THURSDAY, OCTOBER 15, 1908.

AIDS TO MATHEMATICAL RESEARCH.

Royal Society of London, Catalogue of Scientific Papers, 1800–1900. Subject Index Vol. I. Pure Mathematics. Pp. lviii + 666. (Cambridge: University Press, 1908.) Price 21*s*. net.

THE output of the scientific world is now so great that considerable attention has been devoted of late to devising means of acquainting those engaged in scientific research with the results attained by other investigators. With the publication of the first volume of the Royal Society Index, the student of mathematics is now particularly well provided in this respect. No one work could provide for his needs, and in fact they are at present supplied by several publications. The helps which have been provided for him naturally fall into three groups. The first of his needs is a means of obtaining a rapid survey of any department of his subject which will make him acquainted with the principal writings on it. Numerous encyclopædic works have been published which aim at supplying this want, the most important being the "Encyklopädie der mathematischen Wissenschaften," which is at present in course of publication. A more important need is a means of following the course of current publications without an impracticable amount of reference to the papers themselves. This want is admirably supplied by the "Jahrbuch über die Fortschritte der Mathematik." This valuable work, which appeared first in 1871, gives abstracts of all papers dealing with mathematics which have appeared within a space of twelve months, but it does not appear until two years after the one with which it deals. The abstracts in this work are arranged by subjects and indexed under the authors' names.

Even the comparatively short delay in the publication of the "Jahrbuch" was found inconvenient, so in 1893 the Mathematical Society of Amsterdam arranged to publish the "Revue Semestrielle," a half-yearly list of papers, arranged according to periodicals, giving titles and a short indication of the subject-matter. Each paper is classified in accordance with an international code, and a subject-index is given as well as an authors' one. In addition to these, the "International Catalogue of Scientific Literature" has appeared annually since 1902, one volume being devoted to mathematics. In this work the papers of the previous year are arranged according to subjects, an index of authors' names being appended.

The above works are supplemented by two immense publications, Poggendorff's "Handwörterbuch zur Geschichte der exacten Wissenschaften," and the Royal Society's "Catalogue of Scientific Papers." The former, which consists of four volumes, gives the works of authors up to 1904, and includes physics, astronomy, chemistry and geology, besides mathematics; the latter covers a much larger range of subjects, and extends to twelve large volumes; its scheme is very similar to that of the "Handwörterbuch," but the volumes already published only extend from 1800 to 1883.

These works, though of incalculable value to the investigator, do not directly supply him with information on a given part of his subject, which is of course what he generally requires. Hitherto he has had to rely mainly on his own sagacity and experience, although of late many bibliographies have been published for special subjects. The book under review will materially lessen this part of the student's labour, and is bound to form an essential part of his scientific equipment; all the more so as it is extremely moderate in price, which cannot be said of any of the other works mentioned above with the exception of the "Revue Semestrielle."

When the "Catalogue of Scientific Papers" was projected by the Royal Society in 1857, the plan included a subject-index, and during the compilation of the published twelve volumes much material was amassed for this purpose. Its completion and publication was found, however, to involve more expense than could be met unaided by the Royal Society, and it is only lately that the funds at the disposal of the Royal Society have been so augmented by private donations as to admit of the completion of the work. The preface states that the Index is especially indebted to Dr. Ludwig Mond, F.R.S., in this respect.

The Index, which will include all papers published during the last century, is to appear in seventeen volumes, each of the volumes dealing with one of the sciences of the schedule of the "International Catalogue." The first volume of the series, which is the subject of this review, deals with pure mathematics. In it all papers on this subject published from 1800 to 1900 have been indexed under subjects, with the exception of about 750 short notes dealing principally with elementary geometry, which were not thought of sufficient interest to be entered. Any mathematician will at once recognise what immense labour this must have involved: the preface gives the number of entries as 38,748, referring to 700 serials.

The index of titles from 1884 to 1900 has been made by referees familiar with the subjects, who have made the titles from the contents of the papers and not merely from headings. Papers published prior to 1884 were not in all cases consulted, but a test made in a subject, with the literature of which the writer is familiar, seems to show that the value of the index has not suffered materially from this.

It is manifestly impossible to discuss here such a work as the Index in detail. Its value was therefore tested by comparison with a bibliography dealing with matrices. The comparison emphasised the difficulties of classification which are inherent to a work like this. In fact, papers dealing with the theory of matrices are scattered over some five or six different headings. This is a drawback which could not have been obviated without swelling the volume to an impracticable size by numerous cross-references, and after a little experience it causes less inconvenience than might be supposed. In some cases, however, the classification might have been easily improved upon. For instance, it is curious to find that the principal modern papers on hypercomplex

numbers are classified under the heading "Other Special Sorts of Complex Numbers," while the older papers are properly classified under the heading "General." Again, Hamilton groups are classified under "Quaternions," and not as one would expect under "Groups." Occasionally the subdivision of headings is carried so far as to be a hindrance instead of a help. For instance, references to papers on matrical equations are scattered over five separate headings, instead of being under one heading with two or three subheadings. Several short notes also have been omitted which might well have found a place. A short note appearing early in the development of a subject is of more importance than a similar one appearing at a later stage. If it was impracticable to classify all such notes minutely, they might have been given under the main headings without any subclassification.

Another difficulty which is likely to occur now and again in the use of the Index is that occasionally short papers are published for the first time in the collected works of an author. Such papers are not classified in the Index, which only includes periodicals in its list. In the case of matrices, too, several interesting accounts of the subject have appeared as appendices to treatises having no direct connection with this subject except in so far as matrices are required for some portions of the analysis. Such articles are of course not indexed, although they are sometimes of some importance.

Such criticisms of detail might no doubt be carried much farther; they affect, however, only points of comparatively small importance, and do not affect materially the great service which the Index will render to the mathematical public. At a moderate estimate it will lessen the labour of forming bibliographies, or of hunting up references, by considerably more than one-half. An exceedingly useful feature of the work is a list of periodicals which gives the names of the principal British libraries in which they are to be found. This should effect a great saving of time for those who are not so fortunate as to be situated close to any of our principal libraries.

The Index is published by the Cambridge University Press, and, as is usual in books published by them, the printing leaves nothing to be desired.

MODERN MARINE ENGINEERING.

Marine Engineering (a Text-Book). By Engineer-Commander A. E. Tompkins, R.N. Third edition, entirely re-written, revised, and enlarged. Pp. viii +812. (London: Macmillan and Co., Ltd., 1908.) Price 15*s*. net.

MARINE engineering has been developed in many directions during recent years, and the influence of these developments upon the design of steamships has been marked. Within a period of fifteen or sixteen years water-tube boilers have practically taken the place of cylindrical (or "tank") boilers in all classes of warships; steam-turbines have been introduced for ship-propulsion, and have already superseded reciprocating engines in the Royal Navy, while growing in favour in other war-fleets and in mercantile steamships; oil-fuel has been adopted as a supplement to or substitute for coal; and now internal-combustion engines are being introduced and greatly increased in size and power. It is a natural consequence of these changes that numerous additions should be made to the literature of the subject, and that new editions of standard text-books should appear.

Among these text-books, intended primarily for the use of students, the work under review holds a distinguished place. The author is an experienced engineer officer of the Royal Navy, who has served long at sea in charge of machinery, and has also been occupied for some time as instructor and lecturer in marine engineering at the Royal Naval College, Greenwich, and the Royal Naval War College. At both these establishments he had to do chiefly with naval officers, whose technical knowledge of engineering was much the same as that of students beginning work on the subject. He has consequently given explanations of both theory and practice in simple language, which makes the book serviceable, not only to students of marine engineering, but to general readers desirous of obtaining acquaintance with modern methods and the most recent designs of marine engines and boilers. This third edition is virtually a new book—re-written and considerably larger than its predecessors—bringing information up to date. It deals briefly with types of boilers and machinery which have been made obsolescent by the progress of recent years, and aims at the presentation of "a summary of the best practice of the present day." It is but justice to the author to say that this intention has been realised.

The theory of thermodynamics is treated in an elementary manner, and its applications to the formation and expansion of steam are explained. One section is devoted to marine boilers, and the various types of water-tube boilers now in use are fully described. Another section treats of combustion, giving details of the methods adopted for efficiently burning coal and liquid fuel, and particulars of the various kinds of liquid fuel now in use. The conclusions reached by the author are that, for a given weight of coal and oil, oil gives from 25 to 30 per cent. greater energy, reduces the space for stowage by 10 per cent., makes it much easier to replenish fuel-supplies, and decreases the number of firemen by 50 per cent. The determining factor in regard to the extended use of oil-fuel is now, as it has been for the last twelve years, the question of adequate supplies at reasonable rates. Reciprocating engines still hold the field in the mercantile marine, and are described at length in their latest forms. Condensers, evaporators, feed-water systems, superheaters, and other accessories also come under review; and so does auxiliary machinery of various kinds—including steering and capstan engines, refrigerating apparatus, air compressors, hydraulic machinery, electrical apparatus, and other classes of machines, all of which are essential to the efficient working of a modern steamship. The care and management of propelling

and auxiliary machinery and boilers in a modern steamship involve great responsibility, and an interesting section of the book is devoted to the discussion of the preservation and repair of boilers, the adjustment of machinery, and the duties of the watch-keeping engineer. A comparatively brief sketch is given of the modern theory of the resistance experienced by ships when moving through water, and of the conditions influencing the efficiency of propellers. In all cases the author illustrates his conclusions by modern instances and recent experiments, showing himself to have been a diligent student of published data. This is a distinctive feature of the book throughout.

The final section describes "recent developments" in marine engineering, including marine steam turbines and the applications of internal-combustion engines to ship propulsion. The Parsons type of turbine naturally receives most attention, having been applied so much more extensively than any other type, and the descriptions and illustrations are excellent. The arrangements of turbine machinery described include those of battleships, cruisers, the latest Cunarders, and certain small, swift vessels of the destroyer class. A summary of the results obtained on contract trials and actual service is also given. It is interesting to note how rapidly the Parsons system has made its way abroad as well as at home. So far, its only rival—and that at a very great distance—is the Curtis turbine, which has been successfully applied in the United States scout-cruiser *Salem*, of which the contract trials took place subsequently to the completion of the book.

In regard to internal-combustion engines the author gives much information, indicating the features in which they must still be regarded as experimental, as well as those in which they promise a possibility of further advances in speed and fuel-economy.

The volume is well produced, has a good index, and contains about 400 illustrations. It deserves and will secure a good reception from all who are interested in the subjects of which it treats. The author has the courage of his opinions, and, in not a few instances, exception may be taken to his conclusions; but in all cases the materials for judging independently are given, and readers can claim no more.

W. H. WHITE.

THE MOON'S MOTION.

The Inequalities in the Motion of the Moon due to the Direct Action of the Planets. By Prof. E. W. Brown, F.R.S. Pp. xii+93. An Essay which obtained the Adams Prize in the University of Cambridge for the Year 1907. (Cambridge: University Press, 1908.) Price 6*s*. net.

PROF. BROWN is much to be congratulated on having at length written the word "Finis" to his lunar theory. His achievement has been a very great one, for he has completely solved the problem that he had proposed to himself, viz. the motion of the moon under the attraction of known bodies; he has pushed his solution sufficiently far beyond the standards required by observation to cover any probable increase in the accuracy of observation during the near future; his mathematics have been elegant, and his numerical computations performed under systems of check that command, not only his own confidence in their accuracy, but that of his readers. At last, therefore, we are entitled to say that any discrepancy between theory and observation must be attributed to fresh causes and not to imperfect calculation. A similar remark has somewhat readily been made before after the completion of other lunar theories, but a degree of numerical accuracy far beyond Hansen or Delaunay may safely be claimed for Prof. Brown's theory.

The memoir especially under review is the investigation of the direct action of the planets, which was recently awarded the Adams prize in the University of Cambridge. The subject was unknown to Hansen, whose tables are still in use. In 1876 Prof. Newcomb discovered an empirical term in the moon's motion. Shortly afterwards Mr. Nevill attributed this term to the action of Jupiter. Some years then elapsed, and Dr. G. W. Hill gave a computation of the new term, and a little later Radau computed a large number of planetary terms in the moon's longitude. It is remarkable that both Hill and Radau gave $0''.90$ as the coefficient of Newcomb's term, and both of them were 20 per cent. in error. Radan's results are in other respects free from sensible error, and it is unfortunate that the term which started the whole subject should have been the one most difficult to calculate with accuracy. Quite recently Prof. Newcomb and Prof. Brown have published their researches. It is clear that the latter has reached a higher order of accuracy, but the former's memoir is probably amply good enough for comparison with observation. They agree in an increased coefficient of $1''.1$ for Newcomb's empirical term. It is not possible to compare either investigation with the other at any intermediate stage before the conclusion.

This is perhaps the time to give an answer to the question, How will the actual motion of the moon agree with Prof. Brown's theory? We have already expressed our belief that any want of agreement will point to the action of unknown causes. Possibly, therefore, Prof. Brown's work will be even of more importance if his tables fail to predict the motion of the moon than if they succeed.

As regards short-period inequalities, we believe that Prof. Brown's tables will be practically perfect. We should like, however, to invite the attention of astronomers in thirty years' time to one point. Let every discordance between observation and tabular position be multiplied by the sine and cosine of the moon's longitude and the mean taken. If this be done for the last fifty years, the result is too large to attribute to accidental error; nor will the alteration of the moon's parallax and the insertion in the new tables of a Venus term with coefficient $0''.7$ entirely remove the difficulty. Possibly the past observations have been affected by a systematic error, but be the cause what it may, the point is worth remembering and looking into when the proper time comes.

As regards inequalities of period over twenty years, Prof. Brown has thrown no fresh light upon the matter. Let us say quite plainly that we do not believe this to be Prof. Brown's fault. We do not doubt that his work is accurate, and because he has not explained certain long-period inequalities which appear to exist, we believe that the cause of those inequalities is something outside the problem that Prof. Brown proposed to himself. Nevertheless, we have only to look down the list of mean errors for each of the last fifty years to see that there still exists some unsolved mystery.

The mystery becomes greater the further we go back. Prof. Newcomb has investigated and is still investigating the occultations of the seventeenth and eighteenth centuries. In 1883 an empirical correction was introduced into the ephemerides to satisfy these occultations, and Prof. Brown's researches do not bring forward any fresh term that will take the place of Prof. Newcomb's empirical term.

If we go further back still, matters are worse. Many years ago Prof. Celoria traced the eclipses of 1239 and 1241 across Europe, collecting records from large numbers of different sources, and he pointed out a disagreement with the paths as calculated from Hansen's tables. The discordance becomes more accentuated as we go further back, until Prof. Newcomb declared that all records of ancient solar eclipses were to be put aside as untrustworthy. We do not think that this conclusion will stand, for two or three investigators have shown that the discordance between the records and the tables is not haphazard, but obeys an empirical law to which different forms may be given, but which is in its effect upon eclipse tracks very much the same in the different investigations referred to. Our conclusion, therefore, is that a splendid mathematical achievement has been performed, but that our power of predicting the motion of the moon has not been increased in a corresponding degree.

PRO'S AND CON.'S OF DARWINISM.

(1) *Selectionsprinzip und Probleme der Artbildung: ein Handbuch des Darwinismus.* By Prof. Ludwig Plate. Dritte, sehr vermehrte Auflage. Pp. viii + 493; 60 figs. (Leipzig: W. Engelmann, 1908.) Price 12 marks.

(2) *Die Lehre Darwins in ihren letzten Folgen.* By Max Steiner. Beiträge zu einem systematischen Ausbau des Naturalismus. Pp. vii + 244. (Berlin: Ernst Hofmann and Co., 1908.) Price 3 marks.

(1) PROF. L. PLATE'S "Selektionsprinzip" has been so much expanded in its third edition that it deserves to be called "a handbook of Darwinism." It is a careful and thoughtful text-book by a thorough-going Darwinian, who is at the same time a believer in the transmission of acquired characters. In the first chapter he considers the objections to Darwinism. These may be relatively unimportant, *e.g.* that Darwinism does not account for the origin of variations, that artificial and natural selection are not really analogous, that the struggle for existence is not selective. But there are other objections which are more essential, *e.g.* that minute changes cannot have selective value, that the process of natural selection cannot be seen occurring, that the theory of selection starts from the fortuitous. It is useful to have a modern Darwinian's answers to these and other attacks on his faith, and it is much to be desired that those who rush into print with anti-Darwinian books and essays would read a work like Plate's, especially if they will not read Darwin.

The second chapter gives a careful discussion of the various forms of struggle and selection. The third discusses the auxiliary, or would-be auxiliary, theories—theories of sexual selection, struggle of parts, panmixia, germinal selection, and mutation; and the author deals in a strongly critical but temperate manner with the difficulties which beset these. He will have nothing to do with germinal selection and not much with Roux's "Kampf der Teile"; panmixia may account for degeneration, but not for rudimentation, and most of what is new in the mutation-theory is not true. Apart from selection, the conditions of evolution are heritability, variability, and isolation; and the discussion of these is admirable. One may not agree—and we certainly do not feel in any way convinced by the author's vigorous Lamarckism—but one must admit that the author's presentation is skilful and just. He states the experimental and other facts which lead him to think that we cannot dispense with modification-inheritance, and he sketches a hypothesis, not unlike Herbert Spencer's, of the passage of a specific influence from the peripheral parts of the soma to the penetralia of the germ-cells. Plate is far from thinking that the selection-theory clears up everything; it starts with growing and multiplying organisms which it does not explain; the conditions of variability and inheritance are still unknown; there are many unsolved problems. But instead of making a harsh alternative between the "Allmacht" or "Ohnmacht" of natural selection, what we have to do, as the author well indicates, is to test this and other formulæ in a critical yet fair-minded fashion. This is what he has aimed at in his book, and it seems to us that he has succeeded well, on the whole, at any rate, for now and again, *e.g.* in his remarks on the vitalists, he seems to us to be unnecessarily hot-blooded. We should like to know, for instance, where Dr. Hans Driesch spoke of a "Degeneration des Gehirns der Darwinisten." Is this not a fictitious quotation?

(2) The author of the second volume before us seems to think that Darwinism has been too much discussed as a biological theory, artificially abstracted from its social consequences. If we understand him, he seeks to put things right by showing what terrible consequences the theory involves. A scientific formulation is not to be judged by its applicability to the order of facts in relation to which it arose—that is a humdrum conventional inquiry which may be left to men like Prof. Plate—it must be judged by its human consequences! So Herr Steiner expounds with gusto his by no means favourable judgment of the metaphysic and ethic of Darwinism and its bearing on æsthetics and the valuation of life. He shows to

what dreadful places the Darwinian path leads. He applies the pragmatist test: What is this hypothesis good for? and he finds that it is not good either for a man's metaphysics or for his morals. This mode of testing scientific conclusions seems a dangerous one. It brings the passions and noise of the market-place into the dispassionate and quiet walks of science. In many pages the author seems to us to be caricaturing Darwinism, and while his work may be of use in showing the danger of hastily transferring biological results into the ethical and social realm, it seems to us to be full of exaggerations and fireworks. Some well-meaning writers have done ill-service by hastily transferring to the human social realm the imperfect results of a rapidly changing biological ætiology which would be better pleased to be left to mind its own business, but it seems to us even more deplorable that an author of Max Steiner's ability should prejudice judgment on Darwinism by showing in lurid colours what *might be* the social, ethical and æsthetical consequences of certain biological doctrines or misinterpretations of these. J. A. T.

THE STUDY OF TROPICAL DISEASES.

