THURSDAY, OCTOBER 13, 1910.

THE HISTORY OF PHYSICS.

Geschichtstafeln der Physik. By Prof. Felix Auerbach. Pp. v+150. (Leipzig: J. Ambr. Barth, 1910.) 4 mk.

PROF. AUERBACH has embodied in this little book of 150 pages upon the chief discoveries in physics the result of notes made during many years for his personal use, in preparation for lectures. It consists of three parts: part i. (110 pages) is a chronological list of the main steps in the development of physics, with the year and the name of the discoverer, but without citing either the authority or the reference by which the discovery is fixed, and extending down to the year 1900. Part ii. (17 pages), a list of selected works, monographs, treatises, and text-books, with their authors, also to the year 1900. Part iii. (5 pages) is a selected list of leading physicists, except those still living, with their years of birth and death. There is also an alphabetical index of names.

Doubtless such a list will be found convenient for reference—much more convenient, for example, than Darmstaedter's recent "Handbuch zur Geschichte der Naturwissenschaften und der Technik," which is a more ambitious work It also covers the ground much more fully than Prof. Lehfeldt's list published in 1894 by the Physical Society.

A good idea of its nature and scope will be gathered by the following selection of the entries about the successive steps in photography.

1311, Camera obscura; Levi ben Gerson.
1505, Improved camera obscura; Lionardo da Vinci.
1556, Blackening of silver chloride by sunlight; Fabricius.
1558, Improved camera obscura; Porta.
1728, Action of light on silver compounds; J. H. Schulze.
1757, Copying of silhouettes on silver chloride paper; Beccaria.
1777, Photochemical reduction of silver; Scheele.
1777, Violet rays are photographically most active; Scheele.
1782, Colour sensitiveness of the silver compounds; Senebier.
1801, The strongest chemical action lies in the ultra-violet; Ritter.
1802, Production of light-images on silver chloride paper in the camera obscura; Davy.
1802, Photographic silver nitrate silhouettes; Wedgewood.
1810, Photochemical production of colours by coloured illumination; Seebeck.
1816, First permanent and printable photographic plates; Niepce.
1826, Discovery of silver bromide and its sensitiveness to light; Balard.
1833, Invention of the actinometer; Herschel.
1837, Production of the first plates with silver iodide, and developed by mercury vapour; Daguerre.
1838, Achromatic landscape-lens; Chevalier.
1839, Production of the first negatives copyable upon paper; Talbot.
1840, Foundation of microphotography; Donné.
1840, Portrait-objective for photography; Petzval.
1842, First useful photographs of the solar spectrum; E. Becquerel and Draper.
1842, Printing-out process with iron salts; Herschel.
1843, Discovery of gold-toning of photograms; Fizeau.
1847, First photographs on albuminised plates; Niepce de St. Victor.
1850, Introduction of gelatine into photography; Poitevin.
1851, Wet collodion process for photography; Archer.
1852, Chrome-gelatine process for photography; Talbot.
&c., &c., &c.

The subsequent steps are narrated in similar detail; but, strangely enough, the name of Sir Joseph Swan is entirely omitted from the list. Similar lists might be adduced in every branch of physics. As might be expected from Prof. Auerbach, the list in acoustics is particularly complete, while those in optics and in magnetism are scarcely less so.

The omission of all references to authorities renders criticism difficult; because the critic, even where he is fairly certain that some error exists, has no means of learning what the compiler of the list relies upon for his statement. Thus the author credits Wilcke, in 1757, with the introduction of the conception of electric resistance; he attributes to Scoresby, in 1827, the discovery of the destruction of magnetism by glowing heat; he credits to Hankel, in 1848, the suggestion of the hot-wire galvanometer. One would wish to know the authorities for these statements. There are several inexplicable omissions: Du Bois Reymond's discovery of non-polarisable electrodes is not mentioned; Shelford Bidwell and George F. FitzGerald are unknown to the author as having achieved anything in physics; Barrett's discovery of recalescence is ignored, as is Osmond's work in the same field. Earnshaw's discovery of the dependence of the velocity of sound on its intensity is unnoticed. Lord Kelvin's publication in 1855 of the doctrine of available energy is not referred to. Osborne Reynolds's work on dilatancy is not mentioned. The foundation of crystallometry is attributed to Weiss in 1813; all reference to the work in that direction of Wollaston, of Haüy, and even of Steno being omitted! In several cases the dates need revision. Thus, Maxwell's electromagnetic theory of light is given as 1871, several years too late. A reference to Dr. Gilbert, who died in 1603, is given as 1630. The first research to register the curves of alternating electric currents is attributed to Colley in 1885; Joubert has dropped out, even from the index. Aitken's classical observations on dust nuclei are not recorded. Lord Kelvin's mariner's compass is dated back to 1868, though only patented in 1876. Foucault's use of gas retort carbon for electric light pencils certainly dates back before 1850; but here it is given as 1866. These blemishes can easily be removed when a second edition is called for—as it ought to be before long.

PSYCHIATRY AND PSYCHOTHERAPY.

(1) *A Text-book of Mental Diseases.* By Prof. Eugenio Tanzi. Authorised translation from the Italian by Dr. W. Ford Robertson and Dr. T. C. MacKenzie. Pp. xvi+803. (London: Rebman, Ltd., 1909.) Price 24*s.* net.

(2) *Psychotherapy.* By Prof. Hugo Münsterberg. Pp. xi+401. (London: T. Fisher Unwin, 1909.) Price 8*s.* 6*d.* net.

THESE two books appeared towards the end of last year, the one being a thoroughly up-to-date work on psychology, normal and morbid, and the other dealing with the psychical treatment of disease, especially of mental disorder.

(1) Prof. Tanzi's book has already been published in Italy for nearly five years and from the first has been recognised as a standard work on mental diseases. It begins with a study of the seat of the psychical processes and considers seriatim the data of physiology and experimental anatomy, embryology, pathology and normal anatomy. Then follows a discourse on the causation of mental diseases, and there is a chapter on the morbid anatomy of the brain, microscopical and macroscopical, in respect of mental diseases. About 150 pages are devoted to psychology of a practical kind, under the headings of sensibility ("sensation" would have been a better translation), ideation, sentiment, movements and other external reactions. This last chapter is really a disquisition on the conduct of the insane and deals with anomalies of the will, of the instincts, of emotional expression and of speech and writing. The classification adopted is mainly that of Kraepelin, but the author does not follow that authority with any slavish rigidity.

It will seem curious to English physicians to find the study of mental diseases beginning with that of pellagra, but it will not be forgotten that this disease plays almost as large a *rôle* in some parts of Italy as general paralysis does in this country.

Many will object to the use of the term "amentia" in the sense of acute confusional insanity or acute hallucinatory insanity; but this is the sense in which the word has been used on the Continent ever since the days of Meynert, whereas in this country "amentia" means idiocy or imbecility. The term maniacal-depressive insanity does not appear; but melancholia, periodic melancholia, periodic mania, and circular insanity are discussed under the heading of "the affective psychoses."

Paranoia is more clearly defined and receives fuller consideration than we have seen in any other text-book. The author divides paranoiacs into those with abstract delusions (mattoids) and those with an egocentric delusion (the querulants, the persecuted, the erotic and the ambitious). Under these various headings there are interesting references to the history of the Middle Ages and to the peculiarities of certain primitive races. There are also some very full accounts of individual cases of paranoia.

The chapter on constitutional immorality is well worth reading. Prof. Tanzi takes a broad view of the subject, and criticises the penal law on the one hand and the narrow views of some of his own countrymen on the other. He rightly condemns stigmatising a person as a criminal merely because he possesses a certain number of the physical stigmata of degeneration, such as a Darwinian ear, plagiocephaly, hexadactylism, &c.

There is a full and excellent index. The book is well illustrated and got up, and there are 132 figures which materially assist the reader in understanding the text.

(2) Prof. Münsterberg divides his book into three parts, the first being on the "Psychological Basis of Psychotherapy," the second on the "Practical Work of Psychotherapy," and the third on the "'Place' of Psychotherapy."

Part i. seems rather unnecessary to anybody who has studied psychology before and, to the practical physician, part iii. will appear rather redundant, as it deals with the relation of psychotherapy to the church, &c. The essential section of the book is part ii., and this will be found exceedingly interesting. It treats of the conditions in which psychotherapy is likely to be of use, general and special methods, and of mental and bodily symptoms. The special methods discussed are suggestion, hypnotism, side-tracking and psycho-analysis.

The methods of psycho-analysis are beginning to be well understood in this country, although they have not yet reached the popularity they have in Austria, where the name of Freud, the propounder of its principles, has become a household word. Freud and his followers hold that by the psycho-analytic method they are able to discover in a patient some long-forgotten memory, and that in their discovery they bring to the surface a source of mental irritation, thus removing from the mind a foreign body in the same way as a surgeon picks a thorn from the finger. English physicians are disinclined to regard the method in this light; they consider that the proceeding is rather one of suggestion to the patient. The patient lies on a sofa whilst the operator sits at his head and reels off a series of words to which the patient is required to fit associated ideas; and the operator subsequently, from the study of the patient's associations, evolves some incident in his past history. This he relates to the patient, and hey, presto! recovery. The same result, however, may be quite well attained by taking a careful history of the patient's past life. Psycho-analysis is most suited for hysterical patients, but Münsterberg recommends it for cases of psychasthenia.

Side-tracking is a somewhat different principle which, however, may be used in conjunction with psycho-analysis. Patients suffering from psychasthenia are obsessed with some thought which they are unable to dispel. By psycho-analytic methods the physician searches for an origin of the obsession and then, by devices of various kinds (side-tracking), he diverts the patient's thoughts from the original incident into different channels. To take an example, a man found that he had developed a tendency to hesitate when walking in the street, and was unable to cure himself. Münsterberg was consulted, and found that on a certain occasion when the patient was running to catch a tram he suddenly saw almost immediately before him a big hole dug out for laying gas pipes. He was able

to stop himself quickly enough to avoid falling into the hole, but he had a strong emotional shock from the experience. Münsterberg persuaded him under slight hypnosis to think himself once more in the situation of his run for the car, but, as soon as he reached the hole, to jump over it. He went through this motor feature on ten successive days with increasing energy, and from that time the trouble disappeared.

Both books make a very useful addition to the libraries of people interested in the subjects with which they deal.

COMMERCIAL GEOGRAPHY.

Physical and Commercial Geography. By Profs. H. E. Gregory, A. G. Keller, and A. L. Bishop. Pp. viii+469. (London: Ginn and Co., n.d.) Price 12*s.* 6*d.*

THE aim of this work is stated to be "to infuse orderliness and sequence into the chaotic data and statistics of trade," and this the authors regard as constituting "a new departure."

The question whether their work constitutes a new departure or not is, however, one of comparatively small importance. We may at least admit that the attempt to carry out this aim in their "own chosen way" is new, and we may add that that way is a good way, and, on the whole, admirably followed. We feel sure that no student or teacher of commercial geography could fail to profit greatly by the perusal of this work, and, above all, of its more general sections.

The work is divided into three parts, each of which, we are told, belongs essentially to one of the three authors, though they have a joint responsibility for the outline and general character of treatment. The first part is entitled "The Natural Environment," the second "The Relation of Man to Natural Conditions," and the third "The Geography of Trade." It is in the first two sections that the aim of the work as above indicated, the tracing of the influence in the moulding of trade of what "might be called the environmental (or geographical) factors," is kept most consistently in view, and with the most satisfactory results.

The third part of the work is the most disappointing. Here the geographical point of view is much less prominent. In it, the authors say, their treatment is "Topical, a short monograph upon each preeminent article of commerce occurring under the general politico-geographical section which leads in the production or use of the article in question."

But in some of the most important cases little or no attempt is made to show what, if any, geographical influences have been at work to help in creating that importance. Emphasis is laid on the remarkable lead which Great Britain takes in the cotton industry and in transmarine carriage; but the question whether geographical circumstances have had anything to do with this in either case is not even raised. There is very little comment on the seats of manufacturing industry in the United States. There is a reference to water-power in certain cases, and coal, iron, and limestone, as determining the localisation of the iron industries of Pittsburg and the Birmingham districts, but little else. The reason for this apparently is the attaching an exaggerated degree of importance to sources of power as localising manufacturing industries, and overlooking the importance of the relation to labour supply and the market. When the latter relations are kept in view it may be shown that the fact that so few important manufacturing towns in the United States are situated on the coalfields is as much due to geographical causes as the fact that in England and Germany so many are.

