms throughout the country thus obtained their managers, designers, and other lower-grade officials, but the foundation of the

Navy of Japan was likewise laid by the products of this remarkable scheme. It is only natural, therefore, to inquire what are the fundamental characteristics of a system that has achieved such a unique success. The details are described in the pamphlet already mentioned; but it may be stated that the underlying principles consist in the adoption of a military form of organisation dependent almost exclusively upon individual merit, and a method of admission to its ranks as broad as democracy itself. Apprentices enter the Royal Dockyards as the result of a competitive examination, and they are compelled to continue their education by attending the Dockyard schools for twelve hours a week (two afternoons and three evenings), of which seven and a half hours are given by the Admiralty. Apprentices pay no fees for attending the schools, are provided with text-books and stationery free of cost, and are paid their usual wages for the afternoons on which they are at school. Perhaps the most astonishing feature of the whole system lies in the fact that this remarkably democratic scheme was quietly inaugurated in the least expected of our national institutions, and in a time when practically every other form of high professional training in the country was a class privilege. In a crisis like the present, therefore, when the whole of the virtues of a nation are powerless without outstanding leadership and genius, the moral is plain.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 4.—M. Camille Jordan in the chair.—G. **Bigourdan**: The conference of longitudes of 1634. A historical account of Morin's proposals.—P. **Zeeman**: Direct measurement of the axial velocity of water in Fizeau's experiment. The axial velocity was formerly determined by measuring the whole of the water passing through the tube, giving the mean velocity, and using the coefficient 0·84 to determine the axial velocity. As this coefficient is liable to uncertainty, a new alternative method is described, based on the introduction of very small air bubbles into the flow, and observing their trajectory by means of a rotating mirror. This has led to an unexpected result: the axial velocity varies in a complicated manner along the tube, so that there is no one axial velocity. The extreme variation is more than 10 per cent. Finally, a standardised Pitot tube was used to measure the velocities at a large number of points, with satisfactory results.—J. **Bougault**: The preparation of acylsemicarbazides, starting from the semicarbazones of α-ketonic acids. The oxidation of semicarbazones by iodine and sodium carbonate, by a quite unexpected reaction, gave a semicarbazide according to the equation, $R.C(CO_2H):N.NH.CO.NH_2+O = CO_2+R.CO.NH.NH.CO.NH_2$. The reaction is completed at the ordinary temperature, and its generality is shown by the examples given, in which R is $(C_6H_5.CH_2)$, $(C_6H_5.CH_2.CH_2)$, (C_6H_5), and $((CH_3)_3.C)$. Of the four semicarbazides thus prepared, three are new.—M. **Luizet**: Shooting star with a persistent luminous track. This meteor left a line of light which, after taking a wavy form, broke up into several fragments. Some of these combined together, taking the shape of an elongated bulb. This disappeared four minutes after the first disruption of the meteor.—J. L. **Dantan**: Observations on the larva of *Ostrea edulis*.—M. **Ranjard**: The first hundred cases of deafness treated by Marage's method at the *Centre de rééducation auditive* of the 8th district. The treatment of deafness by the method of Marage has been proved to be useful from the military, financial, and social points of view. Only 16 per cent. of the cases gave negative results under the treatment.—J. **Danysz**: The causes of the disturbances observed after the injection of products of the arsenobenzene group, and anaphylactic crises. A study of the conditions producing a precipitate in the veins after injection of arsenobenzene derivatives.—L. **Camus**: The preparation, properties, and advantages of a homogeneous vaccine.

BOOKS RECEIVED.

The Punjab, North-west Frontier Province, and Kashmir. By Sir J. Douie. Pp. xiv+373. (Cambridge: At the University Press.) 6*s*. net.

Le Principe de Relativité. By E. M. Lémeray. Pp. 150. (Paris: Gauthier-Villars et Cie.) 3.75 francs.

Cours d'Hydraulique. By Prof. J. Grialou. Pp. vi +536. (Paris: Gauthier-Villars et Cie.) 20 francs.

The Influence of Joy. By G. Van Ness Dearborn. Pp. xviii+223. (London: W. Heinemann.) 5*s*. net.

Wratten Light Filters. Third edition. Pp. 72. (London: Kodak, Ltd.) 1*s*.

The Photography of Coloured Objects. Second edition. Pp. 118. (London: Kodak, Ltd.) 1*s*.

The Birds of Shakespeare. By Sir A. Geikie. Pp. x+121. (Glasgow: J. Maclehose and Sons.) 3*s*. 6*d*. net.

Rev. William Hall's Visible Astronomical Compass. (London: J. D. Potter.) 1*s*. net.

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