The Practical Study of Malaria and other Blood Parasites. By Dr. J. W. W. Stephens and S. R. Christophers. Pp. iv+414+xiv. Third Edition. (Liverpool: The University Press; London: Williams and Norgate, 1908.) Price 12*s.* 6*d.* net.

THE issue of three editions of this book in the space of five years is eloquent testimony to its usefulness, and we can well understand that, to the worker in the tropics, far away, perhaps, from libraries, laboratories, and fellow-workers, it is invaluable. The authors are both well known for their researches on tropical diseases, and Dr. Stephens is lecturer in the Liverpool School of Tropical Medicine, so that they know the needs of the research student. In the present edition various alterations have been made—trypanosomes, the Hæmamœbidæ and spirochætes are described at greater length than before, the chapter on ticks has been re-written and extended, the consideration of mosquitoes has been confined to the Anophelinæ, and the chapter dealing with Filariæ has been omitted.

The last-named omission is, in our opinion, a mistake, for this section added much to the completeness of the volume, without enlarging it to too great an extent. The book is profusely illustrated with rough but characteristic sketches, more finished drawings, and coloured plates, which enhance its value.

The first two chapters deal with the normal and pathological cells of the blood, their enumeration, and staining. In the drawing of the megaloblast (Fig. 1, p. 2), the nucleus is depicted too deeply stained, and it is hardly correct to describe the nucleus of the large mononuclear leucocyte as irregular and much indented. The caution to use pure methyl alcohol in making up the Leishman stain might have been emphasised. Chapters iii., iv., and v., on malaria, are concise and to the point, and embody a number of useful practical "tips." We miss, however, any reference to the term "subtertian," now commonly used to designate the malignant tertian fever. Chapters vi. to xix. deal with mosquitoes—their general structure, development, life-history, habits, and classification, methods of examination, breeding, capture, and identification. As regards killing, no mention is made of the ordinary entomologist's killing bottle, which can often be obtained or extemporised, and when at hand is one of the best methods available. As regards classification, that of Theobald is adopted, which is based largely on the characters of the scales on the wings and body. The authors are probably wise in confining their description of species almost to the Anophelinæ; these are the important ones from the point of view of medical research, and to have included much more would have occupied far more space than could be allotted. Chapter xxi. is a useful one, indicating how to make a malarial survey of a district. In chapter xxii. the clinical study of malaria is detailed, and contains much useful information. The Hæmamœbæ, hæmogregarines and Piroplasmata are next considered, and the occurrence and main characters of the important species described. We note that it is stated that Miyajima cultivated a trypanosome in blood bouillon from *Piroplasma bigeminum*, but this is an error; the species giving rise to these flagellated developmental forms was probably *P. parvum*. The consideration of ticks naturally follows that of the Piroplasmata, and a very full description of these arthropods is given; but in the classification and description of species more mention of synonyms would have been helpful. The trypanosomes are next considered in great detail, and a chapter on biting flies, *e.g.* Stomoxys, Tabanus, and Glossina, concludes the descriptive matter.

The book also includes chapters on blackwater and yellow fevers, and an appendix containing formulæ for stains and other solutions, preparations of tissues, weights and measures, &c.

We congratulate the authors on their work, which will be indispensable in all laboratories.

HUMAN PHYSIOLOGY.

Physiologie des Menschen. Von Dr. L. Luciani. Ins Deutsche übertragen und bearbeitet von Prof. Dr. S. Baglioni und Dr. Hans Winterstein. Sechste bis zehnte Lieferungen. (Jena: Gustav Fischer, 1907.)

THE issue of the sixth to tenth parts of Luciani's text-book of physiology nearly brings the work to a conclusion. Within the limits of a review it is only possible to mention the most salient features of the book.

Part vi. deals first with the excretory functions of the intestines. The description is noteworthy, not only on account of its excellence and completeness, but also because it indicates more fully than is usual in text-books of physiology the important bearing of the facts on practical medicine.

In the next chapter the chief chemical constituents of the urine are enumerated and described. In view of the large number of works entirely devoted to

this subject, the author has wisely limited his account to the more important facts. It is somewhat unfortunate that Hopkins's method for the estimation of uric acid has been omitted, since it is much simpler than that of Salkowski and Ludwig, which has been selected by the author. A considerable amount of space is devoted to the subject of the toxicity of the urine under normal and pathological conditions. A comprehensive account is next given of the various theories dealing with the secretion of the urine. The description of the functions of the urinary system concludes with a very full and lucid review of the functions of the bladder.

The physiology of the skin and its glands forms the subject of the next chapter. The final pages of the section are devoted to a very thorough and interesting description of the histological and chemical changes involved in the secretion of milk.

Part vii. deals first with the general physiology of muscle. An exceptionally complete account is given of the methods employed in studying muscular work. The mechanics of the special organs of motion are also discussed in greater detail than is usual in text-books of physiology. A description of the mechanism of voice production forms a natural conclusion to this chapter.

The following chapter gives a clear and detailed account of the general physiology of the nervous system, and includes several hitherto unpublished figures from Golgi. An excellent critical review of the neurone theory of the constitution of the nervous system forms a prominent feature of this section. The recent work of Verworn and his pupils on the hitherto somewhat obscure subject of the metabolism of the nerve centres is fully described. The recent interesting experiments of Baglioni and Winterstein on the isolated cord of the frog are also included in this chapter. The physiology of the spinal cord and its nerves forms the subject of the next chapter. A noteworthy feature is the very lucid and thorough description of the segmental distribution of the spinal nerves. Baglioni and Winterstein—the translators of the work—have added a very useful summary of the physiology of the sympathetic nervous system.

The physiology of the bulb and associated cranial nerves is next described in detail. In the following chapter, a very valuable and critical account is given of the physiology of the cerebellum, largely based upon the author's own work.

The two final chapters deal with the physiology of the mid-brain, basal ganglia, and cerebrum. They embrace a very comprehensive survey of the historical development of our knowledge up to the most recent date. A masterly description is given of the localisation of the sensori-motor, sensory, and association centres in the cerebral cortex of man and the higher mammals.

It would be difficult to speak too highly of the value of this text-book. Its preparation must have entailed an almost incalculable amount of labour, combining as it does that wealth of detail usually only found in text-books written by numerous contributors with the uniformity of treatment resulting from the fact that it is essentially the work of one author. The account of the nervous system especially reveals an exact and intimate knowledge of the literature. The work of English physiologists in this field receives fuller treatment than in most foreign text-books.

The translators of the work—Baglioni and Winterstein—have made many valuable additions with the object of bringing the book fully up to date. The book is remarkably free from typographical errors. The following errata, however, should be noted:—on p. 370 of vol. ii. "phenol" is used instead of "indol," and on p. 600 of vol. iii., in the description of Flechsig's scheme of the projection and association centres, "parietal" is used instead of "frontal." In one instance also the word "verleiten" is used instead of "verleihen." J. A. MILROY.

TECHNICAL CHEMISTRY.

Leather Industries Laboratory Book of Analytical and Experimental Methods. By Prof. H. R. Procter. Second edition, revised and enlarged. Pp. xx+460. (London: E. and F. N. Spon, Ltd.; New York: Spon and Chamberlain, 1908.) Price 18*s.* net.

AS the first edition of this work has been out of print and unobtainable for more than two years, the appearance of a second and revised edition is extremely welcome to those who are in any way connected with the leather and allied trades.

The second edition of this work is similar in style and external appearance to the first edition, but has been considerably enlarged and in parts completely re-written. Prof. Procter has added new methods of analysis for the control of the tan-yard, in some cases as supplementary to the old, but in others has substituted the newer methods as being more accurate; and as the author states in the preface that "they have been carefully tested in my own laboratory," the dictum of such an authority will suffice to satisfy all chemists working in this branch. The work is not meant to teach either chemical theory or the principles of leather manufacture, but contains in handy form practically all the various common analytical methods likely to be required either by the chemist in the tannery or by those doing work in connection with the chemistry of the leather and allied trades. It is not intended to take the place of ordinary chemical text-books, but to supplement them; and throughout the volume the fullest references are given to original papers and methods.

The work deals in various chapters with general methods of analysis, technical water analysis, depilatants, the estimation of ammonia and hide substance, the analysis of materials used in puering, bateing, liming, &c. Chapter viii., dealing with the chemistry of the tannins and their derivatives, has been considerably enlarged and brought up to date. In this the author has summarised all the work which has been done on this subject up to the present time, and gives copious references. The chapters dealing with the analysis of tanning materials and the official methods of tannin estimation have been completely re-written, and full details of the new international

method of tanning analysis are given. The subsequent chapters deal with the estimation of colour in tanning materials, the analysis of used tan-yard liquors, the analysis of alum and chrome. In connection with this last-named subject the author gives some valuable practical information on the making up of chrome liquors in the testing of liquors in use. This branch of leather manufacture has progressed by enormous strides during the past ten years.

The next chapters deal with the estimation of adulterants in leather, the analysis of soaps, oils and fats, and a table of important constants for oils and fats used in the leather trade is given, and the effect of various fats on leather explained. The analysis of leather, dyes and dye-stuffs follows. The last three chapters are devoted to the use of the microscope, the structure of the skin, and bacteriology. These have been largely re-written, and the author has added some fine photomicrographs of adulterants in tanning materials, and indicates the value of the use of the microscope in competent hands. The bacteriology and mycology of tanning is gone into thoroughly, and our somewhat scanty information on this subject brought up to date, the rapid growth of our knowledge of this most important branch being made evident.

The work is illustrated and printed on good paper, and is written in Prof. Procter's well-known clear style.

At the end of the book some blank leaves are bound in, so that pending the arrival of the third edition those using this book may add notes, and so keep the volume up to date. With such a volume as this before us one is almost tempted to say that after all science has secured a firm foothold in one of the most conservative trades existent.

J. GORDON PARKER.

OUR BOOK SHELF.

Geology and Mineral Resources of the Western Coalfield. By J. E. Carne. Pp. xii+264; with 37 plates and portfolio of maps and sections. (Sydney: Geological Survey of New South Wales, 1908.) Price 15*s*.

IN New South Wales the existence of beds of coal was known in very early days, and was the reason for the name of the colony. It is calculated that New South Wales has yielded altogether 138½ million tons of coal, the output last year alone having exceeded 8½ million tons. In addition to coal, the kerosene shale deposits are of considerable importance, and are at present attracting attention owing to the introduction of British capital for their development. Mr. Carne's elaborate monograph, which reflects great credit upon himself and upon the Geological Survey, is consequently a work of the utmost importance to the mining industry, as well as a valuable addition to scientific literature. With the accompanying portfolio of coloured geological maps and sections, it forms the first instalment of a systematic geological survey of the productive Permo-Carboniferous Coal-measures of New South Wales. The total area mapped and described in this memoir amounts to 2877 square miles, of which 2261 square miles may be regarded as productive. The country described embraces the principal parts of Cook and Hunter counties, and a large portion of Roxburgh and Phillip counties, the greater part of the Blue Mountains being included. From an economic point of view, coal and kerosene-shale are the chief assets of the country mapped. Limestone, firebrick, pottery clays, building stones, and iron ore follow in order. The smelting of local iron ore has been successfully begun at Lithgow; and if the iron-smelting venture and the extensive development of the kerosene-shale export and retorting industry continue to progress, the district will soon become a great centre of industrial activity. The picturesque character of the country is well shown in the numerous admirable illustrations accompanying the memoir. Massive Triassic sandstone, imparting boldness to the scenery, is sculptured by denudation into rugged walls and isolated masses. Irregularities of the plateau are not less varied. Huge domed laccoliths, conical volcanic peaks, and flat coulee remnants are everywhere prominent. A glance at the illustrations impresses one with the magnitude of the task of geologically surveying these mountains, which in 1788 effectually barred Governor Phillip's progress into the interior from the settlement on the shores of Port Jackson. The persistence of the explorer of the present day in forcing his way along jungle-fringed and boulder-strewn streams flowing through deep cañons and almost impassable ravines is hardly less astonishing than that of the first surveyors, who, far from an accessible base of supplies, traversed this unknown and inhospitable region.

Science and Empiricism. By H. C. Daniel. Pp. 29. (London: Scientific Press, Ltd., 1908.) Price 1*s*. 6*d*. net.

THIS booklet contains a strange medley of fact and fiction, though apparently written with a good motive, for in his preface the author acknowledges the "splendid efforts of our scientists and medical professors," and deplores "the neglect of hospitals and laboratories." In section i. the author discourses on biology and Weismannism; in section ii. on pathology, with special reference to cancer and its cure, in which we are exhorted "in the place of fiction to substitute truth. Instead of holding to the absurd principle that the red corpuscles are the bearers of oxygen, let us in the future build upon the more scientific principle that oxygen is the bearer of the red corpuscles." Cancer is easily explained. "Superficial cancer is a disease of the blood tissues and is only dangerous is so far as it affects the tissues or envelope of life. Plasmic cancer, however, is a disease of the oxygen or vital ground, that is to say, of the white corpuscles or physical unity of life, and as such it goes deeper than the tissues." The seven last pages are devoted to sections on theology, education, and government, but what they are all about we really are not quite sure! R. T. H.

Vegetationsbilder. Edited by G. Karsten and H. Schenck. Sixth Series. Part i., Samoa. By Karl Rechinger. Part ii., New Guinea Archipelago. By Karl Rechinger. Part iii., North-Eastern Brazil. By E. Ule. Part iv., The Algerian Sahara. By H. Brockmann Jerosch and A. Heim. Parts v. and vi., Alpine Vegetation. By H. Schenck. (Jena: Gustav Fischer, 1908.)

THE sixth series of the "Vegetationsbilder" fully maintains the reputation of the preceding volumes. The pictures of Samoan vegetation furnish an indication of the humidity of the climate where ferns supply 25 per cent. of the higher plants. Illustrations are provided of *Polypodium sabauriculatum*, an epiphyte in the rain forest, *Angiopteris evecta*, growing by the streams, and *Todea Fraseri*, an

endemic species of the genus, also of a peculiar liliaceous epiphyte, *Astelia montana*. As characteristic plants of the Solomon Islands there are figured the epiphyte *Polypodium quercifolium*, an expanse of "alang-alang" grass, *Imperata arundinacea*, and a huge specimen of *Calophyllum inophyllum* growing close to the sea. A fine photograph of the stilt-roots of a Ficus is contained in this part. Mr. E. Ule has contributed the photographs from the "campos" in the Brazilian State of Bahia. Various cactus plants are illustrated, also some of the abundant leguminous trees. The cluster of palms, *Copernicia cerifera*, the species yielding Carnauba wax, forms an imposing group. The number devoted to the Algerian Sahara is also a xerophytic study. The plates include representations of *Limoniastrum Feëi*, *Aristida pungens*, and *Pistacia terebinthus*. In the final double number Dr. Schenck presents some excellent studies of plants in the Swiss and Tyrolese Alps. The photographs that more particularly evoke admiration are those showing cushions of *Androsace helvetica*, flowers of *Ranunculus alpestris*, clumps of *Thlaspi rotundifolia*, and straggling plants of *Salix retusa*.

British Rainfall, 1907. By Dr. H. R. Mill. Pp. 100 +[280]; with maps and illustrations. (London: E. Stanford, 1908.) Price 10*s*.

THIS excellent work, which has now reached its forty-seventh annual volume, has, by the energy and ability of its founders, established for itself a unique position among general rainfall publications. It deals with the distribution of rain in space and time over the British Isles during the year 1907, as recorded by more than 4000 voluntary observers, and is supplemented by articles upon various branches relating to that subject. As it has appeared in practically the same form for many years (which is a great advantage for the purpose of reference), there is little to be said about it that has not been previously mentioned; the work of the British Rainfall Organisation is continually expanding, and the author receives no pecuniary assistance in the onerous labour of preparation and publication of the report beyond some subscriptions from persons interested in rainfall work.

Among the articles we may specially refer (1) to an interesting discussion of the typical thunderstorms of July 21–22, showing distinctly the linear arrangement of heavy rainfall in such storms and its disregard of the configuration of the land, and (2) to an instructive note on mapping rainfall. The discussions of droughts and rain spells, and the monthly and seasonal charts illustrating the rainfall of the year, are also of exceptional interest.

Arbeiten aus dem Gebiet der experimentellen Physiologie. By Dr. Hans Friedenthal. Pp. xi+493. (Jena: G. Fischer, 1908.) Price 8 marks.

THIS is a collection of fifty-five papers written either by Dr. Hans Friedenthal or by the workers in his laboratory. Dr. Friedenthal does not appear to have any university or other official post, but is the happy possessor of a private laboratory at Nicolassee, near Berlin, and he seems to be a prolific and versatile worker. The first paper of the collection is an obstetric one, written in 1894, but subsequently the various branches of physiological investigation appear to have had greater attraction for him, and he has produced since that time publications dealing with such subjects as absorption, immunity, digestion, colloids and ions, cardiac and sympathetic nerves, cancer, syphilis, the urine, and histological methods. The papers themselves are of considerable interest, and the collection is one of which any investigator may well be proud.

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.*]

Observations on the Active Deposit of Radium in Mid-ocean.

IN the month of May, 1908, by the kindness of the captain and officers of the ss. *Lake Erie*, observations were made between Montreal and Liverpool on the radio-active matter collected on a negatively charged wire exposed to the air for three or four hours. The wire was insulated by ebonite rods, suspended from the flag halyards, and charged by a Zamboni dry pile. After exposure it was coiled on a skeleton reel and placed in an electroscope clamped to a board, together with the observing microscope. There was no difficulty in obtaining satisfactory readings, in spite of the slight motion of the ship.

The results obtained in mid-Atlantic appear to approximate to those found in Canada or in England, but it must be remembered that the amount of active deposit determined at any given locality is liable to considerable variations.

To an arbitrary scale, after deducting the natural leak, the measurements of the active deposit were as follows:—

May 5.	Montreal	34
,, 6.	,, ...	26
,, 14.	Ocean, lat. 50°, long. 45°	21
,, 15.	,, ,, 52°, ,, 38°	64
,, 16.	,, ,, 54°, ,, 30°	41
July 1.	Hornsea, E. Yorkshire Coast ...	28
,, 2.	,, ,, ,, ...	80
,, 15.	,, ,, ,, ...	53
,, 20.	,, ,, ,, ...	60
,, 22.	,, ,, ,, ...	48
Aug. 22.	Seascale, W. Coast, Cumberland ...	30
,, 24.	,, ,, ,, ...	270

The large value at Seascale on August 24 was obtained on a vertical wire well exposed to a strong west wind. The small values at Montreal resulted from a horizontal wire on the roof of a house. An uncharged wire at sea gave no result.

These experiments, so far as they go, indicate that the active deposit due to radium is prevalent to nearly the same extent over land and sea. Observers have also found that the ionisation of the atmosphere, measured by Ebert's apparatus, is nearly the same over the ocean and over the land.

We may deduce, then, that in mid-ocean the radium emanation, which decays to half value in 3·8 days, and gives rise to the active deposit, cannot be entirely wind-borne from the land, but that the emanation enters the air from the ocean somewhat as from the ground.

This is contrary to expectation, for the average number of grams of radium per c.c. of rock is about $3{\cdot}5\times10^{-12}$ (Strutt) and per c.c. of sea water 3×10^{-14} (Joly). It is, however, probable that the emanation due to radium in solution in sea-water escapes more readily than the greater quantity generated in soil or rock. The emanation per c.c. in the atmosphere near the earth's surface would be in equilibrium with about 6×10^{-17} grams of radium.

Montreal, September 22. A. S. EVE.

The Indigo Question.