RESTORATIONS OF EXTINCT ANIMALS.

Extinct Monsters and Creatures of Other Days; a Popular Account of Some of the Larger Forms of Ancient Animal Life. By the Rev. H. N. Hutchinson. New and enlarged edition. Pp. xxxiii+329. (London: Chapman and Hall, Ltd., 1910.) Price 10*s.* 6*d.* net.

SINCE the author of this volume was the first to recognise that the larger extinct animals of former ages presented a promising field for a popular work showing what these creatures probably looked like in life, he thoroughly deserved success in his attempt to fill a gap in literature, and we have therefore great pleasure in congratulating him on the appearance of a second edition. In the volume now before us, Mr. Hutchinson has combined his original two works in one, with some condensation of the old matter, and with the addition of a large quantity of new material, both in the shape of text and illustrations, in order to bring it abreast of modern palæontology. Since 1892 and 1894, the respective dates of publication of "Extinct Monsters" and "Creatures of Other Days," vertebrate palæontology has indeed made vast strides, as is especially noticeable in the case of the anomodont reptiles and the proboscideans, and the author appears to have discharged the difficult task of bringing the work up-to-date in a satisfactory and interesting manner. From first to last the volume is thoroughly readable, and it is to be hoped that it may aid in dissipating the ignorance still so prevalent with regard to the relative ages of the mammoth and the iguanodon.

In referring to the iguanodon as a smooth-skinned reptile, and then giving a plate of it clad in crocodile-like armour, the author appears to display inconsistency; and in the plate of Ceratosaurus the individuals in the background are depicted with relatively larger fore-limbs than the one in front. Reference might also have been made to the evidence in favour of an elephant-like pose of the bones afforded by the figure of an undisturbed limb of Diplodocus; and recent researches indicate that the restoration of Stegosaurus with a double row of plates is incorrect. A few improvements might also be suggested in the text, as, for instance, on p. 169, where it is stated that the teeth of Claosaurus resemble those of Hadrosaurus, without any clue being given as to the nature of the latter. Misprints and typographical inaccuracies are singularly few, although we notice Jakutsh on plate xliii., and Yakutsk in the first note on p. 276. The book is thoroughly deserving of a large sale. R. L.

HINTS FOR THE GARDEN.

(1) *The Carnation Year Book*, 1910. Edited by J. S. Brunton. The official organ of the Perpetual Flowering Carnation Society. Pp. 53. Price 1*s*.

(2) *Gardening Difficulties Solved. Expert Answers to Amateurs' Questions.* Edited by H. H. Thomas. Pp. 160. (London: Cassell and Co., Ltd., 1910.) Price 1*s*. net.

(3) *Leitfaden für gärtnerische Pflanzenzuchtung.* By M. Löbner. Pp. vii+160. (Jena: Gustav Fischer, 1909.) Price 1.50 marks.

(4) *Wild Flowers and How to Identify Them.* By H. Friend. Pp. 64. (London: Robert Culley, 1910.) Price 1*s*. net.

THE popularity of the carnation as a florist's flower has already been enhanced by the spread of the American or perpetual flowering carnation, and will become more so as the qualities of this type are more generally recognised. Originally raised in France where they were known as "remontants," their value was not realised until American growers took up their cultivation with excellent results. Only within the last decade have British horticulturists entered the field, but sufficient growers were found in 1906 to form the society which offers the "Carnation Year Book" (1) as its official organ. One important object of the society is to undertake the registration of new varieties; about a dozen have so far been registered, including the already famous Britannia and Mrs. H. Burnett, as compared with about 800 recognised by the corresponding American society. The volume contains several short articles, of which the most interesting deal with cultivation and hybridisation.

(2) Amateur gardeners do not lack opportunities for obtaining assistance in their difficulties, as all the gardening papers are prepared to supply expert advice. The brochure edited by Mr. Thomas has been collated from replies to correspondents inserted in the columns of the *Gardener*. The questions cover a wide field, so that, although they are grouped in sections, it is a small chance that any specific matter for which the book is consulted will be mentioned therein. So far as it goes, the information is sound and practical, and some practical hints are conveyed in the illustrations.

(3) The perusal of Herr Löbner's book has afforded much pleasure and instruction, as it provides a successful combination of scientific teaching and practical experience. The book consists of a general part dealing with the acquisition of new plants by selection, hybridisation, importation, grafting, and sports—here limited to vegetative anomalies—and a special part in which the origin of specific novelties is treated. It is only possible in the limited space to note that the author discusses seed-fixation, the means of getting seed from double flowers, fertile and infertile hybrids, and the keeping qualities of pollen. In the latter part no section is more interesting than that on roses which includes some account of the author's experience.

(4) The arrangement for identifying British plants offered by Mr. Friend is, to all intents and purposes, the Linnean system, with the omission of many genera; species are only cited for eight genera, and then partially. The notes on season, habitat, and structure provide but little help towards identification, especially as no clear definition is given for some of the technical terms, *e.g.* fruit, bract, and stipule; further, there is a singular confusion on p. 32 of bulb and root, corm and tuber.

OUR BOOK SHELF.

The Telegraphic Transmission of Photographs. By T. Thorne Baker. Pp. xi+146. (London: Constable and Co., Ltd., 1910.) Price 2*s*. 6*d*. net.

THOSE who look at the illustrated papers, and especially readers of *The Daily Mirror*, are aware that the telegraphic transmission of photographs has already entered the commercial stage, and if the results are not yet all that can be desired it will generally be admitted that they reach a high standard of merit considering the very numerous difficulties that have had to be surmounted. This little book from the pen of Mr. Thorne Baker, who has been carrying out the work for *The Daily Mirror* during the last two-and-a-half years, is consequently very welcome.

A brief historical survey of the earlier work is given, and a more detailed account of the later work of Prof. Korn, M. Belin, and the author, which has resulted in the development of systems of actual commercial value. One is impressed throughout by the number of small difficulties which have had to be overcome by persevering experiment, and it is evident that the present state of the art owes its perfection considerably to the development of the kindred arts of photography and reproduction without which the advances on the purely electrical side would have been of slight avail. Problems such as this, though theoretically simple of solution, present great difficulties on account of the amount of technical skill and knowledge of a number of different subjects that is required.

The book is well written and illustrated. A good deal will only be understood by the technical reader fairly well equipped with electrical knowledge, but there is sufficient simple description to enable the non-technical reader to acquire a very fair idea of the whole subject. Some of the phototelegrams which are reproduced are excellent, especially when looked at from a sufficient distance to render the "grain" indistinct, and the two sketches transmitted by wireless telegraphy, though poor in themselves, afford evidence of still further possibilities of development.

M. S.

Liste des Observatoires Magnétiques et des Observatoires Séismologiques. By E. Merlin and O. Somville. Pp. x+192. (Brussels: Havez, Rue de Louvain, 112, 1910.)

To those who seek to establish definite relationships between solar and terrestrial phenomena, the multiplication of well-distributed stations equipped for the observation of terrestrial magnetism and earth movements is a hopeful sign. Hitherto, one of the grave difficulties encountered in such researches has been the paucity of trustworthy and continuous data for sufficiently long periods.

The list now published leads us to hope that a future generation may be more fortunate, for here we find some 220 observatories, of which at least eighty are devoted to the study of terrestrial magnetism and electricity.

The usefulness of such a list has been proved, in principle, by the publication of a similar list of astronomical observatories in 1907, and the Royal Ob-

servatory of Belgium, under the auspices of which both were prepared and published, is to be congratulated upon having performed an exceedingly useful, if tedious, duty.

As any attempt to separate magnetism and seismology would have led to needless duplication and confusion, the arrangement is purely alphabetical. For each station are given the geographical position, the altitude, the nature of the ground on which the observatory stands, the publications wherein the results appear, the names of the staff, a brief history of the observatory, and the nature and distance of any disturbing elements, such as tramways, &c., and, finally, a description of the instruments and the special researches to which they are dedicated. Other lists show the continental and national distribution of the two kinds of observatories, and, alphabetically, the names of the observers.

Such a list was to have been prepared by the International Commission for Terrestrial Magnetism, but the project failed; the data then collected, however, have been placed at the service of the compilers of the present work, and have proved very useful.

W. E. R.

An Inconsistent Preliminary Objection against Positivism. By Prof. Robert Ardigo. Translated by Emilio Gavirati. Pp. 52. (Cambridge: W. Heffer and Sons, Ltd., 1910.) Price 1*s.* net.

THIS pamphlet, by the veteran leader of Italian positivism, is issued in translation by a devoted admirer and disciple who wishes to find an English helper in the translation and publication of other works by the "great master." Its argument is directed against those opponents who, on behalf of modern idealism, contend that in positivism there is to be found this fundamental fault—namely, that, according to the method which the positivist has prescribed to himself, the subject ought, in his system, to become an object which cannot have, therefore, any of the characteristics belonging to subjectiveness. Prof. Ardigo, as St. George to the dragon of metaphysics, develops a subtle and closely reasoned argument for a positivist treatment of psychology, criticising the positions associated with the names of Bergson and Boutroux. He is also careful to show that positivism differs widely from materialism, with which there is—very naturally—a tendency to confound it. The substance of this pamphlet is contained in the second part of volume x. of Ardigo's "Philosophical Works."

Analytical Chemistry. By Prof. F. P. Treadwell. Authorised translation from the German by William T. Hall. Vol. ii. Quantitative Analysis. Second edition. Pp. x+787. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1910.) Price 17*s.* net.

A REVIEW of the first edition of Mr. Hall's translation of Prof. Treadwell's work on quantitative analysis was published in NATURE of August 11, 1904 (vol. lxx., p. 341). In the present issue certain additions have been made which are not found in the German text, and the main part of the work has been compared with the fourth German edition.

Students' Life and Work in the University of Cambridge. Two lectures by Prof. Karl Breul. Revised edition. Pp. 60. (Cambridge: Bowes and Bowes, 1910.) Price 1*s.* net.

THE two lectures delivered by Prof. Karl Breul to the students attending the University Extension summer meeting in 1908 give an interesting and informative account of the life and work of Cambridge undergraduates. In the revised edition a few corrections and additions have been made.

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.*]

Early Burial Customs in Egypt.

ALL who are interested in the serious attempts that are being made to reconstruct the real history of ancient Egypt and to sift established truth from wild conjecture must deplore Prof. Flinders Petrie's attempt (see NATURE of September 29, p. 401) to revivify the corpse of a belief in the supposition that the archaic Egyptians were in the habit of cutting up their dead, a view which has been so effectually hanged, drawn, and quartered during the last ten years.

When Prof. Petrie states (*op. cit.*, p. 401, quoted from *Man*, September) that "it has long been known that in prehistoric burials the corpse was stripped of its flesh, the bones even being broken to extract the marrow," he should have written that he and M. de Morgan had *stated* that the prehistoric Egyptians dissected the bodies of their dead. But, even though Profs. Maspero, Sayce, Wiedemann, and Lortet repeated these or similar statements (Sayce and Lortet invoking the aid of birds of prey to do the bone-cleaning!), the experience gained by other excavators has totally shattered and destroyed every scrap of evidence that could lend any support to the belief in the reality of such practices.

In 1896 Prof. Petrie ("Naqada and Ballas," p. 32) attempted to explain the disturbed condition of the skeletons found in many archaic Egyptian graves by saying "*that bodies were sometimes—with all respect—cut up and partly eaten*"!

Four years later Dr. George A. Reisner proved that such disturbances of the bones as Prof. Petrie mentioned were the result of the operations of grave-plunderers (see the Egyptian Exploration Fund's Archæological Report for 1900–1, p. 25); and every year since then this explanation has been proved to be true in every case where disturbances have been found amongst many thousands of burials of all ages and in every part of Egypt and Nubia, which have been submitted to the most thorough and critical examination, not only by Dr. Reisner himself, but also of many independent witnesses. The evidence referring to Nubia is set forth *in extenso* in the First Annual Report of the Archæological Survey of Nubia, which is being published in Cairo this month. During my ten years' association with Dr. Reisner, my collaborators in the anatomical branch of the work and I have examined and made notes on the remains of more than 15,000 human beings buried in the Nile Valley, and we have not seen a single case which afforded any evidence whatsoever of the practices postulated by Prof. Petrie.

Secondary burials, of course, occurred in ancient Egypt: but they were exceedingly rare, probably more so than in modern England. Perhaps some archæologist of the next millennium will find infinitely more evidence in English graveyards of the twentieth century in support of speculations on our "customs of mutilation of corpses and cannibalism" than Prof. Petrie has been able to gather in Egypt.

It would, indeed, be a matter for astonishment if such a people as the ancient Egyptians, whose respect for their dead is proverbial, did not attempt to restore to order the graves of relatives that had been desecrated by grave-plunderers. The surprising thing is not that we find instances of reburial, but that they are so exceedingly rare.

During the Græco-Roman period in Egypt and Nubia, when the decadence of the art of mummification had definitely begun, it often happened that bodies handed over to the embalmers were treated in such a careless manner that they fell to pieces in an early stage of the process, and had to be rebuilt—sometimes with limb-bones reversed, leg-bones as skeletons for arms, portions of other skeletons introduced, and often foreign materials added. This "faking" of mummies is described in detail in the forthcoming Report of the Archæological Survey of Nubia.

Would it be unreasonable to suppose that in the early experimental stages of the art of embalming—corresponding to the epoch with which Prof. Petrie is dealing—similar failures may have occurred, and that such a condition, for example, as Prof. Petrie has described from Deshasheh, where the fibula was upside down (see "Deshasheh," 1898, Pl. xxxvii.), would receive a natural explanation? Such cases are so exceedingly rare that it is idle to quote them as representing the "custom" of the country.

Apart from these rare exceptional cases of secondary burial and embalmers' "faking," all the disturbances of the bones of unplundered graves result from (1) the operation of the force of gravity on bodies falling into decomposition, and (2) the occasional action of rodents moving small bones. That this is so has been conclusively demonstrated by Dr. Reisner in the minute and critical examination of many thousands of burials in Egypt and Nubia. Thus there are very precise and definite reasons for discarding Prof. Petrie's fantastic speculations, and for accepting in their stead the simple and perfectly obvious explanation of the disturbed state of the skeleton in many graves, which he who runs may read.

The phrase "the bones even being broken to extract the marrow" (*op. cit.*, NATURE, p. 401) calls for some further comment. Does it mean that Prof. Petrie is reaffirming his former statement of a belief in the practice of cannibalism (already quoted)? Can he point to one single case where the bones of a prehistoric Egyptian have been broken *post-mortem*, except by grave-plunderers, excavators, or the natural forces of the denudation of the soil and the disintegration of organic matter?

In "Naqada and Ballas," p. 32, Prof. Petrie referred to the forcible scooping out of the marrow as an evidence of cannibalism; but that statement was clearly inspired by his lack of familiarity with the normal medullary cavity of a human long bone and its relation to the cancellous tissue at the ends. But he added, further, that "there were grooves left by gnawing on the bones"—a sure sign of anthropophagy! Dr. Fouquet, who examined M. de Morgan's material of a similar nature, also saw these grooves, but called them "syphilitic ulcers."

Two years ago (*Lancet*, August 22, 1908, p. 521) I was able to demonstrate that the bones of many pre-dynastic Egyptians were certainly gnawed, but neither by man nor the spirochæte: the damage was inflicted by small necrophilous beetles. Although Prof. Petrie no longer refers to these signs of gnawing, he still speaks of the prehistoric Egyptian breaking human bones "to extract the marrow," *i.e.* presumably to eat it. The whole evidence afforded by excavations in Egypt goes to prove that this statement is pure fiction.

G. ELLIOT SMITH.

The University of Manchester, October 1.

British Marine Zoology.

"THE proof of the pudding is in the eating," and surely Prof. MacBride will admit that whether a biological station is or is not suitable for research must be decided, not by the expensiveness of the equipment, but by observing whether research is being carried on there.

That one station is ten times as large and expensive as another is no advantage and no credit to it unless it is also ten times as efficient. That it is only in such an establishment that Prof. MacBride can "bring research to a successful issue" is, of course, an important personal record, but it might be unsafe to generalise from one such observation.

I am sorry not to be able to agree with Prof. MacBride in the distinctions he draws between the stations equipped for research and others; and I cannot avoid a doubt as to whether he has personal knowledge of the smaller stations of this country.

W. A. HERDMAN.

October 1.

I SHALL gratify Prof. Herdman's curiosity so far as to say that I have worked at more than one small station in this country.

I fully agree that "the proof of the pudding is in the eating," and I am content to leave it to the judgment of my fellow-zoologists whether in reviewing the work done at the various zoological stations in this country Plymouth has not justified its superior equipment by the superiority of the original work, both as to quantity and quality, which has been accomplished there.

E. W. MACBRIDE.

Hormones in Relation to Inheritance.

WITH reference to my presidential address to Section D of the British Association, of which a full report appeared in NATURE of September 22, I must rectify an omission by pointing out that the theory of the possible influence of hormones in inheritance was first enunciated by Mr. J. T. Cunningham in a paper in the *Archiv für Entwicklungsmechanik*, vol. xxvi., 1908, entitled "The Heredity of Secondary Sexual Characters in Relation to Hormones, a Theory of the Heredity of Somatogenic Characters." It was through inadvertence that the reference to Mr. Cunningham's paper was not printed in the copies of the address distributed at the meeting at Sheffield.

GILBERT C. BOURNE.

Savile House, Oxford, October 4.

Pwdre Ser.

MY friend Mr. Frank Darwin has sent me the following additional information respecting the *Pwdre Ser*.

"The 'Treasury of Botany' says that Nostoc is called 'Falling Stars,' and quotes Dryden (no reference)—

> 'And lest our leap from the sky prove too far,
> We slide on the back of a new falling star,
> And drop from above
> In a jelly of love.'

"The note is signed M. J. B.=Berkeley, so it may be trusted so far as that it really refers to Nostoc."

T. MCKENNY HUGHES.

Ravensworth, Brooklands Avenue, Cambridge, September 30.

Unemployed Laboratory Assistants.

A NUMBER of lads who have been employed as laboratory monitors in secondary schools, and whom the London County Council are unable to retain in their service beyond the age of sixteen years, have been referred to us by the London County Council with the view of our placing them. Some of them we have already been able to place in suitable employment, but there are still one or two on our books for whom we seek situations.

They all have an elementary knowledge of physics and chemistry. Some have learned glass-blowing and bending, and a few of the applicants have already passed the Board of Education examination in Chemistry (Stage I.). If any readers of NATURE would like to have further particulars of these boys, I should be glad to supply them with information.

GODFREY E. REISS (*Hon. Sec.*).

Apprenticeship and Skilled Employment Association, 36 Denison House, 296 Vauxhall Bridge Road, London, S.W., October 5.

THE INTERNATIONAL UNION FOR COOPERATION IN SOLAR RESEARCH.

THIS union held a very successful meeting—the fourth since its foundation—on Mount Wilson Observatory, California, during the last week of September, when there was an assembly of nearly forty European astronomers and physicists, who had crossed the Atlantic for the meeting, and many more American men of science. England was represented, among others, by Sir Joseph Larmor, Profs. Newall, Turner, Fowler, and Mr. Dyson. The gathering, representative as it was of all nations actively engaged in solar work, would have been even more so if a number of those who had signified their intention of being present had not at the last moment been pre-

vented by illness or other causes from attending. Among them were Sir David Gill, Dr. Lockyer, Profs. Righi and Violle. To the great regret of everyone present, Prof. Hale was prevented by bad health, brought on through overwork, from taking part in the discussions. Together with Mrs. Hale, he received his guests at a garden-party at their home in Pasadena, and was able to come up to the observatory on the first day of the meeting, but on the advice of his doctor he returned to Pasadena, after delivering a short address on the general work of the conference.

As regards the results of the meeting, the first place must be given to the extremely satisfactory report of the committee on the determination of standard wave-lengths. The requirements of modern spectroscopic research having rendered all previous measurements obsolete, even for purposes which only require relative values, the Solar Union set itself the task of preparing new tables. The direct comparison between the wave-lengths of the red cadmium line with the standard metre carried out by Fabry and Pérot gave a result practically identical with that of Michelson, so that already three years ago its numerical value could be definitely adopted. Taking this line to be the primary standard, a sufficient number of iron lines had next to be compared with it, so that they might serve in subsequent work as secondary standards, with an accuracy hardly, if at all, inferior to that of the primary. This work was undertaken independently in three different laboratories by Fabry and Buisson, at Marseilles, by Eversheim under Kayser at Bonn, and by Pfungst under Ames at Baltimore. The numbers obtained agree so well that we are now already in possession of a large number of lines with accurately known wave-lengths. How accurately? Using the Angström (10^{-8} cms.) as unit, the average differences of the three independent determinations only amount to about three or four in the third decimal place, which means less than one part in a million. The few cases where the differences are somewhat greater are easily explained by a deficiency in the homogeneity of the lines, except in a small region in the orange.

The secondary standards are now sufficiently close together to serve as fixed points for interpolations, when gratings are used, and it is intended to proceed immediately with the further determination of tertiary standards so near to each other, that even with a prismatic dispersion every observer will have at his command a system of lines on which he can depend entirely for comparison or interpolation. In the orange region referred to, some barium lines will have to be added, and the total length of spectrum dealt with, which extends from λ 4282 to λ 6494, will before long be substantially increased on the red side. In order to avoid confusion between the new and old determinations, the now adopted unit will be known as the "international Angström" (I.A.). If the Solar Union had done nothing else than this work on wave-lengths, it would have justified its existence.

We next note the report of the committee on the investigation of sun-spot spectra, which was presented by Prof. Fowler. Its work is sufficiently indicated by the following recommendations, which were adopted by the meeting:—

(1) That, notwithstanding the progress of photographic work, visual observations of spot spectra should be continued, and that the committee should be re-appointed to continue the organisation of this work.

(2) That in view of our increased knowledge of spot spectra, the committee should be authorised to prepare and circulate a revised and extended scheme of visual observations.

(3) That it is desirable that, for the use of visual observers, the separate sections of the new photographic map of the sun-spot spectrum should not exceed 60 centimetres in length, and should be on a scale of 5 mm. to the Ångström.

Another committee dealt with spectroheliograph work, and here also we may confine ourselves to quoting the more important resolutions:—

(1) That daily photographs of the calcium flocculi be continued by the co-operating observatories.

(2) That provision be made, if possible, for the measurement of the photographs.

(3) That the desirability of utilising large spectroheliographs of high dispersion for the study of the upper layers of the solar atmosphere is recognised by the committee.

A report on the spectroheliograph work carried on at South Kensington was sent in by Sir Norman Lockyer, and will be printed in the transactions of the union, as also a discussion of solar phenomena as revealed by the spectroheliograph, which was presented by M. Déslandres.

An important, but from the nature of things somewhat slowly progressing, committee deals with the study of solar radiation. Its work has been seriously retarded by the lamented death of Knut Ångström, whose pyrheliometer had been adopted by the union as standard instrument, and who had undertaken personally to standardise all pyrheliometers sent out from Upsala. Latterly serious defects in the constancy of the indications of the instrument have shown themselves, and unless a ready means is found to keep an accurate log of their changes by frequent comparison with some standard radiator, the union will be forced to modify its previous decision. Mr. Abbott presented the report of the committee, and gave an account of his own important work on solar radiations, which has revealed some fluctuations in the amount of heat and light which enters our atmosphere. These fluctuations, which frequently amount to 5 or 6 per cent., may still be due to uncorrected influences of atmospheric absorption, and Mr. Abbott laid stress on the importance of establishing an independent station in a locality where the atmospheric conditions are favourable, so that simultaneous observations can be carried out, at least in two places, and atmospheric inequalities still further eliminated.