IN an admirable article, "A Contribution to the Indigo Question," which appeared in NATURE of July 30 (p. 296), Prof. Meldola discusses the report of the work carried on by Messrs. Bloxam, Wood, Orchardson, Gaunt, and Thomas in the clothworkers' laboratory at Leeds University, and agrees with the authors in the opinion they express that there is still scope for considerable improvement in the manufacture of natural indigo. On the other hand, the general secretary of the Bihar Planters' Association (Mr. T. R. Filgalt), in replying to this article (NATURE, October 1), makes the remarkable statement, "nothing further can be done in improving the main processes."

Although Prof. Meldola has already dealt with this statement, I should like to be allowed to make a few remarks on the same subject. The most important point in the whole discussion is the question whether, in the future, it will be possible for the natural product to compete successfully with its coal-tar rival.

If the planters and their adviser, Mr. Bergtheil, can be induced to recognise and extend the results of the scientific investigations carried on in Leeds under my general supervision, I am strongly of opinion that there is still a bright future for natural indigo. The details of these investigations have been published in the Journal of the Society of Chemical Industry, and I cannot go into them again here, but I may be allowed briefly to state the main conclusions which were arrived at and confirmed in the fullest possible manner.

There can be no doubt that the indigo leaf contains much more indican than was formerly supposed to be the case, and this fact has hitherto been overlooked because of the defective analytical methods employed by the scientific advisers to the indigo planters. Mr. Bloxam and his colleagues very carefully investigated these analytical processes, and were able to prove conclusively that the persulphate method, carried out according to Mr. Bergtheil's directions, gives results which are quite untrustworthy. The first step, therefore, was to devise trustworthy analytical methods, and this was ultimately accomplished by the development of the isatin method for determining the indican in the leaf and the tetrasulphonate method for estimating the indigo in the finished cake. A very large number of control analyses, carried out under a great variety of conditions, have shown conclusively that these analytical methods are the only ones which give accurate results. The application of these new methods has proved beyond doubt that there is much more indican in the leaf than is converted into indigo under the present conditions of manufacture. In spite, therefore, of the statement of the general secretary of the Bihar Planters' Association that "nothing further can be done in improving the main processes," I am convinced that there is a great prospect of considerably increasing the yield of indigo provided all the details of manufacture are systematically subjected to searching and skilful scientific investigation.

A. G. PERKIN.

Memory in the Germ-plasm.

IF "a lamb's tail is shortened" and the germ-cell "records" the event, surely there is more to be "remembered" by it than a "momentary cut," viz. a permanent change of shape? Setting aside mutilations, there remain use-acquirements. From infancy forwards a man develops physically and mentally, principally under the stimulus of use. For instance, the muscles of an infant's limbs do not grow unless used. His mind is almost blank at birth, but grows under the influence of experience (use). In this way he learns to coordinate his muscles and a vast deal more. Prolonged parental protection affords the opportunity. In proportion as animals are low in the scale of life they appear to be less and less capable of making use-acquirements until they are quite incapable. Most insects, for example, are not protected by their parents, and must come into the world fully equipped physically and mentally to cope with the environment. They have no need for use-acquirements, and apparently make none. It seems clear, then, that the power of developing under the stimulus of use (plasticity, as it is called) is a product of evolution. It confers the immensely valuable trait of adaptability on the individual. The position, then, appears to be this: low animals cannot make use-acquirements, and therefore can transmit none; higher animals can make use-acquirements, but obviously transmit none, for in them the innate has been progressively replaced by the acquired. When we speak of the transmission of a use-acquirement, we do not really mean that the child has inherited the parental trait—we mean that the trait has been *transmuted* into something very different and much less useful, an innate character. In other words, we suppose that the adaptability of the parent is replaced by rigidity in the child, and we suppose this in spite of enormous and conclusive evidence to the contrary. We close our eyes carefully to facts, and found our science on vague analogies.

Southsea, October 9. G. ARCHDALL REID.

A Red Rainbow at Sunset.

OCTOBER 9 was a mild day with south-west wind, and slight showers in the afternoon. The sky was overcast until sunset, when breaks appeared in the clouds. In the west there was a fine effect of orange-yellow sunset colour, while in the south-east at the same time the clouds were pink. Here, on some pink clouds near the horizon, a fine, nearly vertical patch of rosy-red rainbow appeared, which shone more brilliantly, and was of a rather yellower red than the surrounding clouds. The colour, varying in intensity, lasted for about three minutes, and the patch appeared to be from 10° to 12° in length; the occurrence took place about 5h. 30m. G.M.T. A similar rainbow is described in the current number of the *Gazette astronomique*.

E. ARMITAGE.

Dadnor, Herefordshire, October 10.

OXFORD UNIVERSITY MUSEUM.

THE fiftieth anniversary of the opening of the Oxford University Museum was celebrated on Thursday last, and a large number of distinguished men of science, representing the universities and scientific societies and institutions of Great Britain and Ireland, assembled to do honour to the occasion. The proceedings were short, and may be very shortly described. The guests assembled in the Sheldonian Theatre, where the honorary degree of Doctor of Science was conferred on Prof. Svante Arrhenius and Mr. A. G. Vernon Harcourt. Fifty years ago Mr. Harcourt was acting as Brodie's lecture assistant, and was engaged in setting up the apparatus for the first lectures delivered in the new museum. Hearty congratulations were tendered by those present on his unimpaired vigour and energy after so many years' active and distinguished scientific work. After receiving congratulatory addresses from universities and learned societies, the Vice-Chancellor read a letter from the Chancellor, and delivered an address which was singularly felicitous both from its style and from the evident sincerity with which he expressed his sympathy with the progress of scientific studies in the University of Oxford.

In the afternoon Dr. Vernon Harcourt gave an address on the early history of the museum. It was unfortunate that the lecture theatre of the museum was too small to accommodate a larger audience. Many were unable to gain admittance, but those who were more fortunate had the privilege of hearing an interesting story luminously told, and enlivened by many humorous passages and personal reminiscences. After Dr. Harcourt's address, the Vice-Chancellor unveiled a bust of the late Prof. W. F. R. Weldon, and the company dispersed to tea and to visit the various departments of the museum.

Though, as the Vice-Chancellor said in his address, fifty years is not a long period in the history of education nor in the history of the University of Oxford, it was fitting that this anniversary should have been commemorated. The building of the Oxford Museum was an indication of a great change in the opinions of educated men in this country, and it is probable that half a century hence the present time will be looked back upon as equally important in the history of the progress of scientific education. In our opinion, too much stress has been laid upon the opposition to the project of building the University Museum; too little credit has been given to the large and enthusiastic support which enabled the project to be realised.

It must not be supposed that Oxford was entirely destitute of scientific collections or of scientific professors and readers in the earlier part of the nineteenth century. The Ashmolean Museum, housed in the beautiful building designed by Wren, contained a considerable number of natural history specimens as well as objects of antiquarian interest, and though it had suffered neglect in the eighteenth century, it had been largely added to by the indefatigable zeal of J. S. and P. B. Duncan since 1823. There were collections of geology and mineralogy in the Clarendon building. Dr. Kidd and the late Sir H. Acland had formed an important anatomical collection at Christ Church, on the model of the Hunterian Museum. Dr. Daubeny had equipped a private house near Magdalen College as a laboratory. The Botanic Garden at Oxford is one of the oldest of its kind. But university laboratories and lecture rooms can hardly be said to have existed, and if they had existed they would not have been filled, for there were no inducements to the study of natural science. In the earliest years of the nineteenth century Oxford had reformed herself. The system of honour examinations was instituted in 1801, and the colleges bestirred themselves to improve and systematise their methods of teaching. But the only subjects recognised in the final schools were "Literæ humaniores" and mathematics; for these exclusively college tuition was provided, and to these subjects alone were allotted all the profits and honours that the colleges could give. The advance in efficiency was no doubt considerable, but it took a direction hostile not only to scientific but to every kind of professorial teaching. Each college undertook to provide for all the intellectual wants of its members, and was jealous of outside interference. As the tutorial influence grew, the professorial influence waned, and the audiences of the scientific professors and readers in particular, if they existed at all, consisted chiefly of graduates who took a *dilettante* interest in natural phenomena.

When the exclusive interests of the colleges are considered, it is a remarkable instance of the liberal spirit prevailing in Oxford before the days of University Commissions that the Honour School of Natural Science was established by vote of Convocation in 1849, and that a large sum of money was shortly afterwards contributed by the University and by private individuals to the building of a museum and laboratories which would be independent of college influence. It is interesting to note that, among many others, Mr. Gladstone's name stands as a contributor of 100*l.* towards the museum building fund, and Dr. Pusey's name as a contributor to the internal decorations. Looking over the records, one cannot but be struck with the large amount of sympathy and practical help given by men whose interests in life lay in very different directions. Equally striking are the high ideals and noble conceptions of those who guided the course of affairs. The new museum was designed to include all the branches of natural science under a single roof, and thus to symbolise the unity of science. Great care was taken that the site and architectural features of the new building should be dignified; that the interior should be enriched with carving; that the history of science should be illustrated by statues of the great men of ancient and modern times. It is well known how Ruskin threw himself into the work and invested it with a poetical fancy which, if detrimental in some respects to the practical requirements of scientific laboratories and exhibitions, is not without value and influence at the present day. Lack of money prevented the completion of the enrichments originally designed, but in very recent years the generosity of the Rev. H. T. Morgan has provided for the carving of the capitals of the pillars of the south and east sides of the central court.

If Oxford was first in the field, it must be confessed that science has not made such rapid strides there as in other universites during the half-century that has elapsed since the museum was first opened. But the progress has been great, though retarded by influences the force of which has only gradually abated in the period. There can be little doubt that the highly elaborated system of college tuition, always more conspicuous at Oxford than at Cambridge, has been a retarding influence. Admirable as it is in many ways, this system has the effect of making colleges reluctant to allow their undergraduates to escape from their immediate influence. College tutors said that when their men went to the museum they lost sight of them. Hence, for many years, they discouraged their going there. As time went on, and it became evident that there was a real demand for scientific teaching, the colleges began to build and equip scientific laboratories of their own; mostly chemical laboratories, in response to the great demand for chemical instruction. Thus it has come about that a great part, probably the larger part, of the chemical teaching in the university is not conducted at the museum, but elsewhere. If this is theoretically disadvantageous, the college lecturers, by organising their courses in combination with the chemical department at the museum, have contributed very largely to the recent rapid progress of chemical science in Oxford, and, further than this, they have been the agents in spreading a real and active interest in scientific studies among all classes in the University. Year by year individual colleges come forward with proposals to endow scientific professorships in subjects insufficiently represented in the University. It would be invidious to particularise, and it would take too much space to enumerate all that has been done by different colleges in this direction in recent years, but special mention may be made of St. John's College, which, after re-endowing the Sibthorpian chair of rural economy, at its own expense has built and equipped laboratories and lecture rooms for the use of the professor.

But the most fundamental and certainly the most encouraging feature in the changed estimate of the value of scientific training in Oxford is due very largely, as the Vice-Chancellor pointed out, to the example set by science itself. By slow degrees the University has come to recognise the value of research. Not long since examinations and preparation for examinations absorbed the whole interest of college staffs. Success in examinations was the only road to a fellowship. In the last few years many colleges have so amended their statutes that they are able to elect a large proportion of research fellows, and have amply availed themselves of their new opportunities. New ideals and new opportunities have arisen, not only in natural science, but in all branches of learning, and the immediate effect, so far as science is concerned, is that emulation has taken the place of opposition.

Thus the celebration of the fiftieth anniversary of the museum marks, not the dawn, but the establishment of a new era. The progress of scientific studies depends more upon sympathy and good will than on laboratories and equipment, indispensable though the latter may be. Those who visited Oxford last week could easily take note of the numerous additions to the departments of the museum and satisfy themselves that the material for scientific work is not lacking. They could satisfy themselves with equal ease of the energy and enthusiasm of the scientific staff, but the spirit of the whole University is more difficult to discern. It should be noted, therefore, that the

Vice-Chancellor's address, which faithfully reflected the opinion of the great majority of resident graduates of the University, was one of the most satisfactory features of the day's proceedings. Nor was evidence lacking that where high ideals and earnest effort are present material assistance is soon forthcoming. The pathological department was largely built and equipped by private generosity, and the Drapers' Company, to whom the University is already indebted for a beautiful and commodious building for housing the Radcliffe library of scientific works, has undertaken to defray the expense of a new electrical laboratory for the use of the Wykeham professor of physics.

All well-wishers of Oxford may join in congratulating her on what she has already achieved, and not less on the abundant promise of future achievement.

MEASUREMENTS OF THE CHINESE.

WE have received from Mr. A. H. Crook, Queen's College, Hong Kong, average measurements of various dimensions of Chinese boys and youths between the ages of ten and twenty-four years, the most important of which we give below. The British Association averages for English boys of the same age, so far as they are available, are printed beneath the corresponding Chinese measurements. Mr. Crook points out an interesting difference in the growth curves of weight and height of the two races.

MEASUREMENTS OF CHINESE BOYS.

Ages	10	11	12	13	14	15	16	17	18	19	20	21	22	23
No.	3	6	15	27	55	95	133	112	98	63	34	12	3	3
Weight.														
Chinese	64·2	66·2	73·6	78·7	90·9	97·6	101·6	106	108·9	114·4	113·4	115·3	116·7	100·1
English	67·5	72·6	76·7	82·6	92	102·7	119	130·9	137·4	139·6	143·3	145·2	146·9	147·8
Height.														
Chinese	54·1	54	56	59·6	62·2	62·9	63·5	64·2	64	65·7	65·6	65	64·6	62·4
English	51·8	53·5	55	56·9	59·3	62·2	64·3	66·2	67	67·3	67·5	67·6	67·7	67·5
Chest (Normal).														
Chinese	24·8	24·6	25·6	26	27·5	28·7	29	29·3	30·1	30·3	30·5	30·5	31·3	29·7
English	26·1	26·5	27·2	28	28·5	29·7	31·5	33·6	34·19	34·5	35	35·2	35 3	35·6
Chest (Expanded).														
Chinese	26 8	26·3	27	27·8	29·3	30·3	30·8	31·4	31·8	32·1	32·2	31·6	33·2	31·4
Neck (Circumference).														
Chinese	10·3	10·4	11	11·2	11·8	12·2	12·5	12·7	13	13·2	13·1	13	13·3	12·9
Wrist (Circumference).														
Chinese	4·8	4·6	5	5	5·3	5·4	5·6	5·7	5·6	5·7	5·7	5·7	5·8	5·7
Hips (Circumference).														
Chinese	27·1	26	27	27·3	29·3	30·2	30·7	31·1	31·7	32	32	31·6	32·2	31·2

From the figures it will be seen that Chinese boys, though lighter in weight, are taller than English boys up to the age of sixteen. After that the stature of the English boy increases much more rapidly than that of the Chinese boy. Mr. Crook thinks that this important difference is due to the fact that the Chinese boy takes much less exercise than the English boy after the critical age. It may be partly due to that, but it is highly probable that the greater part of the difference is racial. Mr. Crook remarks on the small amount of chest expansion of the Chinese, but the 2 inches which he usually obtains is little, if any, short of English and French normals. Mr. Crook's measurements are of considerable value, and it is much to be desired that Englishmen residing among little-known races should imitate his example.

MOSQUITOES AND PEAT.

THE likes and dislikes of mosquitoes are so multifarious that one may never be surprised at anything in their bionomics. Some prefer to live in their larval stages at the edge of weedy pools and rivers, some in clear pools, others in such artificial collections of water as are to be found in old sardine tins, calabashes, cisterns, rain-water barrels, and tanks on board steamers, even the liquid in the pitcher plants forms a breeding ground, and yet others occur in the water held up in cut and insect-damaged bamboos. Each species seems to have its own particular place to live.

A recent letter in the *Times* refers to the absence of mosquitoes in swamps and marshes with peat. The writer, "Many Lands," says:—"Given marshy lands and no peat mosquitoes abound, given marshy land and peat there are none." This may be true where the writer has been, and in many other places, but it is not a universal rule. It must certainly depend on what species the mosquitoes are, for we have found such as *Anopheles nigripes*, Staeg., and *Anopheles bifurcatus*, Linn., breeding in the water of peat cuttings in Wales and Somerset, and on the far-famed Wicken Fen numbers of *Culex cantans*, Meigen, in the waters there. Mosquitoes are often very abundant in the fens, even where the peat is dug. Besides these, we have found *Anopheles maculipennis*, Meig., and *Theobaldia annulata*, Meig., in peaty water and near peat piles in North Wales. In America Smith records that the mosquito larvæ are few where sphagnum swamps abound, and we may find that peat areas are similarly not favourable to certain mosquitoes. Nothing definite is known of this subject. It would not be waste of time to try if a few blocks of peat thrown into a pool or artificial collection of water would destroy the larvæ, but from what we have seen of at least five of our twenty-two British Culicidæ it seems doubtful if it would do so.

Towards the end of the letter in the *Times* the writer says, "for of course mosquitoes cannot breed in salt water."

This statement is quite incorrect, for many do so. Take Australia alone, and we find three species

breeding in salt water, namely, *Mucidus alternans*, Westwood, *Culex vigilax*, Skuse, and *Nyssorhynchus annulipes*, Walker. In Malta we get *Acartomyia zammitii*, Theobald, in Italy *Culex salinus*, Ficalbi, living in salt water, and others could be mentioned. It would be as inaccurate to say that mosquitoes cannot breed in water on marshy land with peat as it is to say they cannot breed in salt water.

FRED. V. THEOBALD.

NOTES.

IT is announced that Sir Daniel Morris, K.C.M.G., Imperial Commissioner, West Indian Agricultural Department, has resigned his post, which he has occupied with conspicuous success during the past ten years.

IT is estimated by an officer of the American Department of Agriculture that the recent forest fires in the United States have caused losses at the rate of a million dollars a day. In New York State alone 44,935 acres were destroyed by the flames by the end of September. The Forestry Bureau at Washington has issued a statement declaring that probably in every instance the fires might have been prevented if the States had provided an adequate number of men to patrol the woods and stop the fires at their beginning, and if lumbermen and others who use the forests had been careful to dispose of brushwood after logging.

THE first International Road Congress was opened at Paris on Monday at the Sorbonne, Paris, under the presidency of M. Léthier, Inspector-General of Bridges and Roads. More than two thousand delegates, representing twenty-nine countries, are attending the congress. Among the groups of subjects to be discussed are:—construction and maintenance of roads; general methods of maintenance; wear and dust; traffic and its working; effect of new methods of locomotion upon the roads; the effect of the roads upon vehicles; signals upon the road; roads and services of mechanical transport.

THE winter lectures at the London Institution, Finsbury Circus, London, E.C., will begin on October 26, and continue until the end of February, 1909, two lectures being delivered each week. The programme arranged is of a varied character. Among the lectures we notice the following:—excavations in Memphis, by Prof. W. M. Flinders Petrie, F.R.S.; underground water supply, by Mr. C. Carus-Wilson; sea-urchins and the relation between the individual and its environment, by Dr. J. W. Jenkinson; Mendelian heredity, by Mr. William Bateson, F.R.S.; and the use of oxygen: demonstration of life-saving apparatus for use in mines and submarines, by Mr. Leonard E. Hill, F.R.S.

THE bison range in the Flathead Indian Reservation in Montana, to establish which the United States Congress at its last session appropriated 8000*l*., has been selected. We learn from *Science* that the range is the one recommended by Prof. Morton J. Elrod, of the University of Montana, after he had examined carefully several parts of the country. It lies directly north of the Jocko River near the towns of Ravalli and Jocko. Approximately 12,800 acres are embraced in the tract, which will be fenced in a substantial manner. Of the amount appropriated, only 2000*l*. will be available for fencing the range and constructing the shelter sheds and other buildings necessary for the proper maintenance and care of the bison. The remaining 6000*l*. will be paid to the owners of the land, many of whom are Indians. Funds for the purchase of bison are being raised under the auspices of the American Bison Society, which was largely instrumental in securing the grant.