It remains to record an important alteration in the constitution of the union, which has decided to extend its scope, and include astrophysics in the range of its activity. In voting for the change, the members of the union were fully aware of the importance of their decision. It was pointed out by several speakers that the union exposed itself to the danger of undertaking more than could be managed, and that before long the primary object of the union might be swamped by the additional problems now introduced. But, on the other hand, everybody recognised that the distinction between the sun and a star was an artificial and accidental one, and that the study of one was a necessary complement to the study of the other. The danger of being overwhelmed by the additional subjects is not great, because only a few well-defined portions of astrophysics are adapted for investigation by international co-operation. At the conclusion of an interesting discussion, the vote went unanimously in favour of the change. A beginning of the new order of things was made at once, and a committee was appointed, with Prof. E. Pickering as chairman, to discuss the possibility of coming to an agreement on the classification of stellar spectra.

The next meeting of the union will be held at Bonn in the year 1913.

ARTHUR SCHUSTER.

POPULAR BOOKS ON BIOLOGICAL SUBJECTS.[1]

(1) THE first of these books forms vol. iv. of the handsomely got-up and well-illustrated "Science in Modern Life." The first eighty-eight pages are a continuation of the account of botany begun in the previous volume, and deal with geographical distribution as influenced by climate, &c., followed by a general systematic survey of the vegetable kingdom. So much of the space is filled by illustrations (usually very good) that the letterpress is exceedingly condensed, and makes the style rather that of an encyclopædia than of a book to be read, but the substance is good.

The section on zoology (114 pages) includes six pages on the history of the science, and ten on a general survey of the animal kingdom, and these are so much condensed as to be almost meaningless without further reading. The remainder is devoted to an account of the evolution of animals as revealed by their fossil remains. In this way descriptions are given of all the chief orders of animals, but short diagnostic descriptions of groups, sometimes with no illustration, convey little definite impression to the reader, and the general effect is distinctly disappointing. The physiological side of zoology, in which its relation with "modern life" is perhaps closest, is not dealt with.

The pages devoted to fisheries are the most readable in the volume. The style is necessarily very concise, but the author succeeds in picking out the salient features and in making the subject interesting. The volume is provided with a full list of contents, but no index.

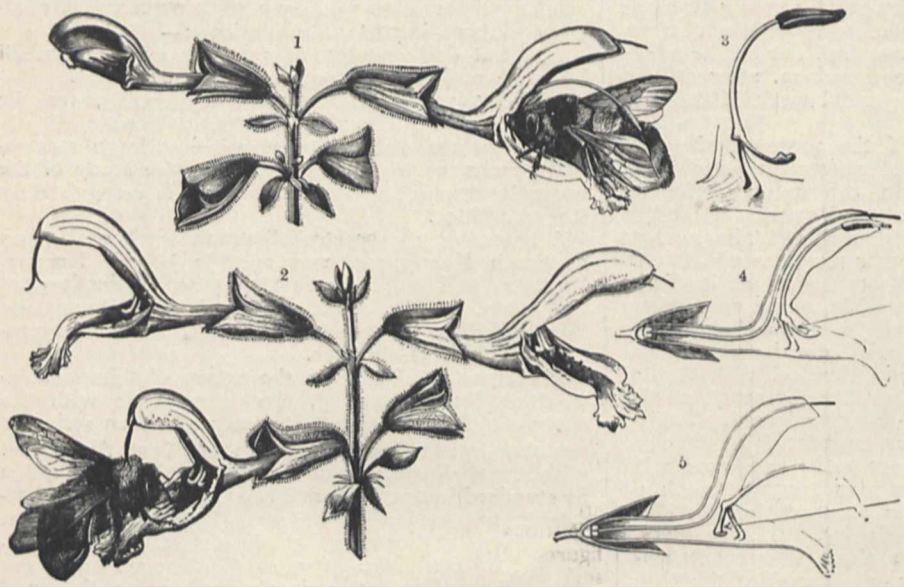


FIG. 1.—Transference of pollen to the bodies of insects by means of mechanism of the percussive type. (1) Part of an inflorescence of *Salvia glutinosa*; the right-hand flower is being visited by a humble-bee, and the pollen-covered anther is in the act of striking the insect's back. (2) Another part of the same inflorescence with three open flowers in different stages of development: the lower flower on the left-hand side is being visited by a humble-bee which carries on its back pollen from a younger flower and is rubbing it off on to the deflexed stigma. (3) A stamen of *Salvia glutinosa* with rocking connective. (4) Longitudinal section through a flower of the same plant. The arrow indicates the direction in which humble-bees advance towards the interior of the flower. (5) Same section; the lower arm of the connective lever is pushed backward, and in consequence the pollen-covered anther at the end of the other arm of the lever is deflexed.—From "Science in Modern Life."

(2) "A Bush Calendar" consists of a series of articles on nature in the neighbourhood of Sydney, reprinted from the *Sydney Morning Herald*. They are pleasantly written descriptions of the birds, flowers, &c., seen, with observations on their habits and haunts; and although to most English readers the names will not convey any clear idea, to those living in that part of Australia it should be a useful little book. It is illustrated with pretty photographs, and for each month a list is given of the flowers, migrant birds, and nests which may be found. An Englishman is at once struck with the fact that there is no month in which some bird does not breed. One small blemish is that generic names should be written with initial capitals.

(3) "Nature Studies by Night and Day" does not claim originality, and consists of a series of disconnected chapters on well-worn subjects—the opening and closing of flowers, protective coloration, the sundew, &c. The photographs are not very well repro-

FIG. 2.—Tadpole before the emergence of the fourth limb.—From "Nature Studies by Night and Day."

[1] (1) "Science in Modern Life." A Survey of Scientific Development, Discovery and Invention, and their Relations to Human Progress and Industry. Vol. iv. Edited by Prof. J. R. Ainsworth Davis; Botany (continued), by J. M. F. Drummond; Zoology, by Prof. J. R. Ainsworth Davis; and Science and the Sea Fisheries, by Dr. J. Travis Jenkins. Pp. x+236. (London: Gresham Publishing Co., n.d.)

(2) "A Bush Calendar." By Amy E. Mack (Mrs. L. Harrison). Pp. vi+109. (Sydney: Angus and Robinson, Ltd.; London: Australian Book Company, 1909.) Price 3*s*. 6*d*. net.

(3) "Nature Studies by Night and Day." By F. C. Snell. Pp. 319. (London: T. Fisher Unwin, n.d.) Price 2*s*.

(4) "Insect Wonderland." By Constance M. Foot. Pp. xi+196. (London: Methuen and Co., 1910.) Price 3*s*. 6*d*. net.

(5) "The Landscape Beautiful." A Study of the Utility of the Natural Landscape; Its Relation to Human Life and Happiness, with the Application of these Principles in Landscape Gardening, and in Art in General. By F. A. Waugh. Pp. 336. (New York: Orange Judd Co., 1910.)

(6) "Bees for Profit and Pleasure." By H. Geary. Farm and Garden Handbooks. Edited by T. W. Sanders. Pp. 114. (London: W. H. and L. Collingridge, n.d.) Price 1*s* net.

duced; perhaps the most interesting is that of a tadpole with three legs, the right front limb not yet having emerged from the opercular fold. A book which might interest a novice in "nature-study."

(4) In "Insect Wonderland" the author endeavours to interest little children in the natural history of insects by conversations between insects and flowers, birds, &c., to which the insects describe their life and habits. It may be doubted whether this method is really more attractive to children than straightforward accounts, if written simply and easily, but in any case, it is unfortunate to write of *Mr.* Bee when the individual speaking is a worker, or of the orange-tip butterfly as "she," when the orange colour is confined to the male. The flowers and insects described as talking together also are not all to be found at the same season. Otherwise the descriptions are clear and good; the illustrations are pretty, but not always easy to understand.

(5) "The Landscape Beautiful" is written by an American "landscape architect," to encourage the appreciation of beauty in nature and in gardens. The first five chapters ("Essays") are in praise of natural beauty in its broader aspects, followed by a chapter to prove that landscape gardening is entitled to a place among the fine arts, since it combines all the objects and technical difficulties of painting and sculpture. This subject is amplified in the succeeding chapters, which deal especially with American landscape gardening, and the need for a greater appreciation of beauty and care for its preservation by the American people. The concluding chapter on "Some Practical Applications," describing the methods used or suggested by the author for encouraging the study of natural beauty in schools is particularly interesting, and might well be read by teachers of "nature-study." The book is pleasantly written and illustrated by very pretty photographs by members of "The Postal Photographic Club."

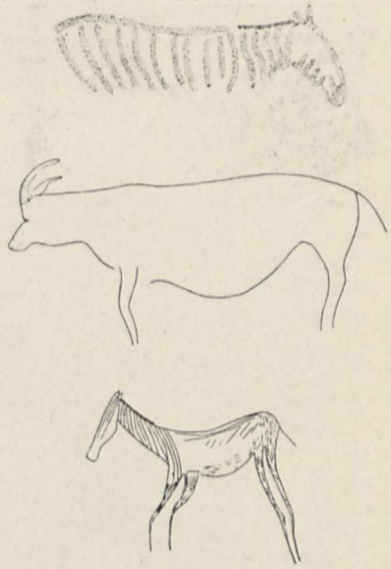
(6) "Bees for Profit and Pleasure" is a practical handbook to bee-keeping, written by an expert on the subject. It points out the advantages of keeping bees either for pleasure or as a supplementary source of income, gives a clear, concise account of their natural history and habits, and a good account of the various kinds of hives and other apparatus, with prices, but in some places the mention of apparatus not described until later in the book might cause some difficulty to the beginner. The instructions for successful management are straightforward and interesting, and the book is provided with an index.

THE GEOLOGY AND ARCHÆOLOGY OF ORANGIA.[1]

THIS work is the fourth of a series containing the author's personal observations and conclusions on the economic geology and archæology of South Africa. The present volume is devoted to Orangia, where the author has resided in practice as a mining engineer; his work gave him excellent opportunities for observation and research, and he has used his chances with admirable industry and judgment.

The first chapters are devoted mainly to the geology of Orangia, which is of less interest, owing to its monotonous uniformity, than that of any other South African State. Most of the country is occupied by rocks belonging to the Karoo system. The granitic mass of Vredeport outcrops near the northern frontier, and is surrounded by a belt of rocks corresponding to those of the Rand goldfield, which is situated further to the north. The extension of the Rand series under the Karoo has been proved by the bores recently made under the superintendence of Mr. A. R. Sawyer, and some of the results revealed by those boring operations are stated in the work. Mr. Johnson gives a short account of the diamond-bearing pipes of northern Orangia; he describes especially the Roberts-Victor Mine, of which he was for some time the mining engineer. This mine, among other points of interest, has yielded an eclogite boulder containing diamonds, which has been described by Dr. Corstorphine. The first such occurrence was found in the Newlands Mine at Kimberley, and is well known from the classical paper by Prof. Bonney. Mr. Johnson rejects the view that the eclogite was the original matrix of the diamond, and his conclusion is supported by the results of Mr. Gardner Williams's elaborate test, which proved by testing a large number that these boulders at Kimberley are barren of diamonds. He adopts the conclusions that the kimberlite, the igneous rock that fills the diamond-bearing pipes, is due to the intrusion of a magma at a comparatively low temperature.

Mr. Johnson's archæological contributions include figures and descriptions of many rock paintings, of which one is here reproduced; the figures show no new general results, but they are interesting additions to those previously recorded. They are cruder than many of those found in South Africa, as shown by the exaggerated steatopygy in one of the figures. Mr. Johnson has diligently collected stone implements at many localities in Orangia, and investigated the sites of many ancient settlements. At one site he collected 700 stone implements from a small area in a short time. Mr. Johnson's most original archæological contribution is the claim that the stone implements belong to two separate periods, which he compares with the Acheulian and Solutrian of Europe. In some localities he found his Acheulic type—a common form of which he calls amygdaliths—below the alluvium and the Solutrian above it. The author candidly remarks at the end of his discussion of this question that his observations may merely prove that some of his Acheulic are older than some of his Solutric implements. This caution appears justified, as the results stated are not quite convincing, and more details as to the depths at which the implements were found would be useful.



Representation of Zebra, Hippotragus, and Quagga pecked and engraved on rock, Biesjesfontein. (Scale ⅛.) Reduced from "Geological and Archæological Notes on Orangia."

In his agricultural notes the author directs attention to the great progress that has been made in Orangia by the adoption of the methods often known as "dry farming," which have long been used by farmers on our chalk downs. They have only recently been adopted in South Africa, where they have already

[1] "Geological and Archæological Notes on Orangia." By J. P. Johnson. Pp. vi+102. (London: Longmans and Co., 1910.) Price 10*s*.

proved remarkably successful; Mr. Johnson reports that the rainfall for the ten years' records at Kimberley, Kronstad, and Bloemfontein are respectively 20·4, 27·1, and 25·2 inches; so the climate would not be regarded as arid in Australia, where wheat cultivation has long been undertaken in areas with a rainfall of as low as fourteen inches. Most of the rain in South Africa falls in the six summer months, and its amount is sufficient to justify Mr. Johnson's confidence as to the future agricultural prosperity of the State.

J. W. G.

SPORT ON THE MOORS AND BROADS.[1]

SO far as I am aware, Messrs. Malcolm and Maxwell are the first to present the public with a concise, authentic, and at the same time highly interesting account of the rise and expansion of modern grouse-shooting in the North—a sport which they rightly declare to have been rendered accessible to English sportsmen as a whole by the development of railways. In our own days the steadily increasing demand for well-stocked moors produced by these means has given rise to great improvements in the care and cult of the moors, themselves coupled with a large extension of the area devoted to grouse; and this, in turn, has added very considerably to the financial prosperity of many parts of North Britain. How enormous is the value of Scottish and Yorkshire moors is told in the second chapter of the volume by Mr. Malcolm, who also discourses, with the confidence of an authority, on the management of moors, the connection between grouse and heather, and grouse disease. At one time it was hoped that the number of grouse on a moor might be largely augmented by suitable treatment, but it is now ascertained that there is a limit to this. In view of the prospect of a second edition, Mr. Malcolm's attention may be directed to a couple of obvious grammatical errors on the latter part of the second page.

The last six chapters are from the pen of Captain Maxwell, who discourses pleasantly on ancient and modern grouse-shooting, with a couple of chapters devoted to blackcock and ptarmigan. In urging the need for an extension of the close season in the case of blackcock, the author ought to enlist the support and sympathy of true sportsmen, since it is a crying shame that half-fledged "cheapers" should, as is so often the case, be shot in August. It is also satisfactory to find Captain Maxwell remarking that grouse-driving has resulted in a more or less indifference to natural history and wood-craft on the part of the modern sportsman, who thereby falls far behind his grandfather, to whom such knowledge was essential.

Coot and Great Crested Grebe on their Nests. From "Life and Sport on the Norfolk Broads.

In commending the united efforts of the two authors, I must not omit a word of praise for the 16 coloured reproductions of sketches of Scottish game-birds and scenery, by Mr. C. Whymper, which add so greatly to the attraction of the volume.

Mr. Ready, the author of the second volume mentioned above, is a born "Broadsman," having been brought up in a rectory in the heart of the broad-country, where forty years ago no railway had penetrated, while a visit to Norwich entailed an eighteen-mile journey by coach. Those early days of the author's life can be recalled only in memory, for the penetration of the district by the railway has altered its primitive character in many ways, although the charm of the more secluded portions of the Broads cannot, fortunately, be destroyed.

[1] "Grouse and Grouse Moors." By George Malcolm and Aymer Maxwell. Illustrated by Charles Whymper. Pp. viii+286. (London: A. and C. Black, 1910). Price 7*s*. 6*d*. net.

"Life and Sport on the Norfolk Broads in the Golden Days." By Oliver G. Ready. Pp. xvi.+249. (London: T. Werner Laurie, n.d.) Price 7*s*. 6*d*. net.

That one who knows and loves his subject so thoroughly as does the author of this volume should furnish a mine of information about the Broads, is only what might be expected; but Mr. Ready is also possessed of a pleasant and readable style, although it may be noted that on the very first page he writes "Peninsular" when he means "Peninsula." Perhaps the three most interesting chapters out of the twelve which form the volume are those on birds' nests and fishing; and attention may be specially directed to the account of the nests of the great grebe—locally known as loon—and the buzzard, the former being illustrated by an excellent reproduction from a photograph. In the chapters on fishing much space is devoted to eels and eel-spearing; and it may be noted that in the author's opinion the old-fashioned spear on which eels were impaled is less cruel than the modern weapon in which they merely become entangled between the prongs. For while the former meant death, the latter allows a number of mangled fish to escape.

The illustrations, in addition to the one of the grebe, depict broadland scenery, Wrexham Hall and Church, various implements connected with eel-fishing, and other local subjects.

R. L.

DR. JOHN PEILE.

THE death of the Master of Christ's College, Cambridge, has removed from the University a striking figure, and from the college over which for twenty-three years he presided so successfully a great master. Dr. Peile came of a well-known Cumberland family. His father was Mr. Williamson Peile, of Whitehaven, a geologist of repute. The late master was born in 1838, and was educated at Repton, whence he proceeded to Christ's College in 1856.

Dr. Peile had a distinguished university career, being bracketed Senior Classic in 1860, and winning the Craven Scholarship the year before, and being bracketed Chancellor's Classical Medallist in 1860. Soon after taking his degree, he became a fellow and lecturer of his college, and in 1870 he began his most successful career as a college tutor. This lasted until 1884, in which year he was elected reader in comparative philology in the University. In 1887 he succeeded Dr. Swainson as master of the college, and four years later, becoming vice-chancellor, he resigned his readership.

Dr. Peile took a large part in university matters. He was always on the side of progress, and, together with Henry Jackson and Henry Sidgwick, led many of the movements which have done much to advance learning in all its aspects at Cambridge during the last forty years. He was for an unprecedented time a member of the council of the Senate, and he took a foremost part in the movement for granting degrees to women, for the abolition of compulsory Greek, for the further provision of university buildings for science and other subjects, in the work of University Extension, and in the rearrangement of triposes and other examinations. He was in university affairs and politics a Liberal in the best sense of the word. His lifelong work in the cause of the higher education of women was recognised in the early "nineties," when he succeeded the late Prof. Adams as chairman of the council of Newnham College; and it was a great pleasure to him and to his wife to learn that the new building, opened only this term, was to be called the Peile building.

Dr. Peile's services to philology were those of the teacher rather than the discoverer. He was one of the first to introduce the study into England, and his manual of comparative philology and the little primer long held the ground practically unchallenged. These books showed a touch of taste and literary charm which are not often found in comparative philologists, perhaps rarely in any branch of science. When Brugmann's "Grundriss" summed up the results of twenty years' brilliant discoveries, Peile's books ceased to be useful, though they could not cease to be interesting. He never revised them. All through the period of transition, however, he was keeping abreast of the new discoveries, and acting on them. He brought a critical mind to bear on these; he took nothing on authority, and very often suggested a way of his own to meet the case. What struck the hearer was his humorous common sense. He had a sense of the fitness of things that kept him from pedantry. And the dullest details were illuminated by some chance remark, as when he lectured on the moods, he said one day, "Now you have Delbrück's view and my view; but I confess that I feel some misgiving when I see that we prove two contrary theories by the same examples." The lectures on comparative syntax probably contained his most original work. These were never published. Peile's infectious enthusiasm never failed to influence his hearers, and the impression is still quite strong after a quarter of a century.

In his own college, Dr. Peile was singularly successful in promoting the study of science in its widest sense. Christ's, which was the first college to award open scholarships in the natural sciences, has ever since maintained a high standard in science. Amongst Dr. Peile's pupils were the late Prof. Marshall Ward and the late Prof. H. Newell Martin, Prof. S. H. Vines, Prof. E. W. Hobson, Dr. W. J. Sell, Dr. H. J. H. Fenton, Prof. Liversidge, Prof. Percy Gardner the president of Queen's College, Dr. Rouse, Prof. J. G. Adami, Dr. A. C. Haddon, Prof. E. W. Brown, of Yale University, Prof. Graham Kerr, Dr. E. A. T. W. Budge, Dr. C. A. Barber, Dr. A. W. Rogers, of the South African Geological Survey, Prof. I. Gollancz, Mr. A. Hutchinson, Mr. R. H. Rastall, Mr. A. W. Clayden, Dr. F. H. A. Marshall, Prof. Gwynne-Vaughan, Mr. C. Warburton, and many others who are holding up the lamp of science in all its forms in many parts of the world.

The master was an untiring worker, and devoted his energies, which were great, whole-heartedly to the services of the University and of his college. During his mastership, Christ's College has been greatly enlarged, and to a great extent rebuilt. The chapel and the hall have been decorated by the late Mr. Bodley, and the same architect rebuilt and rearranged the library. A third court has been opened up, and contains a handsome building, with sets of students' rooms, and a more recently constructed pile of lecture-rooms erected at the time of the quatercentenary of the college. John Peile was a wise counsellor, a loyal colleague, absolutely unselfish and unself-seeking. He has left an impress on his University and on his college which can never be effaced.

NOTES.

By the bequest of the late Mr. F. Tendron, for many years chairman of the St. John Del Rey Mining Company, the trustees of the British Museum have recently acquired a few choice mineral specimens. Conspicuous among them is a magnificent, and probably unique, crystal of pyrrhotite, measuring as much as fourteen centimetres across. The suite also includes smaller specimens of pyrrhotite, two specimens of the rare mineral chalmersite, some well-crystallised gold, &c.

THE States of the South African Union have decided to present to His Majesty the King a representative collection of living specimens of the wild animals of the country, and arrangements are already in progress for bringing together the collection and transporting it to England. The latter part of the task will be under the superintendence of the Zoological Society of London, in whose menagerie it is hoped that the whole collection will be ready for exhibition next summer, under the title of the King's African Collection.

IT is announced in *Science* that the original laboratory of Liebig in Giessen is to be purchased and preserved as a memorial to the eminent chemist. An anonymous donor has guaranteed 3000*l.* for this purpose.

WE notice with deep regret the announcement that Mr. J. W. Clark, who until quite recently held the post of Registrary of the University of Cambridge, died on Monday, October 10, at seventy-seven years of age.

THE death is announced of Prof. W. H. Niles, Meredith professor of geology at the Massachusetts Institute of Technology. Prof. Niles was appointed to the chair in 1871, and was known for his contributions to geology.

THE death is announced, at fifty-five years of age, of Dr. F. W. D. Fraser, formerly professor of anatomy and physiology at the Imperial University of Osaka, Japan; and also of Mr. A. H. Stokes, until recently Chief Inspector of Mines in the Midland district, at sixty-eight years of age.

WE record with regret the death, on October 5 at Eastbourne, of Mr. Cecil H. Leaf, known for his studies of cancer. Mr. Leaf was in 1900 appointed to the staff of the Cancer Hospital, and at the time of his death was one of the senior surgeons of this institution. He was the author of numerous important surgical works on cancer of the breast, diseases of the rectum, experiments with chloroform, and other subjects.

PROF. A. VAMBÉRY, the well-known Orientalist, completed on Sunday his fiftieth year of membership of the Hungarian Academy of Sciences. In honour of the occasion the society presented him with a jubilee diploma on Monday, October 10. The *Times* correspondent at Vienna states that in the course of the day Prof. Vambéry received congratulatory visits from a large number of Hungarian men of science and others, as well as telegrams of congratulation from learned bodies and friends in England and America. A subscription has been opened for the purpose of founding a Vambéry scholarship in philology.

WE notice with regret the death of M. Maurice Lévy, who became a member of the Paris Academy of Sciences in 1883, when he took the place vacated by Bresse. M. Lévy was born at Ribeauvillé in Alsace in 1838. After studying at the École Polytechnique he entered the corps des Ponts et Chaussées, becoming eventually inspector-general. In 1885 he succeeded Serret as professor of mechanics in the Collège de France. His work was chiefly connected with mechanics and mathematical physics. His best known mathematical researches were on elasticity, hydrodynamics, action at a distance, and conservation of energy.