ON October 10, in the presence of the leading aëronautical experts of France, Mr. Wilbur Wright, with M. Painlevé as a passenger, accomplished a flight of 1h. 9m. 45·6s. in duration, the distance covered being estimated at nearly seventy kilometres. This successful flight is the last demanded of Mr. Wright by the French syndicate which has acquired the local rights in his aëroplane by the payment of 10,000*l*. at once and 10,000*l*. in a month's time, after three men have been trained to work the machine. The *Daily Mail* states that on November 1 the Société navale des Chantiers de France will begin at Dunkirk the construction of fifty Wright aëroplanes, which are to be sold at the price of 1000*l*. each. The Aéro Club of France has decided to award to the brothers Orville and Wilbur Wright its grand gold medal for the year 1908.

THE Committee on Ancient Earthworks and Fortified Enclosures, under the chairmanship of Lord Belcarres, has during the past year lost the services of two men who contributed largely to the conservation of these important remains—Mr. I. Chalkley Gould and Sir John Evans. It is satisfactory to learn that Maiden Castle, near Dorchester, has been transferred to the care of the Commissioners of Works; and that mounds at Thetford Castle, in Norfolk, and Waytemore, near Bishop's Stortford, have been taken over by the local authorities. So far only the county councils of Hertfordshire, Leicestershire, London, Staffordshire, the West Riding of York, Galway, and Louth have exercised the powers conferred by the Ancient Monuments Act of 1900. Meanwhile Scotland and Wales have succeeded in procuring the appointment of Royal Commissions to compile an inventory of their local antiquities. It is high time that antiquaries in England pressed for a similar measure, and for the appointment of an Inspector of Ancient Monuments, particularly as much recent damage is reported from various parts of the country. The report of the committee gives interesting details of excavations in progress, and notes some cases in which measures have been taken to check that spirit of vandalism which is now happily decreasing under the watchful care of the local archæological societies.

THE first meeting of the council of the International Electrotechnical Commission is to be opened by Mr. Balfour on October 19 at the new rooms of the Institution of Electrical Engineers, Victoria Embankment. The commission originated through resolutions of the Government delegates to the St. Louis Electrical Congress in 1904, when it was decided that steps should be taken to secure the cooperation of the technical societies of the world by the appointment of a representative commission to consider the question of the standardisation of the nomenclature and ratings of electrical apparatus and machinery. A preliminary meeting of the International Electrotechnical Commission was held in London in June, 1906, fourteen countries being represented. The chief question which will be discussed next week is that of nomenclature. The subcommittee on nomenclature, under Mr. A. P. Trotter, appointed by the British committee, has been at work during the past year trying to settle the best explanations for the terms in general use in the electrical industry, and has drawn up a preliminary list. The suggestions put forward by the French committee for a provisional standard of light are to be considered, and the subject of the metric system as affecting the work of the commission is also to be discussed.

THE International Conference on Electrical Units and Standards, the constitution and objects of which were described in last week's NATURE, was opened on Monday at the rooms of the Royal Society by Mr. Churchill, M.P., president of the Board of Trade. In the course of his remarks at the opening of the proceedings Mr. Churchill said :—" Fourteen years have passed since the last International Congress, at which definite resolutions were passed as to electric units. The resolutions of Chicago in 1893, based as they were upon the conclusions reached at Edinburgh in the previous year, have formed the starting point of legislation in various countries. The present conference owes its inception to the resolution agreed to by the delegates of many countries four years ago at the great exhibition at St. Louis. That resolution not only confirmed the necessity for a more practical and perfect uniformity of electrical standards through the labours of an international commission, but further expressed the hope that that commission might ultimately be preserved in a permanent form. His Majesty's Government has responded with precision and cordiality to the proposal to convoke an international conference in London. The result of the invitations has been most gratifying. The importance of the work is undoubted, the capacity of the conference is indisputable. It is not within the scope of such a conference to formulate laws for Governments and nations. It is its business to define in clear and accurate expression those scientific quantities in terms of which electric energy is bought and sold, and, if possible, to embody its conclusions in draft articles which may form the basis of legislation and administration, so far as electric units and standards are concerned. While the work of the conference is scientific, it must also be practical. It is of the greatest interest to science to realise, in the most exact manner, the fundamental units of the electrician; but the primary work of the conference is to define and specify standards for the purposes of trade and commerce. Those standards must be definitely fixed in value; they must be permanent, and they must be reproducible. Physicists will continue their researches into the exact relations of those standards to the fundamental units, and each year will make the knowledge of those relations more complete; but the object of the conference is to secure the immense advantage to trade and commerce, by establishing a universal system of standards acceptable to all." After a vote of thanks had been passed to Mr. Churchill, Lord Rayleigh took the chair, and the business of the conference commenced. In the evening the delegates were entertained at dinner by the president and members of the Royal Society Club, and a reception was held by Lord Rayleigh and the council of the Royal Society. As at present arranged, the last meeting of the conference will be held on Wednesday, October 21, and we hope to publish an account of the proceedings in NATURE of the following week.

Naturen for September contains the conclusion of Dr. L. Stejneger's article on the relations of the fauna and flora of western Norway. Reference is made to the distribution of certain liver-worts and to the bearing of the newly described *Microtus arvalis exsul* of the Hebrides on the theory of a former land-connection between Scandinavia and Scotland.

INSECTS injurious to local crops in 1907 form the subject of Bulletin No. 251 of the Michigan State Agricultural Experiment Station. Among these, the most harmful appears to be the so-called rose-chafer, which visits many of the vineyards in millions. It is noted that certain evil-smelling bugs prey upon the potato-beetle.

SOME time ago Dr. F. A. Bather attempted a revision of the nomenclature of the crinoids. The subject has been further elaborated by Mr. A. H. Clark in a paper published as No. 1623 of the Proceedings of the U.S. National Museum. Dr. Bather's conclusions with regard to the names to be used are stated to be incorrect, except in the case of two genera.

No. 4 of vol. v. of the University of Colorado Studies includes a list of Colorado Entomostraca, by Mr. G. S. Dodds. The list is not a long one, but this is probably to a great extent owing to imperfect knowledge, and when collections have been made from the numerous small lakes at elevations between 6000 feet and 1200 feet, it is probable that the number of these organisms will be very largely increased.

WE have received a copy of a second edition of a guide to the Wilberforce Museum at Hull, in which Mr. T. Sheppard gives much interesting information with regard to William Wilberforce and his connection with that city, which was his birthplace. In addition to Wilberforce relics, the building also contains objects connected with the history and trade of Hull, among the latter being a complete collection of whaling implements.

IN a paper on the Ceylon fishery of window-pane oysters (*Placuna placenta*), published in the August number of *Spolia Zeylanica*, Mr. A. Willey describes a certain very remarkable peculiarity in the development of that species. The fact that the largest oysters examined during the inspection in October last were immature leads to the conclusion that Placuna does not produce an annual brood, but that one generation succeeds another at intervals longer than one year, and that sexual maturity is attained only after completion of the superficial growth of the shell, the life of individual oysters probably being three years.

IN the September number of the *Zoologist* Mr. H. E. Forrest directs attention to the remarkable difference between the vertebrate faunas of Wales and Ireland, dwelling specially on the absence from the island of moles, short-tailed field-mice, weasels, polecats, reptiles, and several kinds of fresh-water fishes. In explanation it is suggested that the paucity of the Irish fauna may be due to that island having become separated from Great Britain before the latter was cut off from the Continent by the English Channel. The theory of a direct connection between Ireland, Scotland, and western Norway is ignored.

IN an article on wild life in the Murray Swamps, published in the August number of the *Victorian Naturalist*, Mr. A. H. E. Mattingley utters yet another protest against the evil deeds of the plumage-hunters. " Dead and dying egrets," he reports of a certain spot, " were everywhere. The plume-hunters had been there before me, and the wreck they had left behind made my blood boil with indignation. It would not have been so bad had the slaughter consisted only of the hundred or so of adult birds, but, as these were the parents of three times as many fledgelings, left to die of starvation, you may readily guess how I felt."

WE have been favoured with a copy of the first number of a new work entitled " Wild Beasts of the World," by Mr. F. Finn, published by Messrs. T. C. and E. C. Jack. The work is to be completed in seventeen parts, at the price of 1s. each, and is to be illustrated by 100 coloured quarto plates, six of which are issued in the part now before us. These, which represent apes and monkeys, are

executed in the three-colour process. In the text Mr. Finn relates a fact previously unknown to us, namely, that Kirk's guereza monkey, of Zanzibar, has been exterminated by natives sent by Sir John Kirk himself to ascertain how many individuals survived.

SOME time ago Prof. Prowazek described certain bodies discovered by him in the intestine of the lizard as the reproductive cysts of *Bodo lacertae*, a parasitic flagellate found in the same situation. It was further stated that these "cysts" underwent a unique kind of "autogamic" development, the details of which it will be unnecessary to discuss. At a later date Mr. C. C. Dobell discovered in the intestine of the frog, associated with parasites known as *Octomitus ranae* (which are apparently near relatives of Bodo), very similar bodies. These he very naturally regarded in the same light as those described by Prof. Prowazek, but fresh investigations have caused him (as narrated in *Biologisches Centralblatt* for September 1) to come to a very different conclusion. He now decides that the "cysts" in the frog's intestines are yeasts, and suggests that the bodies described by Prof. Prowazek from the lizard are of a similar nature. If this be so, the "autogamous" reproduction of Bodo is a myth.

IN order to obtain a better knowledge of the *rôle* of birds in the economy of nature, a novel kind of ornithological survey was undertaken a year ago in Illinois, a couple of observers in summer marching at a distance of thirty yards apart over long strips of three different districts, and noting the number of birds of each species seen. The total number of birds observed per square mile was 645, or almost exactly one per acre, but by eliminating 1414 interloping European sparrows, the number of native birds was found to be 527 to the square mile. The total number of native birds on this basis for the whole of Illinois works out at 30,750,000, in addition to which are 5,536,000 sparrows. Of the eighty-five species represented by the 7740 birds recognised on the trips, the twenty-one most common species accounted for no less than 6596; in other words, 85 per cent. of the birds belonged to 25 per cent. of the species. It is these abundant species that are alone to be considered in the effects of bird-life on the products of the country.

IN a paper published in vol. xxxiv. (pp. 393–402) of the Proceedings of the U.S. National Museum, Mr. M. W. Lyon expresses his opinion that the placing of the American prong-buck (Antilocapra) in a family by itself is not justified by the facts. Its only essential difference from the Bovidæ is to be found in the forking and annual shedding of the horns, and the consequent absence of annual rings of growth at their bases. In addition to these characteristics may, however, be mentioned the large number of cutaneous glands (namely, a pair behind the lower jaw, another pair on the ischium, two interdigital pairs, a pair on the hocks, and a single one on the hind part of the back in advance of the rump-patch) in this ruminant. The species should be regarded as representing a subfamily (Antilocaprinæ) of the Bovidæ.

DURING the last twenty years of his life, the late Mr. C. B. Clarke became the recognised authority on the Cyperaceæ, and received species for identification from all parts of the world, whereby he accumulated material for a prospective monograph of the order. On account of its great length the preparation of the work for publication is not at present possible, but the director of Kew Gardens has assigned the eighth volume of the additional series to the Kew Bulletin to the publication of his descriptions of unrecorded determinations. There is also included an enumeration of all the species in his manuscript ordered according to his proposed classification under generic subdivisions.

WE have been favoured with a copy of the paper, by Mr. F. A. Stockdale, on the fungus diseases of cacao, published in the *West Indian Bulletin* (vol. ix., No. 2). Stem canker and root disease have been chiefly responsible for destruction of trees in the West Indies, but "die-back" of branches caused by *Diplodia cacaoïcola* and a pink disease connected with a Corticium have been troublesome in St. Lucia, and recent investigations in Trinidad point to the ravages of a species of Lasiodiplodia. The pods are liable to be rusted by the Diplodia mentioned, or may be infested by *Phytophthora omnivora*, which produces a black rot. Altogether a formidable list of pests is recorded, but, fortunately, most are amenable to treatment, whether this consists in improving the vigour of the trees by tillage or manuring, or in spraying with or without the application of the excising knife.

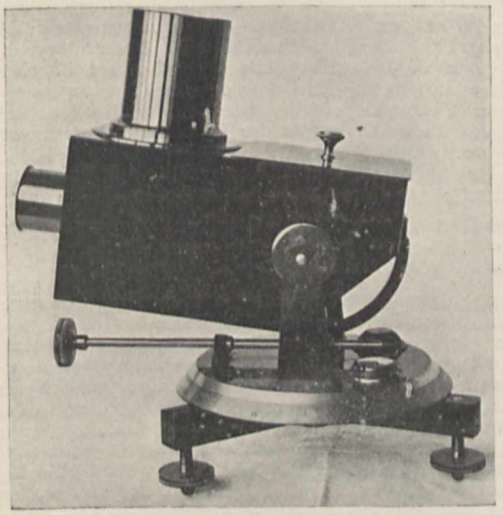
THERE are no stages in the life-history of phanerogams more widely and correctly known than the normal divisions of the nuclei in the embryo-sac or megaspore; the stages at which the "reduction-divisions" take place are not, however, so accurately known. In the *Botanical Gazette* (June) Prof. J. M. Coulter discusses the interpretation of irregular nuclear and cell divisions occurring at these stages. He points out that ordinarily five successive divisions occur from the megaspore mother cell to the fertilisation stage, and observes that the two reduction divisions are essential. In Lilium there are only three divisions, of which two should be regarded as reduction divisions forming megaspore nuclei. All these nuclei enter into the structure of the female gametophyte, and there is one subsequent division. Peperomia and the Penæaceæ afford difficulties of another kind, but here there has been, in the author's opinion, no additional division of the free nuclei.

THE meteorological year-book of the Bremen Observatory for 1907, published by Dr. P. Bergholz, contains complete hourly observations from automatic instruments with results, and rainfall values for several stations in the neighbourhood. A special feature is made of phenological phenomena; the results are given for the year in question, with means for the years 1896–1907. The work forms one of the excellent year books of the German Empire, and is the eighteenth volume of the Bremen series.

MAURITIUS in 1850 was covered with forests to the extent of about one-third of its area. In 1880 this had been diminished to about one-tenth of the area of the island, and, of course, some of this has been cleared since. In view of the opinions expressed by Mr. Thompson in 1880 and Mr. Gleadow in 1904, that the destruction of the forests had an adverse influence on the climate of the island, Mr. A. Walter, chief assistant of the Royal Alfred Observatory, has made a thorough examination of the data available in order to find some statistical evidence either for or against these opinions ("On the Influence of Forests on Rainfall and the Probable Effect of 'Deboisement' on Agriculture in Mauritius"). Mr. Walter finds in the smoothed rainfall curves extending over the period 1860 to 1907 evidence that the cutting of the forests may have had some little effect on the total fall, but has had more effect on the number of rainy days. The distribution through the year is almost more important than the amount. The rainy days in the districts denuded of forests have been decreased by about

30 days per year, but under such conditions that the amount due to these 30 days is only about 6 to 10 inches, whereas the annual variation of total rainfall is often 60 inches. Before the forests were cut rain fell on many calm afternoons, because the presence of moisture transpired by the trees was sufficient by increasing the humidity and decreasing the pressure to cause slight showers. The rain caused in this way is, however, very local, and apparently Mr. Walter does not recommend any great work and expense in planting trees with the idea of improving the climate generally.

THE exact knowledge of the speed at which the clouds travel is one of the best means of ascertaining the presence, direction, and velocity of certain currents of the upper atmosphere which directly affect aërial navigation. The accompanying illustration shows an instrument designed for this purpose, and manufactured by Richard, of Paris. The apparatus is mounted on a horizontal axis around which it may be turned by means of a long screw. The two supports on which it rests are fixed over a divided brass disc, which may be turned horizontally around an axis placed on a support fitted with three adjustable screws.



The Nephoscope.

Inside the apparatus are two mirrors placed relatively at an angle of 45° in the direction of a spy-hole, through which the operator looks, and towards a reticle consisting of a four-sided piece of glass placed in such a way that the distance between two lines represents the angular space of a degree. The reticle is placed in a tube holding a special system of lenses arranged in such a way that the face of the reticle is reflected in the mirror. It thus happens that on looking through the spy-hole the face of the reticle is seen projected upon the cloud under observation. It is necessary to observe the movement of the cloud and to know its altitude in order to determine the speed at which it is travelling. Two such instruments placed at a known distance apart and observing the same cloud would give the height, and, at the same time, two measurements of the velocity. The mounting of the apparatus on two axes, one vertical and the other horizontal, allows it to be placed at any angle, so that the sky may be explored in every direction.

THE August Bulletin of the Bureau of Standards at Washington contains a paper of 132 pages on the various formulæ for the calculation of the self and mutual inductances of coils, by Messrs. E. B. Rosa and L. Cohen. The authors have included all the formulæ which have been found correct, and indicate the conditions under which one or other is to be preferred. The numerical work is carried out in a number of cases in order to show the application of the formulæ, and more than twenty pages of tables to facilitate the calculations are given.

ACCORDING to a communication made to the Versammlung deutscher Naturforscher und Aerzte at the recent meeting at Cologne, Prof. H. W. Schmidt and Dr. P. Cermak, of Giessen, have discovered the cause of the different results which have been obtained in experiments to determine the effect of high temperatures on the radio-active properties of substances. They find that if the experiment is made with the radio-active material in a new quartz tube, change of temperature appears to have no effect on the activity of the substance, and that the apparent effect obtained with an old tube is due to the diffusion into and through the material of the tube of the products of decomposition—radium B and C. Although the authors have not yet completed their experiments, they consider they have sufficient evidence to justify the statement that for changes of temperature up to 1500° C. no change of the radio-active properties of substances can be detected by the most sensitive instruments.

IT is a well-known fact that when a saturated vapour below its critical temperature has its volume suddenly decreased, some of the vapour is condensed on the walls of the containing vessel, and, in running down them, gives the appearance of ripples. In the *Physical Review* for August, Messrs. W. P. Bradley, A. W. Browne, and C. F. Hale, of the Wesleyan University, Middletown, Connecticut, show that the phenomenon of ripples is also exhibited when the same experiment is carried out with vapour above the critical temperature. They consider that this observation supports the theory that at and above the critical temperature the miscibility of liquid and vapour is unlimited, while below it is limited by the existence of a saturation point. On this view the "area of liquefaction" of the Andrews diagram is really the "area of saturation"; outside it on the side of large volumes liquid may exist, but not in sufficient quantity to saturate the vapour, while outside for small volumes vapour may exist, but not in sufficient quantity to saturate the liquid.

INCREASED importance is year by year attached in our elementary schools to simple instruction in the elementary rules of healthy living. Many easy reading books have been produced to assist teachers in this direction, and among these is Mr. W. Taylor's "First Reader in Health and Temperance," a new edition of which has just been issued by Messrs. George Philip and Son, Ltd., and the Church of England Temperance Society.

A USEFUL catalogue dealing with apparatus suitable for chemical lecture experiments and various forms of lecture lanterns has been received from Messrs. A. Gallenkamp and Co., Ltd. It includes particulars of all the equipment necessary for the performance of the experiments described in the better-known books dealing with chemical lecture demonstrations. In addition to the illustrations and particulars as to the sizes and prices of the instruments, the catalogue provides many hints to teachers as to the way the apparatus should be used and the purposes to which it may be put. The list also contains information concerning the supply of compressed oxygen, and particulars respecting liquid air and the apparatus employed in handling it.

ON previous occasions we have referred in terms of praise to special catalogues, like that of books on the

useful arts, prepared by Mr. Basil Anderton, the public librarian, and published by the Newcastle-upon-Tyne Public Libraries Committee. We have now received a copy of the new catalogue, edited by Mr. Anderton, of the Newcastle-upon-Tyne Central Lending Library, which includes all books in circulation except English fiction, children's books, and books for the blind. The volume consists of 712 pages of large size, and is, in the main, an author catalogue arranged in the alphabetical order of authors' names and writings. A noticeable feature is the introduction, under an author's works, of particulars of books by other writers containing scientific, philosophical, or other criticisms of them. It is satisfactory to find that scientific works occupy a prominent place in the library. The readers of Newcastle-upon-Tyne may be congratulated on the possession of a complete and well-arranged guide to the large number of books at their disposal.

OUR ASTRONOMICAL COLUMN.

A NEW SATURNIAN RING.—A telegram received at the Kiel Centralstelle on October 8 announces that a new, dusky ring surrounding the bright rings of Saturn has been discovered at the Geneva Observatory (Kiel Circular, No. 104).

COMET MOREHOUSE, 1908c.—Numerous observations of Morehouse's comet, 1908c, are recorded in No. 4275 of the *Astronomische Nachrichten* (p. 46, October 5).

Some suggestion of change, which may be due to observing conditions, appears in the observations of Prof. E. Millosevich and Dr. Zappa at Rome between September 12 and 17. On the former date the brightness of the comet appeared to be less than at a previous observation, made on September 4, and a tail was suspected extending a little to the west of south. On September 14 the coma showed a nucleus of magnitude 10·5, and the tail extended to a distance of 11′ in position-angle 217°. Both coma and tail exhibited an increase of splendour on September 15, the latter extending for some 14′ to 15′. On September 16 the coma and nucleus were again brighter, but the tail, in position-angle 228°, was not so well seen; with a clear, moonless sky on the following day this note was confirmed, and the tail was seen to be curved with its convex side towards the east, the position-angle of the tangent at the commencement of the tail being 204°.

At the Moscow Observatory, on September 17, M. P. Sternberg found the comet's head to be about 45″ in diameter, and to contain a condensation which exhibited a granular structure. A photograph obtained by Dr. Kostinsky, on September 19, with the 13-inch astrographic telescope, exposure 44m., showed a short fan-like tail extending towards the south; the magnitude of the whole comet was estimated as 8·0.

In the *Comptes rendus* for October 5 M. Bigourdan reports striking changes in the comet's tail. On September 29 it was regular and 20′ in length, but on the succeeding night it was irregularly fainter, showing bright patches. At 10h. 24m. on October 1, however, no tail was to be seen, although it was detected again, some 4′ or 5′ in length, on October 3. All the observations were made with the same instrument.

A new set of elements, by Prof. Kobold, appears in the *Astronomische Nachrichten*, and Prof. Dale has also computed new elements and an ephemeris, which is given below :—

Ephemeris, for Greenwich Midnight.

1908	R.A. h. m.	Dec. N. ° ′	log r	log Δ	Brightness
Oct. 16	19 23·5	48 1·7	0·1778	0·0107	5·4
,, 18	19 17·9	44 27·8	0·1707	0·0121	5·5
,, 20	19 13·3	40 55·4	0·1635	0·0151	5·7
,, 22	19 9·4	37 26·8	0·1562	0·0194	5·7
,, 24	19 6·1	34 2·8	0·1489	0·0255	5·8
,, 26	19 3·3	30 46·0	0·1415	0·0332	5·8
,, 28	19 1·0	27 36·5	0·1341	0·0412	5·8
,, 30	18 59·0	24 34·3	0·1264	0·0495	5·7

Observations made at South Kensington on October 10 showed that Prof. Dale's positions are very nearly correct.

PHOTOMETRIC OBSERVATIONS OF VARIABLE STARS.—In No. 4275 of the *Astronomische Nachrichten* (p. 33), Herr A. Tass places on record the results of a number of photometric observations of variable stars. The observations were made at the O'Gyalla Observatory during the years 1905, 1906, and 1907.

A BOLIDE WITH A PERSISTENT TRAIL.—A number of drawings and a description of the trail of a bolide, observed by M. Quénisset, at Juvisy, on July 31, appear in the October number of the *Bulletin de la Société astronomique de France*. The bolide itself appeared at 11h. 12m., and was sufficiently bright to illuminate the surrounding scenery for about half a second, as though the moon were shining. The trail left by the bolide was visible in a binocular twenty minutes after the apparition, and could be seen with the naked eye for half that time. At first a straight line, the trail afterwards curved up at both ends until finally it became an elliptical nebulous cloud, very like a telescopic comet. During these transformations the whole cloud was displaced, gradually but regularly, in a W.N.W. to E.S.E. direction. When the first drawing was made, the trail was situated about 1° north of, and parallel to, the line joining α and β Aquarii, the coordinates of its commencement and end being, approximately, 335°, +3°, and 320°, $-5\frac{1}{2}$°, respectively.

RADIAL VELOCITY OF ALGOL.—From measurements of the spectrograms taken at the Pulkowa Observatory during 1905–7, Prof. Belopolsky has derived a set of elements for the orbit of Algol, and publishes it, together with a detailed account of the reduction, in No. 22, vol. xi. (1908), of the *Mitteilungen der Nikolai-Hauptsternwarte zu Pulkowo*. Each of the lines Hδ, Hγ, λ4472 (Hε), λ4481 (Mg) and Hβ is discussed separately, and the following elements result from the complete discussion :—

$\omega = 42°{\cdot}5 \pm 1°{\cdot}35$	$a = 1{,}693{,}523 \pm 100$ km.
$e = 0{\cdot}0476 \pm 0{\cdot}0037$	$i = 90°$
$T = 2{\cdot}509 \pm 0{\cdot}00019$ days	

THE EFFECT OF STAR-COLOURS UPON THE CONSTANT OF ASTRONOMICAL REFRACTIONS.—To determine the effect of the colour of the star observed upon the constant of refraction, Mr. Hirayama, of the Tokio Observatory, reduced the observations of Courvoisier, Bauschinger, and Nyrén by dividing their stars into three groups, according to colour, and then deriving the corrections to the assumed value of the constant corresponding to the different colours. The results of the discussion are published by the Tokio Mathematical Society, as a reprint from No. 17, vol. iv. (second series), of the *Tôkyô Sûgaku-Buturigakkwai Kizi*, and show (1) that the effect of the colour of the star upon the constant of refraction is not shown in any single series, (2) the arithmetical mean of the three series to be 60″·19 for whitish-yellow stars, 60″·16 for yellow stars, and 60″·12 for reddish-yellow stars.

HALLEY'S COMET.—Prof. Turner's discourse on Halley's comet, given at the recent British Association meeting, has been published by the Clarendon Press at the price of 1s. net. After some general, personal, and historical notes, Prof. Turner describes the several circumstances which led to Halley's sagacious conclusion respecting the periodicity of comets, and then proceeds to describe briefly the conditions under which the coming reappearance of Halley's comet will probably take place. According to the ephemeris prepared by Messrs. Cowell and Crommelin, the comet should enter Pisces, from Aries, in January, 1910, travel westwards towards γ Piscium until the beginning of May, and then, turning eastwards again, travel back through the constellations Cetus, Orion, Monoceros, Hydra, and Sextans. From this it will be seen that observers in the southern hemisphere will be better situated for seeing the comet, and, as Prof. Turner points out, it is just possible that it will be well seen in Tasmania during the total solar eclipse of May 8, 1910. The computed brightness varies from 1·0 on January 2 to 58 on May 2, to 1112·0 on May 10, and afterwards decreases to 8·6 on May 30, 1910.

CAMBRIDGE UNIVERSITY APPEAL FUND.

ON February 16, 1907, the late Duke of Devonshire, my predecessor in the Chancellorship of the University of Cambridge, was through your courtesy enabled to make a statement dealing with the needs of the University, and to give some account of the efforts made by the Cambridge University Association to obtain funds to increase the endowments of the University. The interest taken by him in the association and its work is well known, and on succeeding to the Chancellorship I have accepted the invitation of the association to become its president. I therefore beg that you will now allow me to renew his appeal to all those interested in the promotion of higher education, learning, and research.

The fact that the majority of recent donors have been Cambridge men encourages me to hope that there may be many others amongst our graduates who will help us according to their ability. Others of our most munificent benefactors have not been themselves members of the University, and I would further appeal to all interested in the advancement of learning to enable the ancient University of Cambridge to continue the development of its sphere of usefulness. I believe that all acquainted with what has been done at Cambridge in recent years will agree that, to the extent of the resources available, progress has been satisfactory and in some departments remarkable.

In the letter which you published on February 21, 1907, my predecessor estimated the needs of the University at nearly a million and a half. Since the financial position of the University was first made known, legacies for specific objects have been received to the amount of upwards of 100,000*l*. The late Vice-Chancellor in his valedictory address to the Senate gratefully acknowledged the continued liberality of the Goldsmiths' Company, as well as substantial donations from the Surveyors' Institute and the Clothworkers' Company. The munificence of the City Companies and the generosity of many private donors have thus enabled the association to transfer to the University sums amounting to about 139,000*l*. The Drapers' Company are giving 1000*l*. a year to the funds of the agricultural department. A further annual grant of 100*l*. for six years for economics is being given by the Girdlers' Company. Since the establishment of the association, the University has thus benefited to an amount of more than 250,000*l*.

A small committee of Cambridge men has recently been formed in London with the object of assisting the association in its efforts. The establishment of this committee was approved by the late Chancellor shortly before his death, and his nephew, the present Duke of Devonshire, has consented to act as its vice-chairman. This committee proposes to direct its attention to specific objects which may appear from time to time to be the most urgently in need of support. At the present moment the completion of the fund for building, equipping, and maintaining the laboratories of the school of agriculture is one such object, and we are indebted to the Duke for taking charge of this appeal, in which his uncle, the late Chancellor, had shown much interest. For this purpose 5000*l*. at least is still required.

It is not advisable to enter here into details as to the various directions in which further endowments of the University are urgently needed, but the Vice-Chancellor will be glad to furnish specific information. For the moment I will confine myself to indicating the projects which are engaging the immediate attention of the association and of the London committee. They are:—

(1) The completion of the fund for the school of agriculture.

(2) The completion of the fund for building the new museum of archæology and ethnology.

(3) The adequate endowment of modern languages.

With respect to this last requirement, I may explain that the mediæval and modern languages tripos, established in 1884, has recently been re-modelled on broader and more practical lines, and that it now includes English, French, German, Spanish, Italian, and Russian. The teaching in these languages is vigorously carried on. Readerships in the Romance and Teutonic languages exist; but there are in the University no professorships of French or German, or indeed of any other modern European language.

In conclusion, I beg leave to say that donations may be sent to me, or more conveniently, as I expect to be away from home for about six months, to Mr. E. H. Parker, the hon. treasurer of the Cambridge University Association, Barclay's Bank, Cambridge. RAYLEIGH.

Terling Place, Witham, Essex, October 5.

THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

THE distribution of prizes and medals to students of the Imperial College of Science and Technology by Sir William White, K.C.B., on October 7, may to some extent be regarded as the inaugural meeting of the college, since it was the first function of its kind at which the new rector, Dr. Henry T. Bovey, F.R.S., was present. In his remarks from the chair, Sir William White gave some particulars as to the work which has been accomplished by the governing body. He explained the objects of the new college, and said that a start has been made with existing institutions, but that branches of science and technology unrepresented in these institutions are to be added to the subjects in which instruction will be provided by the new college. Any higher instruction in technology which is provided in provincial institutions will, he said, be utilised, and every effort made to build up a great college capable of conferring advantages both upon the home country and the whole of the Empire. Referring to the appointment of the new rector, Sir William White remarked that in appointing Dr. Bovey the governing body has secured a man whose qualifications and experience represent in the happiest manner the imperial idea which will inspire the future work of the college. In conclusion, the chairman announced that it is hoped that in future years the honours gained by the students in each of the institutions included in the Imperial College will be presented at the same ceremony.

After the prizes and medals had been distributed the rector delivered his address, which is here published in full. At the conclusion of his address, Dr. Bovey announced the provision of the equipment of the mining and metallurgy laboratories in the new buildings, the plans of which have been prepared by Sir Aston Webb, and the erection of which will be begun in the near future; the gift by Mr. Charles Hawksley of 4000*l*. for the equipment and endowment of an hydraulic laboratory in memory of his father; the equipment and endowment of electrical engineering laboratories at the college in memory of Lord Kelvin—a project which has met with the hearty approval of the King; and many valuable donations for the college library and museum. A vote of thanks to the rector for his inspiring address was proposed by Sir Norman Lockyer, K.C.B., who insisted that in all higher instruction in science and technology the great requisite is quality rather than quantity of work, and that the duty of an imperial college is not only the production of the skilled technologist but of men in the best sense of the term fully able to take their share in the work of the Empire.

Rectorial Address by Dr. Henry Bovey, F.R.S.

We are met to-day as a section of the Imperial College of Science and Technology, a union of long-established and justly famed institutions. We are looking forward to a career the usefulness of which shall combine that of each of our component parts, and which will give to London another channel in which its force may be expressed as a whole. This is no light undertaking, and it would seem that the most appropriate subject on which I can speak to you to-day is that of our aims and ideals in this union, together with any suggestions which may occur to me as to the best means of carrying them out; and it may be well at the outset of our career, so to speak, if we should spend a few minutes in considering the advantages and disadvantages which are inseparable from our constitution.

I cannot doubt that in the Imperial College we shall

find ourselves confronted with the same sort of problems as have beset other unions of all degrees of complexity, from family life to a United Germany or a United States —the problems, namely, which arise from the new mutual relations of the parts. In my opinion there is nothing to be gained and much to be lost if we do not frankly face these problems and see—yes, and foresee, so far as possible —the limitations, the responsibilities, the foundations, and perhaps the dangers of union.

In these days we do not need to be persuaded that union is strength, for it may be called the panacea of the age, and men fly to it as their only method of accomplishing every kind of object; but we do not so clearly see that a union is not necessarily strong in *direct* proportion to its numbers. The bridge-builder should not need to be reminded that there is a point beyond which length becomes a danger, yet we find in practice that there is still a temptation to make an engineering work the largest in the world—a temptation, in fact, to measure greatness by size. That we may be less likely to fall into this error, let us set before ourselves some ideals as to the quality of our union. I shall be forgiven, I am sure, if I seem to speak of the old and the obvious.

In any union of equals, if the members are to be loyal to the idea which has brought them together, they must remember that it is possible for selfishness to entrench itself in the care of one's particular and special department and in the ambition for its paramount influence, and that in this case, as in individual instances, he finds himself best who loses himself. This last resort of selfishness, as we may call it, not infrequently becomes apparent when there is a question of unequal advance. It is not unnatural that in such a case there should be a lurking sense of injustice, particularly if, as often happens, the new privileges fall to the share of the new departments and leave the old apparently unrecognised. The elder brother is not extinct even in the twentieth century. Yet, viewing the matter more largely, not only is it absolutely true that an increased advantage to, or an increased demand for, any special part increases the value and reputation of the whole, and therefore of all other parts, but if we think of it this is the usual method of growth in institutions which are not altogether the creation of Aladdin's lamp. Usually there is not enough of money to go all round at once, and we must be content if it goes around in time. In parenthesis, let it be taken for granted that it will be someone's duty to see that the time is not too long deferred.

Next, may I remind you that in a union of equals responsibility falls equally on all? How often do we hear it said, "*I* cannot help it, *they* would do it!" How often does a man rest content with not being an obstructionist, and never reflect that there is an active duty required from each person if the general good is to be achieved. What right has a man to sit down and let another do his share? It may be quite as bad to be indifferent as to be too anxious to lead. As to being an obstructionist, that is to put oneself outside the pale altogether—for it is to be a positive source of disunion. In order to secure wisdom as well as energy in the taking of personal responsibility, it will be well to think of the real foundations of union, which, for our present purpose, I may briefly put as:—first, a common object; second, a common method of obtaining it; third, a spirit of mutual respect and good-will.

The first and second will require in this instance a more lengthened discussion; the third we can count on in a convocation of educated and right-minded men, yet as the association is so close and the possibilities of clashing so many, it is well to keep it in mind as an essential.

Two dangers only I shall mention, opposite tendencies which, not seldom, are the fruitful sources of much evil. The first is the evil of courting popularity—of waiting to see which way popular opinion may lean. About this many things might be said which there is no time to say, but in general we may perhaps assume that the evil lies in shaping our course with any reference to the security of our own position, either in fact or in the esteem of others.

Then there is the reverse danger of being always in the opposition. It seems unlikely that every man who finds himself solitary should be an Elijah, and if he is like Elijah he should teach himself to recognise the 7000 like-minded.

Let us now consider a few suggestions as to our common object in the Imperial College and the best method of attaining to it. First, then, as to our object.

It may be well to think a little of our title as expressing our aims. Why do we separate science and technology in the title of this institution? Does it come from some feeling that technology is different from science, or that it is science *plus* something else? Some time ago I had occasion to study the relations of science and technology, and came to certain conclusions, which I may be allowed to give you without entering into the discussion of them.

Perhaps the most clear and concise definition I have come across of pure science is that it is "the knowledge of powers, causes, or laws considered apart or as pure from all applications." It involves the making of experiments, by which these laws have been made manifest. Compare this with the will of Count Rumford concerning the founding of a chair at Harvard in 1816 for teaching "the utility of the physical and mathematical sciences for the improvement of the useful arts." If we examine the curricula of the best modern schools of technology, we find advance has been made in this conception, and that they include:—

First, a study of selected laws of nature (*i.e.* those which have been or may be applied to practical purposes) (*a*) as seen in nature; (*b*) as seen in examples or descriptions of the means by which they have been utilised. This includes the study of all types of machinery, implements, and instruments.

Secondly, a distinct aim to train the mind of the student so as to develop what may be called the scientific mind; as yet this has been mainly attempted only by causing the student to study in a scientific manner.

Thirdly, (*a*) a research into the nature of the practical facts essential to any art with the view of finding out the known laws of nature on which they depend; (*b*) original research into the problems arising out of industrial processes with the view of finding out unknown laws of nature, and especially those which must be investigated on a large scale.

We see that technology, while in one department a pure science, investigating any problems arising out of the artificial working up of natural products, is in the main to be called an applied science—that its applications, even when exactly similar in outward appearance to the experiments called for by pure science, differ from the latter in one important particular. In the case of pure science the resulting fact is viewed as an instance of a law; in the case of technology, the fact itself is the important thing. Therefore the idea of utility seems to be the real key to the difference between the two—which seems to be a difference of aim. If our purpose is to establish a law we call it pure science; if our purpose is to establish a fact we call it applied science or technology.

Having thus more or less defined the difference between the two, we may say that our common object in the Imperial College is to give the right education in science and technology, and if we agree with the conclusions I have quoted we shall see that there should be great economy in combining the training in these two, the foundations being, in both cases, practically similar, and the only real difference coming from a wish to specialise either on the theoretical or on the practical side in one's professional life.

We may take it, in fact, that there will be less waste in the world's advance if the scientific man is influenced in his choice of his research by practical necessities, and if the practical man is influenced by pure science so as to be interested in and to recognise the light which may be shed on scientific relations by accidental or intentional changes of circumstances in the course of his work. There is no necessity in the nature of things that pure science should be absolutely lost in applied science. An education in the same place and under the same influences should therefore be desirable as giving opportunities for the increase of mutual knowledge and respect.