THE Berlin correspondent of the *Times* has announced the death, on October 5 at Charlottenburg, of Prof. Ernst von Leyden in his seventy-eighth year. In 1865 Leyden was appointed professor at the University and director of the Klinik at Königsberg. In 1872 he was sent in the same capacity to the newly founded university at Strassburg. Four years later he succeeded Traube at Berlin, where he continued to work until 1907, when he retired. Leyden was the author of a work on the diseases of the spinal cord and of other medical books. He was a corresponding member of various foreign medical societies, and amongst other distinctions he received a patent of hereditary nobility.

THE death is announced of Mr. John Roche Dakyns, who for thirty-four years was attached to the Geological Survey. He was born in St. Vincent, West Indies, on January 31, 1836, and died at Beddgelert on September 27. After joining the Geological Survey in 1862 he was actively engaged for twenty-two years in Yorkshire and the bordering counties of Derbyshire, Lancashire, and Westmorland; for ten years he was occupied in mapping the central Highland rocks in the counties of Perth, Stirling, and Dumbarton, and he was engaged during two years in the neighbourhood of Abergavenny before he retired from the public service in 1896. He was part author of numerous memoirs of the Geological Survey, and he contributed papers, mainly on Carboniferous and igneous rocks, and on Pleistocene deposits, to the Geological Society, the *Geological Magazine*, and the Yorkshire Geological and Polytechnic Society.

THE lecture list of the London Institution for the session 1910–11 includes the following subjects:—Secrets in a pebble-beach, Cecil Carus-Wilson; malaria, Major Ronald Ross, F.R.S.; smoke and its prevention, Prof. Vivian B. Lewis; autumn and winter, the web of life, F. Martin-Duncan; Cretan discoveries, David G. Hogarth; the art of aviation, R. W. A. Brewer; life and work of Lord Kelvin, Prof. S. P. Thompson, F.R.S.; and the art of Palæolithic man, Dr. A. C. Haddon, F.R.S.

IN connection with the London County Council's work of indicating the houses in London which have been the residences of distinguished persons, a tablet has been affixed to No. 4 Marlborough Place, St. John's Wood, N.W., where at one time Huxley lived. Huxley moved into the house in 1872, and lived there nearly twenty years. Most of his letters in London were written at Marlborough Place, and a picture of the house appears in his "Life and Letters."

A COPY of the list of the zoological gardens of the world in September, compiled by Capt. S. S. Flower, of the Zoological Gardens, Giza, Egypt, has been received. The list includes the names of 104 such gardens in existence at the date specified, as well as references to many others now closed or in process of formation. The oldest of the gardens appears to be the Schönbrunn in Vienna, founded in 1752; the zoological garden in Madrid was opened in 1774, and that in the Jardin des Plantes in Paris was inaugurated in 1793. The gardens in Regent's Park date back to 1828. Two collections have been opened this year, one in Munich and the other in the Edgbaston Gardens, Birmingham.

PROF. RAYMOND MCFARLAND, of Middlebury College, Vermont, has just returned from a two months' tour of exploration, during which he penetrated into parts of western Labrador never previously visited by a white man. During the first part of his journey, from Lake St. John to the Mistassini post of the Hudson Bay Company, he was accompanied by two colleagues, Profs. T. C. Brown and P. N. Swett. His companions then left him in order to make magnetic observations and to study geological formations along the Fiel Axe and Chief Rivers. Prof. McFarland, with a single Indian guide, then travelled a hundred miles further north, visiting hitherto unexplored regions to the east and north of Grand Lake, Mistassini,

and climbing the Porcupine range of mountains. The three explorers are well satisfied with the results of their expedition, having brought back many valuable geographical and geological data.

PROF. E. FUGGER, of Salzburg, one of the explorers of the newly discovered ice-cave near Obertraun, in the Hallstadt region of Upper Austria, has favoured us with the following particulars relating to it. The opening is visible from Obertraun, and lies 1600 metres above the sea in the back wall of a cirque between the Mittagkogel and the Hirschberg. A low, narrow passage leads into a hall 10 metres high, the floor of which is covered with ice, bright and clean as a mirror. A cone of ice rises nearly to the roof. After a steep descent of 25 metres an ice-lined cathedral is entered, measuring 40 metres from floor to roof. The floor is strewn with blocks of ice 4 to 7 m. high, the walls are thickly coated with ice, and an ice-pyramid rises here also almost to the roof. A ridge of ice, running in the direction of the length of this cave, leads upwards from it into a gigantic ice-grotto, containing superb needle-like groups of ice-crystals. From a conspicuous group, styled "Monte Cristallo," a stream of clear ice stretches eastward for more than 100 m., leading up to a cross-passage. The right-hand passage is free from ice, and a tooth of *Ursus spelaeus* was found in it. It can be followed into another large hall 100 m. long, 50 m. wide, and 25 m. high, with a castle-like mass of ice rising from its floor. An ice-chasm has now to be scrambled down to an imposing doorway of ice, from which a very narrow passage, 20 m. long, leads into a hall 200 m. long and at least 30 m. high. This hall is free from ice, and breaks up into a series of tunnels, in some of which water-worn pebbles indicate the course of an ancient stream. The total length of the series of caves is 2000 metres. Where ice prevails, the temperature is from 0° to 1° C., while it rises to 5° C. in the portions free from ice.

UNDER the title of "Byways in the Caucasus," in *Travel and Exploration* for September, Colonel C. E. de la Poer Beresford gives a graphic account of a tour through a region which was the scene of some of the hardest fighting in the great struggle between the Russians and the tribesmen. He describes Gergebil, which was attacked by Vorontzoff in June, 1847, when held by the Murids under Shamil; Gunib, the famous fortress into which Shamil retired in 1857 after waging war against the Russians for twenty-five years; Akhoulgo, like "Edinburgh Castle with another higher rock covering Scott's and Wallace's monuments, rivers rushing round their bases, and a connecting ridge between the rock and Arthur's Seat." He commends the system by which the Russians have reduced these stubborn mountaineers to subjection to the notice of British officers now engaged in the task of subduing the frontier tribes like the Afridis and Waziris.

IN the twentieth Bulletin of the Sleeping Sickness Bureau the records of fifty cases of sleeping sickness in Europeans are tabulated and discussed. Of these cases, forty-five were men, five women; nineteen came from the Belgian Congo, fourteen from the French Congo, and four from Uganda. "Of the fifty patients, thirty are known to be dead, eleven survive, and the fate of the remaining nine is uncertain. Of the thirty, fourteen lived a year or more after trypanosomes were discovered, and four two years or more. Of these, one lived three and a quarter years and one six years." One of the survivors, infected probably in 1900, but possibly earlier, is considered to have made a real recovery, and there are grounds for hope that at least four other cases have done the like. Full clinical details of the cases and their treatment are given. The case that is regarded as cured was treated with Fowler's solution.

THE *Journal of Hygiene* (vol. x., No. 2) contains a memoir by Miss Harriette Chick on "The Process of Disinfection by Chemical Agencies and Hot Water," giving the results of experiments with phenol on *Bacillus typhosus*, *B. coli communis*, and *Staphylococcus pyogenes aureus*, and with hot water on the same three species and on *Bacillus pestis* and *B. paratyphosus*. It is concluded that "disinfection is an orderly time-process, which may be considered analogous with a chemical reaction." "The fact that the individuals [in a culture of bacteria] do not die all at once, but at a rate proportional to the concentration of the survivors at a given moment, is to be attributed to temporary and rhythmical changes in resistance which, by analogy with chemical processes, may be supposed to be due to temporary energy changes of the constituent proteins."

IN the Launceston *Examiner* of August 23 Mr. H. H. Scott records the discovery of a skeleton of Diprotodon in the Smithton district, this being the first record of the occurrence of the genus in Tasmania. The species is presumed to be identical with the Australian *D. australis*.

ACCORDING to their reports for 1909, all the five museums of the Cape of Good Hope have suffered from shortness of funds, largely owing to the policy of economy rendered necessary by the present state of the colonial finances. In the case of the South African Museum, lack of space for exhibition purposes and the numerical inadequacy of the staff have likewise hindered progress. The director of this institution states that, in his opinion, the time has come for prohibiting the export from South Africa of ethnological and anthropological relics. The plea for the prohibition is based on the systematic manner in which such objects have of late years been exploited, and the high prices paid for them.

THE August number of the Journal of the South African Ornithologists' Union contains the report of the migration committee for 1908–9. Eight records of the arrival of storks, either singly or in parties, are chronicled, from which it appears that December is the month when most of these birds reach Cape Colony, although the period of immigration lasts from September to January. In a separate communication Mr. Haagner states that four storks marked by the Vogelwarte Rositten and five by the Royal Hungarian Central Ornithological Bureau have been taken in South Africa, but adds that many more records must be secured before full knowledge of the migration of these can be obtained. Mr. Seebohm, for instance, was of opinion that the birds which travelled farthest north of the equator likewise flew farthest south, but another observer has suggested the reverse of this. Only one record of the movements of the cuckoo is mentioned, this being a departure in the middle of March. No reference is made to a query which recently appeared in the *Field* as to whether cuckoos ever utter their characteristic note in South Africa.

A NOTEWORTHY paper by Dr. M. Nowikoff appears in the August number of the *Zeitschrift für wissenschaftliche Zoologie* (Bd. 96, Heft 1) on the structure, development, and significance of the parietal eye of saurians. The author's investigations were conducted chiefly upon species of Lacerta and Anguis. The parietal or pineal eye in these genera agrees closely in histological structure with

that of Sphenodon, but the author finds that it is innervated from the right habenular ganglion, and not from the left as Dendy has shown to be the case in the Tuatara. He now adopts the view that the pineal eye and epiphysis are dislocated members of one and the same pair of sense-organs, serially homologous with the lateral eyes, as Dendy has also maintained in the cases of Sphenodon and Geotria. He suggests that, inasmuch as the pineal eye is well developed in small and unprotected lizards, it is, though incapable of image-formation, probably still of service in giving notice of the approach of an enemy flying in the air when the lizards are sleeping in the sun with their paired eyes closed.

WE have recently had an opportunity of seeing at work the large new microtome brought out by the Cambridge Scientific Instrument Company. It is designed to cut flat sections up to 150×120 mm., the thickness of which can be varied by 0·002 mm., the maximum thickness of the section being 0·06 mm. The sliding carriage, in which the object, embedded in paraffin or celloidin, is held, is moved backwards and forwards on plane guides by a handle working through levers. The object is fed upwards by a ratchet turning a toothed wheel, and an arrangement similar to that found in the well-known rocking microtome of this company is adopted to lower the object-holder on the return stroke, so as to prevent the object fouling the knife. The knife can be very securely clamped either at right angles to the direction of movement of the object, when the latter is embedded in paraffin, or at an oblique angle when cutting celloidin. Arrangements are provided for changing the inclination of the cutting edge of the knife, and there is a small angular scale on the knife-holders, so that the angle found most suitable when cutting a particular object can be easily noted and repeated. The strength and rigidity of the instrument are striking features, but the care and attention devoted to the details of construction are no less evident, the device just mentioned, for reading off the angle of the knife, being an example of the useful details which will be greatly appreciated by the operator. We have seen a number of sections, cut by this microtome, of various tissues which can be cut only with some difficulty, which demonstrate the capabilities of the instrument, and we can recommend it to those whose work necessitates the preparation of large flat sections of material containing cartilage, decalcified bone, and other resistant tissues.

A SMALL pamphlet on the cultivation of mushrooms, of which Mr. R. L. Castle is the author, has been published in the series of "One and All" garden books. It can be recommended as a practical and authoritative guide.

A LIST of varieties of sweet peas classified according to colour has been prepared by the National Sweet Pea Society, and is published in the *Gardener's Chronicle* (October 8). It is described as an up-to-date selection of varieties in commerce, and comprises sixty-three varieties grouped in twenty-five classes; the first item in each class is that which produced flowers most true to colour in the society's trials. The society has also issued a list of varieties "too-much-alike" with the intention of allowing only one out of each colour group to be shown on a competition stand. Further, the society is taking steps to arrange for the registration of new varieties.