Our common object might be now a little more fully stated as the attempt to develop the ideal scientific and

technical man. It is evident that the clearer our conception of what we want to produce, the more likely we are to attain *to* it. In reading and trying to harmonise the various ideals which have been brought before our notice by many distinguished writers and speakers, we are forced to the conclusion that no mere specialist can possibly fulfil modern requirements. Looking backward, we can see that formerly the scholar and the man of action were separated in idea and generally in fact. We can realise the change that has taken place, and can perceive that the ideally educated man of the world of to-day must possess, not only powers of thinking, but powers of doing, and must show that he has the will to do honest work both with and for his fellows.

One case occurs to me as confirmatory of this position as regards the mere specialist—the case of a man extremely successful in a line of life not originally chosen. Our hasty conclusion is usually that his first choice was bad, and bound to end in failure; but another quite possible explanation is that he does well in his second choice, just because, having possessed another point of view, he is more quick to grasp the possibility of those combinations which have characterised much of the advance in modern science.

I fancy there will be little disagreement as to the kind of man we want to produce, but when it comes to agreement on right methods we cannot hope to find unanimity of opinion. All we can expect to attain is a working hypothesis, and trust for the rest, first, to what is really the greatest factor in all true education, namely, the personality of the teacher, and next, and scarcely less, to the attitude of the student. Still, a working hypothesis must be embodied in every curriculum, and, to be really valuable, must be fixed enough to conform to the eternal laws of the mind and elastic enough to admit of constant translation into what we might call the scientific language of the moment.

Now that scientific training has acquired a foothold which justifies the existence of all the scientific and technical schools of the world, and the establishment here of a college such as we are contemplating, it can afford to spend a little time in adjusting its methods and examining its results.

What, then, is the general tendency of that which has been called a practical education in either science or technology, namely, an education intended to prepare a man for his life's work by direct methods only, as, for example, if we should try to train a man to be a mining engineer by giving instruction solely on those points which would be of immediate commercial value to him? I think, in comparing results, we must conclude that an education in facts, and even in laws and processes alone, cannot produce what we call the scientific mind. If we are to select the powers of the mind which are most essential to the scientific man, we shall find these generally admitted to be observation, concentration, imagination, the logical faculty, and last, but not least, the power of doing. No matter, then, how good an education may be, if these are not well developed it must be incomplete, and as the scientific man is, after all, first a man and then a man of science, nothing which leaves out of sight his intellectual relations with his fellow-men of this and other generations, nay, further, nothing which leaves out of sight his obligation to rule his life in accordance with the highest standards of health, of religion, and of morals, can fairly be called a good education. Viewed from this standpoint, the task set before itself by the Imperial College is by no means simple, but I think much may be done by throwing emphasis on processes rather than, or perhaps as well as, on results. It may be possible to give credit for evidence of the use of the powers that we seek to produce. For example, let us enter into some detail and see what this would involve. One would think, from most of what has been written on the subject of observation, that the power to observe, which does really seem to follow the system of training by experiment, was a power which, once gained, would necessarily be exerted in any direction; but, as a matter of fact, do we always find that a botanist, trained to observe, amongst other things, the colours of flowers, will always observe the colours, say, of ladies' dresses? Do we find that a geologist, who recognises every stone in his path, will always and at once recognise different types of men? It is interesting to note, in this connection, an experiment published in a recent book, from which it appeared that evidence taken from a large number of scientifically trained men showed a considerable number of cases in which important and even typical details were omitted.

Again, there the diffusiveness caused by the observation of unnecessary detail, which ought to be corrected by what is almost equally necessary to the student—the power of selection which is implied in concentration. No one needs to be persuaded of the value of the logical faculty, but we may remark that, although it cannot but be trained by the study of mathematical problems, yet that in the solution of the problems of life it is very possible to find that personal bias is so strong as to prevent its exercise.

From these premises we might reasonably argue that more attention should be paid to the application, in different directions, of the observing powers and of the reason. Further, I believe we should do well to admit more generally than we do that in the higher walks of science the reason must often be preceded and supplemented by what we must regard as even a loftier faculty, inasmuch as when present in a high degree it amounts to genius—I mean the imagination. I should like to insist a little on this, because of its great importance. Whether from the belief entertained by many that the imagination is not required on the scientific side of education, or from overhaste in education, which is the very natural result of an age of nervous over-pressure, I cannot tell, but the result has been that little provision has been made for its exercise in purely scientific schools—this in spite of the fact that it seems to be a natural concomitant to training by experiment on account of its close relation to visual memory.

The imagination could be made of the greatest service in the proper study of science, and would, if rightly used, prevent much of the cramming, against which we are all setting our faces. It should then be possible to train it, even by the study of science; but a more rapid stimulus would probably be found in the reading of good literature, history, poetry, and the study of art in any form—subjects often received by science students with a feeling akin to contempt, as being unworthy the serious attention of a really practical man.

Yet the search for ideal truth, like the search for ideal beauty, requires the imagination as its instrument, and to leave out one of the most important means to the end we wish to reach is clearly not science; therefore, I say, let us cultivate the imagination, and if the introduction of other subjects into a scientific course is really the quickest way to that end, let us introduce them into the training, but let us devise means to prevent their becoming merely a fresh tax upon the students' time. As a matter of practical politics this may be ensured, I believe, by studying them, not with the view of acquiring knowledge, but strictly with the view of acquiring a power.

We have said that the scientific man should be a man of practical capacity, the man who can *do*, and, if possible, the man who can *make*—powers which do not always go together. Generally speaking, our schools of science succeed in training the latter, but very little importance seems to have been attached to the necessity of giving any training in the former. Nor does it appear to be safe to leave it to instinct, as the not uncommon proceeding of students, viz. to dawdle through a term and cram at the end, is the very last manner in which it would be desirable to "put through work" in after life. The power of dealing with men in every relation of life and of learning, to some extent, the responsibilities of citizenship should be provided for in a reasonable degree by encouraging social intercourse, by the promotion of clubs for mutual improvement and recreation, especially those for the discussion of the problems of the day. In such ways the student may learn to handle affairs both of business and of citizenship.

Of course we cannot make bricks without straw, and we must recognise that if all this is to be done, or even aimed at, it will take time to do it, which brings me to the general subject of over-pressure, a burning question in these days, when by perpetual competition, from the very earliest years, we risk spoiling our best intellects in the endeavour to quicken the sluggish current of our duller

minds. The standard of quantity in learning, like the price of food, seems to be perpetually rising, and as the human mind shows no very lively signs of expanding in direct proportion, but, on the contrary, shows some tendency to collapse, it would seem to be well to think more of quality in work and less of quantity. We must remember that forced growth in plant or man is in the end destructive. The day of the grammarian, celebrated by the poet, is perhaps gone, and it is more than doubtful if we want to read his whole book; but we should do well to take at least a page out of it, and allow our ideals to be, not shaped, but modified by the splendid sentiment, "Leave *now* for dogs and apes, man has forever."

If, then, we could plan our curriculum with more provision for this training of the powers, as apart from actual professional work, and with at least a tacit recognition of the fact that rest and recreation must follow mental exertion, and *precede* more exertion if that "more" is to be effective, I think it would be possible to require a much higher quality of work and make up for omissions in detail of direct training, which, after all, if one knows how, can be learned in the first stages of practice which follow college life. This little phrase, "if one knows how," should really indicate the difference between the man who enters shops direct and the man who enters them after college work. Our results in practical work should, if we are on the right track, prove, what is not questioned any longer in many places, that the college graduate is the man who is wanted in business life.

As to those higher elements of character, without which no education is of much avail, in these especially the training must be indirect, but never neglected. In every college there are endless opportunities for self-knowledge, self-control, and, if a man so choose, for self-sacrifice. In a *scientific* college there are special influences making for the development of character. The constant effort to eliminate error tends towards the development of truth and accuracy. The cultivation of the will in overcoming obstacles should produce the sturdier manly virtues; the patient waiting on nature's working encourages the gaining of a wise self-restraint, which we may hope to see employed in the directing of life; and the emphasis laid on the pursuit of truth for its own sake should help to overcome the spirit of commercialism—that caring for scientific success mainly for what it will bring in financial success—which is an ever-present danger of the application of science to life.

We see then, in general, that we should like to make it our aim in the Imperial College to develop scientific education both on the imaginative and on the practical side by, on the one hand, bringing our men into somewhat closer touch with the noblest thoughts of the past and with the world-wide strivings after truth which characterise our present age; on the other hand, by inviting the advice and cooperation of men of business and of professional men in actual practice, so as to keep our courses in accord with their methods, and, if possible, to earn the reputation of being the place where an employer must easily find the man he requires.

Finally, we consider that if we can succeed in training men to be at once good scientific men and good citizens, we shall have done the best that is possible to serve our country by giving to it a class of workers who can be trusted to put the true service of man above their personal success, who are willing patiently to search for truth in hidden and dangerous places, who will be able to follow true laws of economy, and to prevent some of that waste which we now see going on in painful contrast to the destitution which runs parallel with it. Such men often show a capacity for leadership through individual force of character, and are no less ready to follow with unselfish devotion the path of common duty.

With grateful pride we may say that, to a high degree, these things have been already achieved by the associates of the several institutions now uniting in the Imperial College. We recall the eagerness with which some of our students went to serve their country in South Africa. A tablet has recently been set up in the Royal College of Science to keep their memory before us. We believe that of very many, had they found a chronicler, similar things might have been written as were actually penned by a western poet about one of the Associates of the School of Mines:—

> The men he worked or
> Say judging as best they can,
> That in lands which try mannood hardest
> He was tested and proved a man.

In conclusion, I am permitted to make some very pleasant announcements. The Bessemer committee has provided, as most of you are aware, for the equipment of the mining and metallurgical laboratories in the new building, of which the first plans have already been prepared by Sir Aston Webb, and the erection of which is to be commenced in the near future.

Again, a gentleman [Mr. C. Hawksley], who I am glad to see is with us to-day, has very generously consented to equip and endow a hydraulic laboratory, which, we hope and believe, will render it possible to investigate many problems of flow which have not heretofore been attempted.

I am sure, too, that it will be no small satisfaction to all those present that, with His Majesty the King's hearty approval, steps are being taken to equip and endow certain other important laboratories.

Many and valuable donations, too numerous to mention in detail, have also been received from Canada and the United States, for which we are most grateful.

Lastly, the roll of honour of those who have occupied the chairs in the different sections of the Imperial College is a very long one, and includes many names which have made England famous in the world of science. I cannot but think that many would like to have a permanent memorial to the names of such men in the form of chairs, laboratories, scholarships, or library endowments. In this matter of giving I should especially wish to enlist the sympathy of the Associates who leave these halls year after year. None have contributed more to the success and advancement of the universities of America than their own graduates. Every college of importance has an alumni association. The class sent out each year appoints its own secretary, who is expected to keep in touch with all its members, each of whom contributes a small sum annually to a special fund intended to help his alma mater. Most excellent has been the result of the scheme. Thus, at one of the great universities, a sum of 10,000*l.* is annually given for general purposes, while a large reserve is always available for any special need. A further advantage is found in the fact that the alumni are always kept in close touch with their college, are imbued with a real *esprit de corps*, and consider it not only a duty but a pleasure to help the institution which has prepared them for their life's work.

There is a grand opportunity for benefactions in the Imperial College if progress is to be maintained and if, as we hope and expect, we are to become the central, the Imperial Scientific School, imperial in conception, imperial in our sphere of work.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

THE geographical section of the British Association this year was particularly fortunate in the meeting place allotted to it, for better accommodation could not be desired than that afforded by the theatre in the Royal Dublin Society's building in Kildare Street.

Opening the sectional meeting on Thursday, September 3, the president, Major E. H. Hills, took as his subject the survey of the British Empire. His address amounted to a plea for the more thorough organisation of the Imperial survey, and he dealt with the work, not only retrospectively, but prospectively, analysing present methods, discussing their shortcomings where such exist, and suggesting plans for the future. One of his most notable recommendations was that the re-measurement of the two principal arcs, meridional and longitudinal, should be undertaken by the British Ordnance Survey, and this recommendation was afterwards embodied in a resolution forwarded by the sectional committee to the council of the association, suggesting that the Board of Agriculture and Fisheries (which controls the Ordnance Survey department) should be memorialised to this effect, and the committee

of Section A (Mathematics) gave support in a similar resolution. Major Hills alluded to the adverse effect of the lack of good maps on British operations during the South African war, and showed that the possibility of a similar occurrence in future was not yet removed. Major Leonard Darwin and Sir David Gill, who respectively proposed and seconded a vote of thanks for the address, urged the same point, which was commented upon by a section of the Press as an adverse reflection on the work of the British Government offices in this direction. Major Darwin, therefore, on the following day, with Major Hills's support, made it clear that no such reflection was intended. Where the work of the Colonial Office was unfettered, they said, it was now admirable.

Prof. W. M. Davis, of Harvard University, who subsequently during the meeting gave a brilliant evening lecture on the Colorado cañon, now gave a short lecture on the physiographic subdivisions of the Appalachian mountain system in the east of the United States. He divided the system into a crystalline longitudinal belt to the south-east and a stratified longitudinal belt to the north-west, distinguishing from both the Appalachian plateau to the north-west again. After elaborating the physical aspect of the system, Prof. Davis went on to demonstrate its effect on early settlement, and showed the peculiar interest of the Appalachians as offering the first barrier to the penetration of the country from the east, but he also showed how certain clearly defined routes were afforded through the barrier. The afternoon lecture was popular in character, and attracted a very large audience for a sectional meeting; it was given by the Rev. W. Spotswood Green, of Dublin, who, under the title of "Ireland: her Coasts and Rivers," addressed himself mainly to those visitors who might be enabled, through the organised excursions of the association or by subsequent travel, to see more of Ireland than its capital. Following geographical methods, he appended to a brief physiographic description of the island remarks on a variety of historical (mainly antiquarian) topics, and illustrated all with admirable lantern-slides.

On Friday morning (September 4) a full audience was attracted to two papers on different aspects of geographical education. Prof. R. A. Gregory, treating the subject in a general manner in his paper on "School Geography as a Mental Discipline," brought out the fact, which, though being slowly realised, must still be constantly insisted upon, that the proper teaching of geography does not consist in the impression of lists of names and disjointed facts on the student's memory. In his paper, and the remarks of speakers who followed him, it was shown that geographical causes and their political, economical, or other effects must be taught in an orderly perspective. Moreover it is desirable, not merely to present facts and their reasons to the student, but also to train him to deduce reasons from facts for himself. Dr. A. J. Herbertson, in opening a discussion on the paper, supported the reader in laying stress on the utility of work in the field and also of instruction in the reading of maps, and all the inferences to be drawn from cartographical representation. The difficulty of finding teachers qualified to teach geography properly was insisted upon by more than one speaker, and finally Major W. L. Forbes enlarged upon the necessity of establishing geographical lectureships at all universities, where training for teachers might be obtained.

Prof. J. L. Myres' paper, which followed, was an admirable disquisition on the value of geographical study applied in a special connection. Speaking on the geographical study of Mediterranean man, considered as an element in a "classical education," he said that the "classical education" as generally conceived and given took no account of geographical environment. Yet only the study of that environment could provide a proper background for the picture which it was desired to impress upon the minds of students. His argument led finally to the conclusion arrived at in the preceding discussion—that classical teachers are not yet generally equipped to give geographical instruction. The Rev. T. Corcoran pointed out a fact both novel and of interest to many of his hearers—that German classical cartographers appear by their work to have been at fault in confining their studies to the Latin, to the exclusion of the Greek world. At the conclusion of this educational discussion Dr. W. S. Bruce showed lantern-slides illustrating the expedition of the *Scotia* in the Antarctic, and alluded to the publication, now in progress, of the scientific results of that expedition.

Mr. W. L. Grant, assistant to the reader in colonial history at Oxford University, lectured in the afternoon on the northward expansion of Canada. His lecture was framed with especial reference to the visit of the association next year to the Dominion, and he pointed out the particular importance of Winnipeg, the place of meeting, as the point of junction in the lines of communications between east and west. As these lines are at present laid down, the developed portions of Canada resemble a wasp in shape, and Winnipeg is situated at its narrow waist. A noteworthy point made by the lecturer was that in the development of the North-West railway construction must precede settlement, not follow it—a sequence hardly to be conceived by those without experience of pioneer work.

On Monday morning (September 7) Mr. E. A. Reeves exhibited and explained three instruments recently designed by him for the use of surveyors and travellers:—(1) a distance-finder alidade for plane-tabling; (2) an astronomical compass and time indicator; (3) a new form of reflecting artificial horizon. Mr. H. G. Fordham read a paper entitled "Notes on the Cartography of the Counties of England and Wales." This paper has been privately printed, and is of great value for reference in a subject which has not hitherto received deserved attention. Mr. Fordham stated that, taking Hertfordshire as an illustration, no less than about 400 maps of that county have been published, about half of which, however, are reprints, more or less altered from the original plates. In this connection it was interesting to recognise, in some of the less reputable maps which are issued to-day for road-users, plates about a century old, though of course brought up to date. Mr. Fordham exhibited a large number of maps, which were inspected with great interest at the conclusion of his paper. In the afternoon Captain H. G. Lyons, of the Egyptian Survey, who was the recipient of an honorary degree of Trinity College during the meeting, read a paper on the longitudinal section of the river Nile. He showed that an almost complete line of levelling existed along the river from Victoria Nyanza to the Mediterranean Sea, a distance of 3500 miles. After the main river debouches from the elevated equatorial plateau upon the level plain of the Sudan, it and its tributaries have the very slight slope of 3 inches, or little more, to the mile. But the flattest part of the whole course is between the Sobat and Khartum, where the slope is from one-half to one-third of an inch per mile. The well-known cataracts are rapids where the river erodes the crystalline rocks which alternate with sandstone. The latter is, of course, laid over the crystalline rocks, but these are not of level surface, and the river has cut down the land far enough to expose their greater elevations. Below Assuan, where the lowest of these cataracts occurs and the great irrigation dam is situated, the river has formed alluvial plains, and is building them up at the rate of about 4 inches per century. The work of the river is erosive in the equatorial plateau region; in the plain of the Sudan it deposits its load of solid matter, and thus raises the land; in the cataract reaches it erodes again, and below these, down to the delta, it again builds up.

As a whole, the papers given on Tuesday, September 8, proved the most popular. They were of the sort to do so, as all were mainly descriptive and all were illustrated with lantern-slides. The Rev. George Furlong's paper, entitled "Unique Experiences at the Birth of a Volcano," attracted the largest audience of any attending the section; the number present did not fall far short of 400. They were kept fully interested, for Mr. Furlong showed that his claim to unique experiences was justified. He was a missionary in Savaii, Samoa, when the volcano of O Le Mauga Mu, after a period of earth unrest, first broke into life, and he witnessed, and carefully observed and photographed, often under great difficulties, the phenomena accompanying the outbreak and the opening and building up of the crater. Some of his photographs were highly impressive, especially those of the eruption of steam where the hot lava flow reached the sea; and though he disclaimed scientific ability, some of his observations were

of much scientific interest. For example, he had no doubt that the volcano was more active during the period of full than of waning moon; he noted a marked variation in the character of the fumes from the volcano at different times, and he was able to correlate the occurrence of a succession of tidal waves with periods of more than usual activity on the part of the volcano.

Mr. L. C. Bernacchi, well known in connection with the voyage of the *Discovery* in the Antarctic, now brought forward an account of his journey in the little explored Rio Inambari region of Peru, where a new field for the rubber trade is opening up. Dr. W. S. Bruce gave an account of his surveying and accompanying scientific work on the island of Prince Charles Foreland in the Spitsbergen group, an island known for three centuries, but never hitherto surveyed. A committee of the section, with a grant from the association, had assisted Dr. Bruce in his work, and his lecture was an elaboration of the report of the committee. He has produced an almost complete detailed map of the island, which has an area of 271 square miles, and has studied its geology, zoology, botany, and meteorology. It may be added here, with regard to the other committees of the section appointed for scientific research, that Mr. R. T. Günther has practically completed his investigation of the oscillation of the land-level in the Mediterranean region, and that Mr. J. Stanley Gardiner's investigations in the Indian Ocean and Dr. A. Strahan's study of rainfall and run-off in certain English rivers are in active progress.

On Tuesday afternoon the meeting of the section was brought to a close with two papers on a subject of local interest, which pointed to a field for new investigation lying at our doors. Mr. Harold Brodrick gave the results of his explorations and measurements in some of the limestone caves of the county Fermanagh—Marble Arch Cave and others in the vicinity; while Dr. C. A. Hill spoke of the Mitchelstown caves in the county Tipperary, one of which, though frequently visited by tourists, is far from having been explored in its entirety, while the other, though discovered at a much earlier date, is never visited now. These caves, unlike those described by Mr. Brodrick, which are underground water-courses, are the product of a hydrographic *régime* no longer extant; they are no longer subject to water action, being practically dry, and their high antiquity, thus proved, gives them a peculiar interest.

EDUCATION AT THE BRITISH ASSOCIATION.

A VERY full programme was arranged for each of the four morning meetings, and the attendance of members, although never very large, was remarkably sustained throughout the sessions. In the afternoons visits were paid to schools of varied types, and no pains were spared by the staffs of the institutions in their endeavour to make these visits as instructive as possible. It was evident that the majority of those present at the discussions were engaged in teaching or in educational administration. The "popular" side of Section L has given way to the professional side, which is as it should be.

The thoughtful address given by Prof. Miall sounded the right note of scientific investigation and careful criticism (*vide* NATURE, October 8). Prof. Armstrong followed the president with a paper entitled "The Outlook: a Grand Experiment in Education." The author took an optimistic view, chiefly based on his observation that a more practical treatment of the scholar prevails than was the case a few years ago. Schoolmasters and mistresses were beginning to recognise that English really was a language, but the brightest spots were the schools at Osborne and Dartmouth. With the advantages of naval discipline and *esprit de corps* the sailor had cut the Gordian knot and broken down the old tradition that the school was a place for literary study. Experimental schools should be introduced into the country, but the hand of the builder should be stayed until it was known what was required. He asked for a Royal Commission of Inquiry, consisting of a few competent persons, who should study existing methods of education and make recommendations.

Mr. R. Blair (executive officer of the London County Council) followed with a paper dealing with the progress made in the organisation of education in the area under the authority of the council. Some idea of the magnitude of the task performed may be gleaned from the annual expenditure, which is four and a half millions sterling on elementary and one million on higher education. In the elementary schools the subjects of instruction, in addition to those usually found in public elementary schools, include elementary science, nature-study, domestic economy, manual training, physical exercises, swimming, and in certain cases modern languages. By means of conferences and consultative committees the twenty thousand teachers employed have opportunities of expressing their views on the management of the schools. In addition to training their own teachers to the standard of professional qualification required by regulation, the council provides for further training of practising teachers in connection with London University. The extensive and highly varied work of technical education, from the ordinary evening school to the polytechnic, is being coordinated. With regard to secondary education, the policy of the council is to provide, or assist in providing, secondary education at a moderate fee for those who are able to avail themselves of it, and to offer the advantages of secondary education free of charge to the most promising children from the elementary schools. Omitting private schools, half the pupils are in secondary schools aided by, and nearly one-tenth in those belonging to, the council. Physical education, organised games, and medical inspection are now receiving a large amount of attention, and open-air schools have been included in the experiments made to deal with physical defects. Necessitous children receive meals through voluntary funds. As an instance of the scale on which the authority works, we note the item of 900,000 plants and other nature-study specimens supplied monthly by a small botanical department. We can only mention that Mr. Blair expounded clearly the principles which guided the authority (1) in its provision of accommodation for pupils in elementary schools; (2) in its provision and award of scholarships; (3) in the training and promotion of teachers.

Mrs. E. M. Burgwin then read a paper on special schools for the physically defective and the mentally deficient. The permissive Act known as the Elementary Education (Defective and Epileptic Children) Act, 1899, enables an education authority to take charge of feeble-minded children (not imbeciles) until the age of sixteen. The late London School Board opened its first special school in 1892, and there are now in London eighty-four schools, with a roll of 6006, for the mentally deficient, and twenty-eight schools, with a roll of 2255, for the physically defective. In the case of the mentally deficient, the schools aim at developing intelligence through the motor senses. The aim in teaching the physically defective is to train them to become good workers in spite of their infirmity; for this, expert trade teaching for four years before leaving school is necessary. Only by decreasing tuberculosis can we reduce the number of cripples.

The second morning was devoted to practical instruction in elementary schools and to education in relation to rural life. Sir Philip Magnus prefaced the reports of the committee on elementary experimental science studies in elementary schools with a review of work accomplished since the appointment of the committee at Southport in 1903. He took the opportunity to congratulate the Irish people on the passage of the Irish Universities Act, and on the prospect thereby afforded of securing for all classes of citizens further opportunities of higher education. He sincerely hoped that those who were training to become teachers in elementary schools might reap the advantage of the wider learning and broader views of life which residence at a university offered. Mr. W. M. Heller read the report of the subcommittee, which insisted upon including in the curriculum experimental work to be performed by the pupils. More attention should be paid to aims and methods in teaching elementary science, and inspectors should understand both subject-matter and methods. Particular emphasis was laid on the importance of training girls in the methods of experimental inquiry. With the report are four appendices containing alternative syllabuses and a list of apparatus.

A thoroughly well-sustained discussion on rural education was opened by Prof. Miall, who urged teachers to lead their pupils to see, handle, and think for themselves. It was regrettable that so many artificial aids—pictures, ready-made preparations, &c.—were employed. Referring to school gardens, Mr. David Houston urged that the education of the child must come before the desire to have a prolific garden. Miss Lilian Clarke described her methods used at Dulwich, and Mr. George Fletcher detailed a course of classes in rural economy which has been given to certain teachers by the Irish National Board of Education. Mr. Fletcher said that it was less a question of the introduction of a new subject into the curriculum than the infusion of a new spirit into the system. If every school in town and country possessed and utilised freedom to make its surroundings a means of education, the problem would be in a fair way to solution. He urged the value of carefully arranged summer courses of instruction for teachers, as the new spirit could only come through the teacher. The audience heartily approved Mr. Fletcher's statement. Mr. C. H. Bothamley gave an account of the fairly successful efforts made to promote rural education in certain English counties, referring particularly to Somerset. The Very Rev. Dr. Delaney expressed the opinion that, alike in the training of children and of teachers, the fetish of examinations was the curse of education. Mr. J. Hegarty, a member of the Co. Dublin Teachers' Committee, pointed out that school gardens would not give a desire for rural living while agricultural wages were so low. Miss Constance Cochrane believed that small holdings would go a long way towards promoting the success of agricultural education—where these had been established she had seen the greatest keenness on the part of both parents and children to learn all they could from the school gardens; where there was no prospect of a holding, the boys' wish was to get away from the country. Miss Cochrane added detailed advice, based on successful experience as a school manager in remote rural districts. The Rev. Dr. Kingsmill Moore, principal of the Church of Ireland Training College, deprecated specialisation in the early education of children. Their object must be, not to fill the mind, but to make it capable of filling itself.

Education in Ireland was the leading subject at the Monday meeting. According to the printed programme, the discussion on this subject was to have been preceded by one on tests of educational efficiency. However, on the request of the committee of the section, the opener, Mr. T. P. Gill (Secretary of the Department of Agriculture and Technical Instruction for Ireland), merged the question of efficiency tests in the consideration of the situation in Ireland, and his paper led to an animated debate. In his original abstract he had considered educational tests under three aspects:—(1) Physical: the effect upon bodily development; health; intellectual efficiency and moral strength as depending on health; manual training; discipline. (2) Mental: the development of observing, thinking, and correlating power; the avoidance of cram. (3) Moral: the test here should aim at ascertaining whether the teachers have the right outlook and influence; whether the pupil is being led to know and love the right things; to understand his private and public duties; to select true aims in life. Mr. Gill welcomed the opportunity of discarding more abstract themes, and turned to the Irish situation at the present moment. The country had to organise a new university system, and he looked forward to such a reform as would produce a truly national education, not, as in the past, imposed from without, but developed by Irish thought concentrated effectively upon this aim. He considered that the educational mill had worked recently in a manner calculated to manufacture a half-baked and inefficient nation, the special target of his criticism being the intermediate schools. He looked forward to a day of intellectual freedom for these schools, when inspection would be substituted for examination. The main impulse for these reforms must come from the universities, and they now had to consider and settle upon their purpose and ideal. They had to create, not only a congeries of professional schools, not only a machinery for research, but an intellectual and moral centre for the nation.

Prof. Benjamin Moore followed with a paper on correlation of primary, secondary, and university education in Ireland. There has been no coordination between the chief bodies—the Board of National Education, which controls the national schools; the Intermediate Board, which exerts bureaucratic sway over intermediate or secondary schools; the universities, which have hitherto taken no share in moulding either the primary or the secondary education of the country. The changes necessary may be summarised as follows:—(1) Primary or national education: the training of the teachers should be under the faculty of education in the university. (2) Secondary or intermediate education: each university within its own sphere of influence should recognise secondary schools, and the university, acting in sympathy with the teachers of the schools, should test the work of the pupils; the system of work should be drawn up by each school with the approval of the university.

The Rev. Dr. Evans defended the action of the Board of National Education, and Prof. Culverwell supported the views expressed by Prof. Moore. The Rev. Canon Mahaffy admitted the existence of serious drawbacks in Irish education. Poverty, the drain of emigration (leaving the feebler behind), and the lack of a sense of duty in regard to school attendance, were responsible for defects, and it was not fair to attribute these to the schools. The system was not such a failure as Mr. Gill had made out, and there was no want of high moral teaching in their schools. The Rev. T. Corcoran would rather modify the examination system than put the teacher under the inspector, with consequent loss of freedom. Subsequent speakers referred to the pay of the teachers, and the Rev. Dr. Delaney warmly sympathised with the strong condemnation passed on the miserably insufficient payment of the teacher in the elementary schools. He also referred to the university question, and approved the Liverpool University charter, which includes representative men of Liverpool and neighbouring counties.

Miss C. P. Tremain opened the discussion on the important question of training in teaching. She pointed to three stages in such training:—(1) General education in school and university college. (2) Professional training, including instruction in the theory and practice of education and hygiene. The longer course for intending elementary-school teachers, where the students pursue degree and training courses together, is less successful than the short, intensive post-graduate course for intending secondary-school teachers. The aim is not to produce finished and perfect teachers, but rather aspiring and intelligent ones who will be able to adapt themselves to and learn from subsequent experience. (3) The experience stage of training. Valuable assistance would be rendered if secondary schools directed more attention to the mother-tongue, drawing, clear enunciation, and physical culture. Mr. Charles MacGregor, as the second speaker on this subject, sketched a system of training which would occupy three years for non-university students and four years for those following a university course. In explaining the principles of such a scheme he emphasised the need for child-study, for study of recent history of education, and for accustoming students to the idea of experiment in education.

The programme for the last day was a crowded one, and the discussions on the topics were much curtailed. First came the report of the subcommittee upon the sequence of science studies in secondary schools, which was read by Mr. G. F. Daniell. The first half of the report summarised the replies received to a number of questions addressed to science masters in different types of school. Speaking generally, there is remarkable agreement as to the subjects taught and the order in which they appear in the curriculum. There is also close agreement as to the aim of science teaching, but a great diversity in method. The committee believes this diversity to be healthy, as it desires that the teacher should have a large liberty in the choice of his methods. It deprecates the discouragement of improved methods which is found to result from the existing system of preparing for examinations. Two useful tables in the report indicate the usual science subjects in schools where the leaving ages are sixteen and eighteen respectively, and the average

age at which they are studied. Among the recommendations are the following:—(1) the teaching of elementary physical measurements should form part of the mathematical course; (2) preparatory schools should teach natural history (including some physical geography) and the rudiments of physics; (3) qualitative work deserves respect, and good scientific literature and lectures should not be underrated; (4) the claims of geography and biology should receive more recognition; (5) all science work of boys should be brought into closer touch with everyday experience; (6) more laboratory assistants should be provided. Mr. Eggar commented on the report, and asked for attention to the historical order of discovery in framing courses of instruction.

Next on the programme came an open discussion on note-taking and reports of work, which was initiated by the president. Prof. Miall, and subsequently Mr. Fletcher, advised that pupils be trained to arrange their work under heads and subheads, and that these should be the most important feature of their notes. The use of intelligible contractions was advisable. Prof. R. A. Gregory directed attention to the waste of labour by writing as lecture-notes matter which was easily available in books. The Rev. T. Corcoran urged that the mapping of histories should be performed by the students themselves. He also advocated the introduction of "scientific" note-taking into classical subjects; in other words, the teachers of classics should take a leaf out of the book of their colleagues on the scientific side. Dr. Kimmins had been impressed with the good quality of the note-taking by American boys and girls; they showed the capacity to seize upon the important point in an argument. He objected to the waste of time involved in making fair copies of notes, while admitting that parents gloat over elaborate note-books. Mr. Mayhowe Heller expressed doubts as to the wisdom of demanding notes from quite young students.

The discussion on clear speaking and reading aloud was opened by Mrs. Mackinnon, who fell under the suspicion of giving us an object-lesson in this art. Besides attending to final consonants and making the children read at a distance from the audience, she made the child give an epitome of the passage before attempting to read aloud. This secures that what is to be read has been understood, which is absolutely necessary for good reading. Miss Cooper wished more attention to be given to phrasing, including stress and pause. Prof. Miall pleaded for a revival of reading aloud in the family. The Rev. Dr. Delaney having stated that boys come to the university unable to speak properly, despite the years spent in secondary schools, Mr. G. F. Daniell suggested that boys ought to be taught to speak well after, as well as before, the break of voice. Dr. Ernest Gray raised the question of the influence of phonographic writing on speaking. He also spoke of the way in which speakers turn their heads without turning their bodies, and pointed out that no successful orator falls into this error.

Dr. G. Archdall Reid gave a paper on acquirement in education. He stated that everything we learn is acquired. The new-born baby is not intelligent; he has only great capacity to learn to become intelligent. When we send a child to school we design that he shall not merely learn knowledge more abstruse than that which he can pick up, like a savage, from the ordinary experiences of life, but also acquire right habits of thought or mental dexterities. The best educational subjects at the same time supply useful knowledge and exercise the thinking faculty. Knowledge to be useful must be remembered; to be remembered it must link up with our subsequent experiences. Prof. Culverwell disagreed with many of Dr. Reid's views, and put forward theories relating to mental change and the transference of energy within the brain. Profs. H. Browne and R. M. Henry upheld the teaching of classics, and Principal Griffiths objected to the fight between the protagonists of science and classics as a mischievous and unnecessary quarrel.

Prof. J. A. Green read an important paper on experimental studies in education. The author gave a sketch of work which is being prosecuted abroad which will greatly help to lay a wise foundation for future teaching practice. The teacher, as such, is not primarily a researcher, but he wants the results of research in a usable form, and university departments of education should be organised so as to provide them. Laboratories have already been instituted in Antwerp, St. Petersburg, Leipzig, Milan, and Budapest for experimental inquiry into the problems which confront the teacher. Miss Foxley gave an account of the work which is being done in Manchester under Prof. Findlay's direction. The audience was impressed with the importance of the subject, and heard with pleasure that a research committee of Section L has been appointed, with Prof. Findlay as chairman and Prof. Green as secretary, to inquire into the methods and results of research into the mental and physical factors involved in education.

By kind permission of the authorities, visits were paid to Maynooth, Loreto Abbey Convent School at Rathfarnham, Wesley College, Christian Brothers' Schools, Alexandra College, Mountjoy School, and Artane Industrial School.

The section was indebted to the Rev. T. Corcoran for a useful exhibit of maps to aid in the teaching of Greek and Irish histories.

The interim report on the conditions of health in schools, prepared for Section L, was presented in the Physiology Section. It was, unfortunately, impossible to arrange a joint meeting of the two sections. Reference was made to the relation between the educational and other sections of the association by Sir Philip Magnus at the opening meeting. He pointed out that Section L was able to help the other sections by discussing the methods of teaching the various branches of science with which they were concerned, and he hoped that the older sections would refer to the education section the consideration of problems relating to methods of instruction.

Twenty-two educational associations were officially represented at the meeting, and it is desirable that means should be devised to render the interest thus displayed of more effect in promoting the work of the section and in spreading the influence of that work.

G. F. DANIELL.

FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE.

George Bell and Sons.—The Farm and the Dairy, Prof. J. P. Sheldon, new edition, illustrated. *The Cambridge University Press.*—Tropical Agriculture, J. C. Willis. *Cassell and Co., Ltd.*—Live Stock; Dairy; Equipment, each by P. McConnell, illustrated. *Williams and Norgate.*—Principles and Practice of Agricultural Analysis: a Manual for the Study of Soils and Fertilisers and Agricultural Products, H. W. A. M. Wiley, vol. ii., Fertilisers.

ANTHROPOLOGY.

A. and C. Black.—Ancient Tales and Folk-lore of Japan, R. G. Smith, illustrated. *J. M. Dent and Co.*—Folk-lore in Lowland Scotland, E. Simpson. *Macmillan and Co., Ltd.*—The Golden Bough: a Study in Magic and Religion, Prof. J. G. Frazer, third edition, Part i., The Magic Art and the Evolution of Kings; Totemism and Exogamy, Prof. J. G. Frazer, 2 vols. *Milner and Co., Ltd.*—Prehistoric Man, J. McCabe; Races of Man, Dr. A. C. Haddon, F.R.S. *John Murray.*—The South African Natives: their Present Condition and Progress, edited by the South African Native Races Committee. *Kegan Paul and Co., Ltd.*—The Scope and Content of the Science of Anthropology, J. Dieserud.

BIOLOGY.

Appleton and Co.—The Cat: its Care and Management, Mrs. Leslie Williams, illustrated; The Life and Habits of Ants, Dr. L. L. Dublin, illustrated; Man in the Light of Evolution, J. M. Tyler; The Sexual Instinct, J. F. Scott, second edition. *Edward Arnold.*—Scottish Gardens, Sir H. Maxwell, illustrated. *George Bell and Sons.*—Biology and its Makers, Dr. W. A. Locy, illustrated. *A. and C. Black.*—The Science and Philosophy of the Organism, Dr. H.