A COLLECTION of plants obtained by Mr. G. Nakhara in the southern half of the island of Saghalien is described by Mr. G. Koidzumi in the Journal of the College of Science, University of Tokyo (vol. xxvii., art. 13). It provides a supplement to the list of plants collected and determined by Dr. Fr. Schmidt in 1868, to which it adds about fifty species—one, *Cirsium Mamiyanum*, being new to science—and raises the total number of ferns and flowering plants to three hundred. A dozen species are limited to the Ochotsk region, including an Abies and a Picea. The special features of the flora are a predominance of the families Compositæ and Rosaceæ, and the small proportion (3 : 2) of species to genera.

ON the subject of tree plantations in Inverness-shire Mr. W. Dallimore places on record in the *Kew Bulletin* (No. 7) some useful data regarding cost and the species that have given good results on different estates. The area planted on the Ardverikie Estate since 1873 exceeds 10,000 acres, for which 34,000,000 plants have been required. Scots pine, larch, and spruce have been most extensively planted; the pine and larch have grown well on dry ground at altitudes exceeding 900 feet, while the spruce has succeeded better on wet ground, but *Abies nobilis* has, on the whole, proved more vigorous than any of the three. The cost of planting, including fencing, is given at 3*l.* 12*s.* per acre. Interest attaches to a note regarding a larch forest on the Invergarry Estate that at an early stage was condemned on account of the larch disease, but was spared at the urgent request of the forester in charge, and has now developed perfectly clean, straight trees.

THE issue of the *Geographical Journal* for October includes the paper on the land of the Incas, read before the society by Sir Clements R. Markham, K.C.B., F.R.S.; the paper provides a graphic account of southern Peru and part of the north of Bolivia, with their variety of climates, geographical features, and products. The land of the Incas extends from the water-parting of the maritime Cordillera to that of the eastern Andes, and from the gorges through which the rivers force their way into the Amazonian plain to the Knot of Vilcañonota, where the two Andean chains unite. The paper gives interesting glimpses at the Tiahuanacu ruins of unknown history, and shows how intimate is the author's knowledge of this part of South America. In the same issue appears Major G. F. A. Whitlock's paper on the Yola-Cross River Boundary Commission, Southern Nigeria, from which some idea can be obtained of the difficulties of accurate surveying in little known countries. Mr. Edward A. Martin gives an exhaustive account of further experiments he has made on dew-ponds. He has come to the conclusion that very rarely does dew ever form on the surface of ponds, and rarely on the puddled margins. He holds that if we continue to use the term dew-pond we must remember that the word must be used in the widest sense as including any form of condensation out of the atmosphere. Rain appears to be the all-important replenisher of these as of all other ponds which are not fed by springs.

THE application of the method of correlation to investigations of the connection between meteorological elements at different places promises to be a fruitful, though somewhat laborious, method of approaching the problem of seasonal forecasts. In a note in Bulletin 4, 1910, of the Central Meteorological Observatory of Japan, Dr. T. Okada has correlated the mean monthly pressures and temperatures for some places in the Far East. He finds that at Zikawei (Shanghai) the coefficient of correlation between pressure and temperature in December is -0.764 ± 0.050. Taking pressure at Zikawei and temperature at Nagasaki, 500 miles distant, he finds for the

value of the coefficient -0.644 ± 0.076. Thus high pressure at Zikawei is accompanied by low temperature, not only there, but also at Nagasaki. Again, taking pressure at Zikawei and rainfall at Keelung, in northern Formosa, 450 miles distant, he finds for the value of the coefficient 0.925 ± 0.037. Thus when pressure is high at Zikawei in winter rainy weather in northern Formosa may be confidently predicted. The paper includes diagrams, in which the relationships can be distinguished, but the definite numerical index furnished by the correlation supplies the meteorologist with much more satisfactory means of comparing the similarity with that for other places and of using the results in more extended researches.

INTEREST in the diurnal variations of the meteorological elements has been stimulated of late years by the addition to our knowledge of the analysed results of wind velocity for certain representative places, and by the difficulty of bringing into dynamical relation with each other the results for pressure, temperature, and wind. In Bulletin 4, 1910, of the Central Meteorological Observatory of Japan, Y. Tsuiji discusses the daily variation of wind and the displacement of the air at Nagasaki. After analysing the variation into its harmonic components, he attempts to connect it with the variation of pressure gradient deduced from the mean hourly values of pressure at the three stations Nagasaki, Fukuoka, and Kumamoto. He concludes that the phases of the variation of the components of wind are almost identical with those of the variation of the corresponding components of pressure gradient. Apart from any effect due to the earth's rotation, it would be expected that these phases would differ by 90°, and although the nearness of Nagasaki to latitude 30° might account for the identity in the phases for the diurnal wave, it is unlikely that the effect in the semi-diurnal wave can be attributed to such a cause. The author does not attempt to explain the anomaly. An examination and recalculation of some of the results shows that time is to be measured from 1 a.m. in the expressions given for the harmonic components, although it is stated that it is measured from midnight. Thus the diagram (Fig. 5) showing the diurnal and semi-diurnal waves is seen to be wrong by a comparison of the sum of the deviations at noon taken from the diagram with the actual values given in Table I. The fact that the phases of the diurnal term in the south and east components of velocity are almost exactly equal, while those for the semi-diurnal wave differ by 40° only, shows that convection is the predominating factor in determining the diurnal variation, and exercises a considerable influence on the semi-diurnal wave.

IN a paper which appeared in vol. xxxii. of the *Annalen der Physik* Dr. M. Knudsen, of the University of Copenhagen, describes an absolute manometer for the measurement of gas pressures not greater than a few thousandths of a millimetre of mercury. It depends on the measurement of the force of repulsion between two plates at different temperatures immersed in the gas, when their distance apart is extremely small compared with the mean free path of the molecules of the gas. This repulsion the author shows is equal in dynes per square centimetre to half the product of the pressure of the gas by the excess of the square root of the ratio of the two absolute temperatures of the plates over unity. The instrument consists of a polished copper plate, which is supported with its surfaces vertical by a thin platinum wire. Opposite part of one surface is the polished end of a fixed copper cylinder, the temperature of which can be raised above that of the suspended plate and the case of the instrument by sending an electric current through a platinum wire wound on it. The rotation of the moving plate about its suspension is determined by means of a mirror attached to the plate, and thermometers give the temperatures of plate and cylinder.

PROF. PATERNO, of the University of Rome, has given an account in the *Revue scientifique* of August 20 of some recent work on colloidal solutions, arising out of an early observation that tannic acid, which behaves as a colloid and produces no osmotic or cryoscopic effects in water, behaves in the normal way as a crystalloid when dissolved in acetic acid. The aqueous solution is a deep brown, although the tannic acid separating from it is white, and the solution in acetic acid is only yellowish. Observations by the ebullioscopic method indicated that the Grignard reagent, magnesium ethiodide, probably exists as a colloid in its ethereal solutions. Several alkaloids were found to dissolve in ether without raising its boiling point, whilst the alcoholic solutions showed a normal elevation.

IN an article in the *American Architect* for September 28 Prof. William H. Goodyear analyses the report of the Pisa Commission on the Leaning Tower, and brings forward evidence to show that the figures of the commission are in error. Prof. Goodyear maintains that the tower has moved 30 centimetres more than the commission has supposed, and that this movement had taken place before the date of De Fleury's "Monuments de Pise" in 1859. The actual movement, he says, has been one of 50 cm., not of 20; but this movement, which was probably caused by the earthquake of 1846, certainly occurred before 1859. Prof. Goodyear also challenges other results published by the commission. Thus the commission's supposed rate of inclination per metre in 1829 is 86½ mm.; the article gives the real average rate as 84 mm. The supposed present rate of inclination per metre is announced by the commission as 92 mm.; here it is said to be really 94½ mm. in 1859. The commission announces 20 cm. additional inclination between 1829 and 1910. There was really, it is said, 50 cm. additional inclination before 1859. The commission announces the rate of increase per metre between 1829 and 1910 as being 5½ mm. Therefore, says Prof. Goodyear, if the supposed increase of 20 cm. be divided by the rate of increase per metre, we ought to obtain the axial height on which the increase was figured, viz. the axial height of the tower. "But when this division is made, the resulting axial height is only 36·36 m., which is the axial height, according to Cresy and Taylor, of the six stories above the first, thus leaving the entire lower story, which is nearly one-fourth of the axial height, out of the computation."

AN illustrated article on the Portsmouth water works appears in *Engineering* for October 7. The borough of Portsmouth has recently put into commission a new system of filter-beds and covered service reservoirs. The new works are situated at Farlington, on the side of Portsdown Hill, distant five miles from Portsmouth. The water supply comes from chalk springs at Havant and Bedhampton, where pumping-stations are situated. The water is delivered through three rising mains to the filter-beds, from which, after passing through the service reservoirs, it gravitates to the town. Previous to the construction of the new works, the water was delivered from the pumping-stations to two open service reservoirs on Portsdown Hill; these are now covered, and form part of the reconstructed scheme. It was the practice under

the old conditions to deliver the water in an unfiltered state from the open service reservoirs to the town. The raw water is normally excellent, owing doubtless to the underground chalk through which it passes, but discoloration occasionally occurs during wet weather following a period of drought. Ferro-concrete on the Hennebique system has been employed largely on the new constructional work.

In this month's *Aeronautics* appears an announcement to the effect that, recognising the importance of flying from a military point of view, that journal offers to present a complete aëroplane to the first suitable officer of the army who applies for it and is willing to try his best to become proficient with it.

In the article on "Mathematics in Austria," in NATURE of September 29, mention was made of arithmetic papers set by the Civil Service Commissioners and other examining bodies. The writer asks us to say that his allusion to the Civil Service Commissioners was due to his belief that they regulated the Army Qualifying as well as the Army Competitive examination. He has since found that the former is conducted by the "Army Qualifying Board." His reference, therefore, to the Civil Service Commissioners was incorrect.

A translation into German by Prof. Julius Ruska of Prof. W. H. Hobbs's book on "Earthquakes" has been published by Messrs. Quelle and Meyer, of Leipzig. A review of the original volume was published in the issue of NATURE for March 26, 1908 (vol. lxxvii., p. 481). The price of the German work is 6.60 marks.

OUR ASTRONOMICAL COLUMN.

Announcement of a Nova.—A circular received from the Kiel Centralstelle states that in a telegram from Cambridge, Mass., received on October 5, it is announced that a new star in Sagittarius has been discovered by Mrs. Fleming on a plate taken on May 31·831 (G.M.T.). This object, Nova Sagittarii No. 2, was then bright enough to be visible in a small telescope, and its position is $\alpha = 17$h. 52m. 15s., $\delta = 27° 32{\cdot}2'$ south, about 7m. west and 3° north of the third-magnitude star γ Sagittarii; like most other objects of its class, this nova lies in, or very near to, the Milky Way.

It is interesting to recall that Nova Sagittarii No. 1 was also discovered by Mrs. Fleming on a photograph taken at Arequipa on March 8, 1898, but was not detected until March, 1899.

Time of the Solar Transit of Halley's Comet.—The examination of various solar photographs for traces of Halley's comet during its transit of the solar disc on May 18 has hitherto been somewhat indefinite, because the exact times of ingress and egress were not certainly known. Figures which should permit of more definitive examinations are now given in No. 616 of the *Astronomical Journal*; they are as follows:—

	G.M.T. h. m.	
Ingress	15 40	... Angle 279°
Least distance between centres..	16 9	... Comet 3′ 15″ N.
Egress	16 39	... Angle 76°

Observations of Comet 1910a.—In a Bulletin of the Catania Academy of Natural Science, just received, Prof. Riccò discusses the observations of comet 1910a, visual, photographic, and spectroscopic, made at the Catania Observatory during January and February. After describing the visual and spectroscopic results, Prof. Riccò directs special attention to the greater similarity of the visual and photographic images in this comet than in several which immediately preceded it, due to the greater proportion of yellow radiations. He also suggests that the appearance of the three "hydrocarbon" and one yellow band, when the comet was near perihelion, is in accordance with Hassellberg's experiment with a Geissler tube containing hydrocarbon and sodium vapours. With the tube cool, only the hydrocarbon bands showed in the spectrum, but when it was heated the sodium band was seen to be relatively strong.