Driesch, vol. ii.; A Treatise on Zoology, edited by Sir E. Ray Lankester, F.R.S., part i., first fascicle, Introduction and Protozoa, Prof. S. J. Hickson, F.R.S., Dr. F. W. Gamble, J. J. Lister, H. M. Woodcock, and the late Prof. Weldon, F.R.S., illustrated; part vii., Crustacea, W. T. Calman, illustrated; part ix., Vertebrata Craniata, Dr. E. S. Goodrich, illustrated. *Blackie and Son, Ltd.*—The World of Animal Life, F. Smith, illustrated; Tales and Talks in Nature's Garden, A. T. Morris, illustrated. *The Cambridge University Press.*—Darwin and Modern Science, a Series of Essays written in Commemoration of the Centenary of the Birth of Charles Darwin and of the fiftieth anniversary of the publication of the "Origin of Species," edited by Prof. A. C. Seward, F.R.S.; Ticks, a Monograph of the Ixoidea, Prof. G. H. F. Nuttall, F.R.S.; Mendel's Principles of Heredity in Application, Prof. W. Bateson, F.R.S.; The New Flora of the Volcanic Island of Krakatau, Prof. A. Ernst, translated by Prof. A. C. Seward, F.R.S.; Trees: a Handbook of Forest Botany for the Woodlands and the Laboratory, the late Prof. H. Marshall Ward, F.R.S., vol. iv., Fruits, and vol. v., Form and Habit, with an Appendix on Seedlings, edited and prepared for publication by Prof. P. Groom. *W. and R. Chambers, Ltd.*—Book of British Birds, J. M. Boraston, illustrated. *Chapman and Hall, Ltd.*—The Craftsman's Plant-book: or Figures of Plants selected from the Old Herbals, R. G. Hatton, illustrated. *T. and T. Clark.*—The Bible of Nature, Prof. J. A. Thomson. *Mr. Robert Culley.*—Bird Hunting through Wild Europe with Gun and Camera, R. B. Lodge, illustrated; The Young People's Nature-study Book: in Garden, Field, and Wood, S. N. Sedgwick, illustrated. *J. M. Dent and Co.*—Animals at Home, W. P. Westell; Nature-study, Prof. J. R. A. Davis, illustrated; Plant Life, E. Evans, illustrated; Our Forests and Woodlands, Dr. J. Nisbet, new edition, illustrated; The Ruskin Nature Readers, edited by G. R. Bennett, illustrated. *Duckworth and Co.*—The Scientific Feeding of Animals, Dr. O. Kellner, translated by Dr. W. Goodwin. *Everett and Co.*—The Stockowners' Manual, F. Townend Barton, illustrated; The Cat: its Points and Management in Health and Disease, F. Townend Barton, illustrated. *C. Griffin and Co., Ltd.*—Technical Mycology: the Utilisation of Micro-organisms in the Arts and Manufactures, Dr. F. Lafar, vol. ii., part ii. *T. C. and E. C. Jack.*—The British Bird Book, F. B. Kirkman, in parts, illustrated; The Dwellers Series, the Rev. Theodore Wood, illustrated: (1) Dwellers in the Garden; (2) Dwellers in the Pond; (3) Dwellers on the River Bank; (4) Dwellers in the Woodland; (5) Dwellers in the Meadows; (6) Dwellers Underground. *John Lane.*—Birds of the Plains, D. Dewar, illustrated; Holly, Yew, and Box, with Notes on other Evergreens, W. Dallimore and T. Moore; The Book of Fern Culture, A. 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CAMBRIDGE.—At Emmanuel College research studentships have been awarded to members of the college as follows:—150*l.*, T. H. Laby; 140*l.*, R. D. Kleeman; 100*l.*, H. S. Tasker.

Mr. A. R. Brown, who recently returned from the Andaman Islands, where he spent two dry seasons in studying the sociology, psychology, and religion of the pigmy inhabitants, was elected on Monday to a fellowship at Trinity College in recognition of his investigations.

In connection with the visit of the members of the Congress of Electrical Units to Cambridge on Saturday next, it is proposed to confer degrees of Doctor of Science, *honoris causa*, upon Prof. S. A. Arrhenius, Prof. G. Lippmann, Dr. S. W. Stratton, and Dr. E. G. Warburg.

Prof. Bateson will deliver an inaugural lecture in the botanical lecture-room on Friday, October 23, at 5 p.m., on "The Methods and Scope of Genetics."

Mr. G. H. Hardy, of Trinity College, and Mr. J. M. Dodds, of Peterhouse, have been nominated moderators for the year beginning May 1, 1909. Mr. A. Berry, of King's College, and Mr. G. Birtwistle, of Pembroke College, have been appointed examiners for the mathematical tripos, part i. (old regulations), for the same period.

A Grace, gratefully acknowledging the munificent gift to the University by Prof. Liveing of almost the whole of the apparatus and material belonging to him in the chemical laboratory, will be brought before the Senate to-day.

DR. CHARLES E. FAWSITT, Graham Young lecturer in metallurgical chemistry in the University of Glasgow, has been appointed professor of chemistry in the University of Sydney, N.S.W.

IN addition to the usual course of Hunterian and other lectures to be delivered during the present winter session, the council of the Royal College of Surgeons of England has arranged a series of demonstrations in the theatre of the college at which specimens from the museum will be shown and their bearing on general and surgical pathology discussed. The first demonstration of the series is to be given on Friday, October 16, at 5 p.m., by Dr. Arthur Keith. The demonstrations are open to all medical men and senior students on presentation of their cards.

ON October 7 Mr. Herbert L. Storey handed over to Lancaster the extensive buildings of the Storey Institute, which he has erected and equipped at a cost of 10,500*l.* The institute itself was the gift of the late Sir Thomas Storey, to commemorate the jubilee of the late Queen's reign. In the original building are housed the public library, art gallery, lecture theatre, and laboratories for science work. Some time ago the need for an extension was felt, and Mr. Storey offered to erect new buildings. These are now completed. The new buildings provide a workshop for manual training and a class-room for domestic science. Prof. Sadler, in an address at the ceremony, spoke of the signal value of the service which private benefactors like Mr. Herbert Storey render to public education by encouraging manual training for boys and the preparation of girls for their future duties as wives and mothers. He expressed the hope that by means of Mr. Storey's gift Lancaster may find it possible to establish a day continuation school for boys and girls of from thirteen to fifteen years of age, with a course of instruction designed to give preparation for skilled industry and for home duties.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 21.—"On some Features in the Hereditary Transmission of the Albino Character and the Black Piebald Coat in Rats." Paper ii. By Geo. P. **Mudge.** Communicated by Prof. A. D. Waller.

These experiments show that albinoes breed true to albinism, whether their ancestry is pigmented or not. They further show that, though externally albinoes may appear to be identical with regard to their coat characters, in reality they may be different, and that some exhibit the "ghost" of the self pattern and others that of the piebald pattern. It has been previously known for both animals and plants that some albinoes carry certain colour and pattern factors, while others carry different ones, but this difference has hitherto been elucidated by means of breeding tests alone. These experiments add an ocular demonstration of the actual presence of the coat-pattern in albinoes. The interpretation placed upon the coat appearances in these albinoes is corroborated by the breeding results.

It is further shown that when a piebald black rat (Cr 5) is mated with one of a similar type, two classes of offspring may be obtained. One of these contains all black piebalds and the other a mixture of black piebalds and albinoes in nearly equal numbers.

When a piebald black rat is mated with an albino (=Cr 5×Cr 4), it may be said that, so far as these experiments have gone, five different results will be obtained. They may be stated as follows: (1) The offspring may be all black piebalds. (2) They may be a mixture of black piebalds and albinoes. (3) They may be all "Irish" forms (=a black self-coloured form). (4) They may be a mixture of albinoes, black piebalds, and "Irish." (5) They may contain albinoes, "Irish," and a grey form (=Cr 2). It can be shown that the divergency of the results obtained when two individuals apparently similar are mated is due to the gametic nature of the albino employed.

June 24.—"Preliminary Account of the Habits and Structure of the Anaspidiidæ, with Remarks on some other Fresh-water Crustacea from Tasmania." By Geoffrey **Smith.**

The paper gives an account of observations made on the habits of Anaspides in its natural state, the most important points being its method of running with the body held straight, and the deposition by the female of the fertilised eggs under stones and weeds. An account is also given of the internal anatomy, certain characters, *e.g.* the structure of the heart and of the filiform spermatozoa, suggesting affinity with the Mysidacea, while others tend towards the Decapoda, thus showing the animal to be the most generalised malacostracan known. A member of a new genus, Paranaspides, is also described, which was found in great numbers in the Great Lake of Tasmania; this animal, which bears a strong superficial likeness to Mysis, is transparent, and leads more of a swimming life than Anaspides, which it resembles in essential structure, though not at all in appearance. The other members of the rich crustacean fauna of the Great Lake are referred to, and reasons are given for deriving this fauna from the lost Antarctic continent.

Received August 25.—"Further Results of the Experimental Treatment of Trypanosomiasis: being a Progress Report to a Committee of the Royal Society." By H. G. **Plimmer** and Captain H. R. **Bateman.**

The following results are a continuation of the work of which summaries have already appeared in the Proceedings of the Royal Society (B, vol. lxxix., 1907, pp. 505–16, and B, vol. lxxx., 1908, pp. 1–12) and in NATURE (October 10, 1907, vol. lxxvi., p. 607, and January 9, vol. lxxvii., p. 238). The experiments have been carried out with the same strains of nagana and surra as were used before, the average duration of untreated diseases being 5·5 and 6·9 days respectively.

I.—Nagana Rats treated with Atoxyl and Succinimide of Mercury.—Of these rats two lived more than 300 days, four lived more than 200 days, five lived more than 100 days, and six more than 50 days. None of the above died with any of the signs of nagana. Of the twenty-one rats tabulated only one died from trypanosomiasis, and this one was probably atoxyl-proof. One of these, which was apparently cured, was used on the 147th day after inoculation for re-inoculation, with the view of ascertaining if any immunity had been conferred. This was found not to be the case.

II.—Nagana and Surra Rats treated with Atoxyl and Mercury Sozoiodol.—One rat lived more than 200 days, one more than 100 days, and two more than 50 days, none of them dying from trypanosomiasis.

III.—Nagana and Surra Rats treated with Sodium Antimonyl Tartrate.—Nine of these rats lived for more than 200 days, and nine others considerably more than 100 days. Of those which have died only four have had recurrences, none of them died with any symptoms of trypanosomiasis, and in none were trypanosomes found after death. An emulsion of the liver and of the bone-marrow was injected into other rats in five cases, with negative results in each case.

IV.—Further experiments.—(A) *Nagana Rats treated with Large Doses of Sodium Antimonyl Tartrate.*—The results obtained showed that pushing the drug does not have any good effect; the trypanosomes are not driven out more quickly, or more effectually; recurrences are more common, and inflammatory intestinal lesions were present in nearly every case. Two rats died with living trypanosomes in the blood; these two had become antimony-proof, as the later doses did not remove the trypanosomes from the blood, nor make any difference in their number.

(B) *Rats treated with Sodium Antimonyl Tartrate after Inoculation with Atoxyl-proof Trypanosomes.*—It was found that the atoxyl-proof strains of trypanosomes are less influenced by antimony than are the ordinary variety, as three rats had living trypanosomes in the blood at death, and seven died at a very early date.

(C) *Rats treated with Sodium Antimonyl Tartrate and Antimony (Metal) suspended in a Fatty Medium.*—In order to make the use of antimony practicable in the form of injection, a series of experiments was undertaken, using various other media than water for solution or suspension of the antimony salt. Finally, the medium Colonel Lambkin devised, consisting of palmitin and antiseptics, which is used very largely for the intramuscular injection of mercury, was tried, and found practical. One great advantage of these preparations is that they can be used upon man with far less difficulties and after-consequences than the watery solutions, which seem to be impracticable; this is of importance should antimony be found of use in human trypanosomiasis.

Of thirteen nagana and surra rats treated with a 5 per cent. suspension of sodium antimonyl tartrate, two have lived more than 100 days, each having had only one dose, three lived more than 50 days, and none have died from trypanosomiasis.

The administration of the metal itself in a state of very fine division has a considerable effect on the trypanosomes; it has a distinctly better effect on surra than upon nagana, five surra rats out of sixteen being alive more than 200 days after inoculation, and four others having lived for a long time. In none of the surra rats were trypanosomes found at death, whereas in three of the nagana rats they were present. The metal is much more irritating than the tartrate, but the effect is in most cases more prolonged; this is probably due to the fact that the absorption of the metal is much slower. Further, the smaller doses would appear to be the most efficient.

(D) Antimony (metal) and sodium antimonyl tartrate were given before inoculation to test their effects upon the development of the disease; and the metal was found to be far more effective in delaying the appearance of the trypanosomes in the blood than the salt; this is probably due to its slower elimination. One dose of the metal given the day before inoculation delayed the appearance of the trypanosomes until the eleventh day.

(E) *Rats treated with Lithium Antimonyl Tartrate.*—There are differences in the effects produced by the potassium, sodium, and lithium antimonyl tartrates, if given under similar conditions and dosage. The sodium salt contains, roughly, about 2 per cent. more antimony than the potassium salt, and the lithium salt contains about 2 per cent. more than the sodium; but the doses of the lithium salt have to be much smaller than the corresponding doses of the sodium salt. When the watery solution is injected intramuscularly, it has not caused necrosis of the tissues in rats, but subcutaneously it has occasionally done so. The best strength of solution for rats is 0·25 per cent., and of this 0·5 c.c. has been given for a dose. Out of twelve rats five are alive and well at periods varying from 125 to 134 days. This salt is much more soluble than either the potassium or sodium compound, which may, perhaps, as well as its greater antimony content, account for its greater effectiveness.

(F) *Experiments with Antimony upon Dogs.*—In order to see what the effects of antimony would be on the larger and more important animals when suffering from trypanosomiasis, a series of experiments on dogs has been begun. The trypanosome used was that of surra, which kills dogs of about 20 lbs. in weight in approximately 14 days, as this is the trypanosome which is of practical importance with regard to dogs. Five dogs were treated at first with the suspensions mentioned under C, but we have found, since trying the lithium antimonyl tartrate, that this acts more effectually and with less irritation than the creams, whether of metal or salt. All the animals are in good condition and are gaining in weight, three at 62 days and two at 53 days after inoculation.

(G) *Experiments made with Rats treated with Antimony, in order to find out in what Organs the Trypanosomes are latent.*—Eleven rats were inoculated with nagana, which is less affected by antimony than surra, and were all treated with four doses of sodium antimonyl tartrate. The rats were killed at various intervals, and the organs selected (the liver and bone-marrow) were made into an emulsion with a minimum quantity of 0·75 per cent. salt-solution, and injected into other rats in doses of 1 c.c.; the same dose of blood from the heart was also given. In four the results were entirely negative; in three trypanosomes were found in the liver, and in six in the bone-marrow. It would appear that the bone-marrow is the place where the trypanosomes can live longest, and that the liver is also a place where they can find protection. This is borne out by some experiments we have made upon trypanosomiasis in birds, in which cultivations of trypanosomes can often be made from the bone-marrow when they cannot be made either from the organs or the blood. The doses given to

the above rats were rather less than those which we should judge to be curative, but in four cases the results were entirely negative.

PARIS.

Academy of Sciences, October 5.—M. Émile Picard in the chair.—A recent change in the aspect of the comet 1908*c* (Morehouse-Borrelly): G. **Bigourdan.** On September 30 the comet possessed a long visible tail, directed from the sun, and at least 15′ long. On October 1 this tail had disappeared, and the head of the comet also appeared less brilliant. Traces of a tail were noted on October 3.—The micro-organisms of intestinal putrefaction: Elie **Metchnikoff.** After reviewing the recent work on the nature and functions of the bacteria found in the normal human intestine, the author regards it as certain that the digestive tube of man contains three species of putrefactive organisms. They occur, not only in the form of spores, but also in their vegetative state of rods. The author is of opinion that the products formed by these bacteria act as poisons, and have a pathogenic *rôle*. These poisons pass through a porcelain filter, and resist the action of boiling water.—Observations of the grey tropical spot of Jupiter: José Comas **Solà.**—The convergence of continued fractions: E. **Nörlund.**—Directed waves in wireless telegraphy and the investigation of syntony: M. **Turpain.** A reclamation of priority as regards the work of MM. Bellini and Tosi and M. Slaby.—Studies on the association in series and in parallel of electrolytic detectors: M. **Jégou.** The combination of two or more electrolytic detectors in series causes a loss in sensibility, the arrangement being always less sensitive than any one of the detectors used alone. The arrangement in parallel may give results which are practically useful.—The analysis of the non-liquefiable gases in liquid air: F. **Bordas** and M. **Touplain.** The apparatus described by the author in a preceding paper for the investigation of the small quantities of gases contained in minerals has been modified to analyse the gases which escape liquefaction during the fractional distillation of liquid air. The gases used were supplied by M. Claude, and were submitted to fractional absorption by charcoal cooled to different temperatures. The spectrum of the mixture of neon and helium thus obtained is given and compared with Baly's figures.—Size of the molecules and charge of the electron: Jean **Perrin.**—The microchemical reactions of arsenic applicable in legal medicine: G. **Denigès.** The drop of the liquid containing the arsenic in the form of an arsenate is evaporated to dryness on the microscope slide, and then treated with the reagent (silver nitrate or magnesia mixture), with certain precautions described. Characteristic crystals are obtained in this way.—The active pinonic and pinic acids: Ph. **Barbier** and V. **Grignard.** The pinenes employed in this investigation were strongly active, and the corresponding acids obtained by oxidation were also strongly active in rotatory power.—The estimation of succinic acid in wines and in other fermented liquids in the presence of fixed acids: Emm. **Pozzi-Escot.**—The effect of dialysis on the ferments from plant juices: C. **Gerber.**—A young giraffe from eastern Soudan recently arrived at the museum menagerie: E. L. **Trouessart.**—A hydrological law of Minard and Belgrand: E. **Maillet.** The author's measurements lead to a slight modification of this law.

DIARY OF SOCIETIES.

FRIDAY, OCTOBER 16.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Repairs, Renewals, Deterioration and Depreciation of Workshop Plant and Machinery: J. E. Darbishire.

WEDNESDAY, OCTOBER 21.

ROYAL MICROSCOPICAL SOCIETY, at 8.—The Mouth Parts of the Nemocera and their Relation to the other Families in Diptera; Corrections and Additions to the Paper published in 1904: W. Wesché.—(1) On the Resolution of Periodic Structures; (2) An Auxiliary Illuminating Apparatus: E. M. Nelson.

ENTOMOLOGICAL SOCIETY, at 8.—On Diagnostic Resemblances in Insects; a Reply to Mr. G. A. K. Marshall: Dr. F. A. Dixey.

THURSDAY, OCTOBER 22.

CHEMICAL SOCIETY, at 8.30.—The Passage of Hydrogen through a Palladium Septum, and the Pressure which it produces: D. Tsakalotos.—The Relationship of Colour and Fluorescence to Constitution, Part ii., Rhodamines of Mellitic Acid: O. Silberrad and C. S. Roy.—Constitution of the Fluorescences of Mellitic and Pyromellitic Acid: O. Silberrad.—A New Form of Gas Burette: A. E. Hill.—A Molecular Compound of Trinitroacetaminophenol and β-Naphthol: R. Meldola and J. G. Hay.—Reduction Products of Azoxybenzene, Preliminary Notice: L. H. Berry.—Constitution of the Salts of the Phthaleins, and the Cause of Colour in the Triphenylmethane Series: A. G. Green.—Chlorination of *p*-Nitraniline: B. Flürscheim.—Relation between Absorption Spectra and Chemical Constitution, Part x., Unsaturated Acids of the Benzene Series: E. C. C. Baly and K. Schaefer.—Condensations with Monochloromethyl Ether, Part i., Condensation of Monochloromethyl Ether with Ethyl Malonate and Ethyl Isopropyl Malonate: J. L. Simonsen.—Relation between Chemical Constitution and Physiological Action in Certain Substituted Aminoalkylesters: F. L. Pyman.—Effect of Constitution on the Optical Rotatory Power of Optically Active Nitrogen Compounds, Part iii.: R. W. Everatt and H. O. Jones.

FRIDAY, OCTOBER 23.

PHYSICAL SOCIETY (National Physical Laboratory), at 3.30.—Demonstrations of Work in Progress in the Laboratory.

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