It is stated in the *Observatory* (No. 427) that whilst the object observed by M. Sykora (NATURE, September 8, p. 322) was in the right position-angle, it was considerably too far from the centre of the disc.

Arabian Astronomical Instruments.—Vol. xli. (1909) of the *Sitzungsberichte der Physikalisch-Medizinischen Sozietät in Erlangen* contains No. 18 of Prof. E. Wiedemann's contributions to the history of science, which deals with some of the astronomical instruments of the Arabs (53 pp.). Chapter i. gives descriptions of the astrolabe and the quadrant, founded on two writings by Al Birûni in the Royal Library of Berlin. Chapter ii. gives a review of the trigonometry of the Arabs and its application to problems arising from the use of the gnomon ("determination of the shadow"). Chapter iii. contains an account (chiefly from Al Birûni) of the use of the astrolabe in surveying. The paper is of special interest on account of the many extracts it gives from unpublished manuscripts, and makes us hope that some further details may yet be brought to light about the instruments used in the great observatories at Cairo, Merâgha and elsewhere, as to which our knowledge is very imperfect.

New Ephemerides for Saturn, Uranus, and Neptune.—For some time it has been a known fact that the observed positions of the three outermost planets showed considerable discordance with Leverrier's tables. In No. 427 of the *Observatory* Dr. Downing directs attention to the advance made by the compilers of the *Connaissance des Temps* in publishing, for 1912, ephemerides based on Gaillot's "Tables Rectifiées" instead of Leverrier's tables. A comparison of the respective corrections shows that an important step in advance, in the calculation of accurate ephemerides of the major planets, has been made.

Irregularities in the Motion of Algol's Satellite.—In the October number of the *Bulletin de la Société astronomique de France* M. Enzo Mora shows that, according to observations made in 1908, 1909, and 1910, the relative motion of the satellite of Algol has been subject to an extraordinary perturbation. Comparisons made between the brightness of Algol and that of ϵ Persei, within about 40 minutes of the minimum of the former, indicate departures from the normal of the time of minimum ranging from 0 to 26 minutes. The latter figure is somewhat uncertain and unique, but the difference cannot be traced to observational error; prior to 1909 the departure from normal had never exceeded 6 minutes. The perturbative action of other satellites is suggested as a possible cause of these irregularities.

The Cambridge Observatory.—The annual report of the work done at the Cambridge Observatory during the year ended May 18 is divided into two sections, in the former of which Sir Robert Ball gives an account of the general observations. From this we learn that the results of the investigations into the constant of aberration and the variation of latitude, made by Mr. Cookson during 1905–7, are being prepared for press by Mr. Stratton, while the manuscript photographic catalogue of 6000 stars, observed at eleven observatories during the Eros campaign, has now been completed by Mr. Hinks.

In the second part Prof. Newall describes the work done in the astrophysical department. The radial velocities of certain red stars, of which many show fluctuations of brightness with long periods of variation, are being investigated by Mr. Stratton. It is with regret that we note that some difficulty is being experienced in obtaining a perfect 12-inch objective, of 60 feet focal length, for use in the solar observations.

Observations of Neptune's Satellite.—The observations of Neptune's satellite, made by Prof. Barnard with the 40-inch refractor during 1900–10, are published in No. 617 of the *Astronomical Journal*. A magnifying power of 700 was usually employed, but the satellite was frequently found to be an extremely difficult object; the recorded magnitudes range from 13·0 to 14·5.

SOME RECENT STUDIES OF FOSSIL PLANTS.

WHEN, many years hence, a history of the study of fossil plants during the first decade of the twentieth century is being elaborated, it will be found that two discoveries, announced in 1903 and 1906 respectively, will stand out as particularly far-reaching in their "after effects." These contributions will be found to rank in importance with any that may be cited in the whole range of the previous history of the study of palæobotany.

In 1903, Oliver and Scott showed that Lyginodendron, a well-known fern-like plant of the Carboniferous period, was in reality a seed plant. Within the next two years a number of similar discoveries were made in the case of several other genera, though since 1905 no further contributions of a like nature have been published. The identification, however, in that year of the male organs of Lyginodendron, which we owe to Dr. Kidston, completed our knowledge of that genus.

In 1906, Dr. Wieland, in his handsome volume on the "American Fossil Cycads," brought home to us, with a vividness which left little to be desired, the amphisporangiate nature of the cone of the Mesozoic genus Bennettites, or Cycadeoidea, as the Americans prefer to call it.

As Wieland himself foresaw, this discovery has thrown light on the phylogeny of the Angiosperms and Gnetales,[1] two groups hitherto of obscure affinities. These contributions have been already reviewed in NATURE[2] at some length, and it is therefore not proposed to discuss them further here.

A very extensive series, amounting to several hundreds, of memoirs, both large and small, have also been published on various palæobotanical subjects within the last ten years. The results there contained all contribute to our knowledge in one direction or another, but these directions are so varied, and often so disconnected, that it will only be possible to notice a few of them very briefly in a concise review such as the present. Further, the selection here made will be chiefly confined to those which have appeared during the last four years, and especially to those dealing with petrified material.

The true Ferns of the past have recently received considerable attention. It is now recognised that the ancient Ferns of the Palæozoic period, for which the name Primofilices has been suggested, differed in certain important respects from the Mesozoic, Tertiary, and recent Leptosporangiatæ. The latter appear to have sprung from the Primofilices, during the latter portion of the Permian period, and it would seem that, very soon after the initiation of the group, it differentiated in a fan-like manner into a number of families, many of which are still represented to-day. The Osmundaceæ, for instance, which of all the Leptosporangiate ferns stand nearest to the archaic stock, the Primofilices, were in existence in Upper Permian times.

This fact is emphasised by the recent studies of Kidston and Gwynne-Vaughan,[3] on the anatomy of a number of Osmundaceous stems from the Permian, Mesozoic, and Tertiary rocks. Three of these memoirs have appeared, and a fourth has been added since this review was written. This work is especially interesting, for not only is our knowledge of petrified plant remains from the rocks of these periods extremely scanty, but the study of the structure of these ancient representatives of the family has thrown light on the ancestral history of certain structural peculiarities met with in living ferns, especially the origin of the adaxially curved leaf trace.[4] The primitively solid, protostelic nature of the stem cylinder of the ancient Osmundaceæ is emphasised, and the evolution of the stele in this group is no longer a matter of theory, but of fact.

Our knowledge of the Primofilices has also recently advanced rapidly. A full account of this group will be found in the new edition of Scott's "Studies in Fossil Botany" (chapter ix.). Dr. Paul Bertrand, in his "Études sur la Fronde des Zygoptéridées," a handsomely illustrated volume published last year, has traced the course of evolution of the petiolar stele of members of this group. In this connection Mr. Gordon's paper on the structure of the stem and petiole of *Diplolabis roemeri* (Solms) from the Calciferous Sandstone of Scotland, which is shortly to appear in the Transactions of the Royal Society of Edinburgh, will be found of interest as carrying further broad conclusions of a similar, if not identical, character.

So far as the other Palæozoic groups are concerned, attention has recently been devoted almost entirely to the Lycopods. The Sigillarias, which until a short time ago remained the one important genus of the anatomy of which we knew very little, especially as regards the numerous species which possessed ribbed stems (Eu-Sigillariæ), have now been studied in detail. The structure of the stele closely resembles that of other Palæozoic Lycopods, especially Lepidophloios, the chief distinguishing features being found in the cortical tissues and leaf-bases. The anatomy of the cone scars is now known.[1] It has been found that, in certain species of ribbed Sigillariæ, the leaf-trace, when traversing the leaf-base and the lower part of the leaf, possesses a double xylem strand[2] (Fig. 2). The ribbing of the stem appears to be quite independent of the leaf-bases. The external features of three species of ribbed Sigillarias have now been correlated with their internal structure.

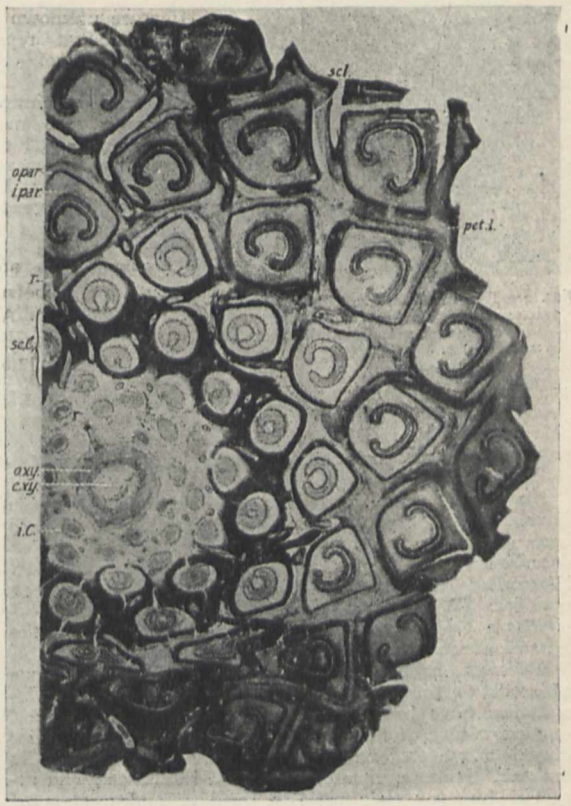


FIG. 1.—*Thamnopteris Schlechtendallii*, an Osmundaceous stem from the Upper Permian of Russia. A transverse section showing *o.xy*, outer xylem ring; *c.xy*, central xylem; *i.C*, inner cortex; *sc.C.* sclerotic outer cortex; *i.par*, inner parenchyma of petiole; *o.par*, outer parenchyma of petiole; *scl.* sclerotic ring of petiole; *r.*, root. Reduced after Kidston and Gwynne-Vaughan.

The Sigillarias, like the Lepidodendrons, were large forest trees, often 100 feet or more in height. Herbaceous members of the group appear to have been comparatively rare, and until recently have been little known. Halle[3]

[1] See Arber and Parkin, Proc. Linn. Soc. Bot., vol. xxxviii., p. 29, 1907, and Annals of Bot., vol. xxii., p. 489, 1908.

[2] See NATURE, vol. lxxi., p. 68, 1904; and p. 426, 1905; vol. lxxv., p. 329, 1907; vol. lxxvi., p. 113, 1907.

[3] Kidston and Gwynne-Vaughan, Trans. Roy. Soc., Edinburgh, vol. xlv., p. 759, 1907; vol. xlvi., pp. 213, 651, 1908–9.

[4] Gwynne-Vaughan and Kidston, Proc. Roy. Soc. Edinburgh, vol. xxviii., p. 433, 1908.

[1] Kidston, Trans. Roy. Soc. Edinburgh, vol. xli., p. 533, 1905; Proc. Roy. Soc. Edinburgh, vol. xxvii., p. 207, 1907.

[2] Arber and Thomas, Phil. Trans. Royal Soc. B, vol. cc., p. 133, 1908; Ann. of Bot., vol. xxiii., p. 513, 1909.

[3] Halle, Arkiv. för Botanik (Stockholm), vol. vii., No. 5, 1907; and *ibid.*, vol. vii., No. 7, 1908.

has, however, figured several impressions of herbaceous Lycopods from the Palæozoic and Mesozoic rocks, some of which appear to be similar in habit to the recent Lycopodium, and others to Seloginella. The latter have dimorphic leaves, and in some cases the sporangia are aggregated into stroboli, while, in at least one species, they are borne in the axils of foliage leaves, a very interesting feature in comparison with the modern Selaginellas. Zeiller, in his fine memoir, "Bassin houiller et permien de Blanzy et du Creusot" (1906), has figured, among other very interesting impressions, a Selaginellites, in which the leaves are arranged in the same manner as in the recent tetrastichous Seloginellas. The heterosporous cones contain a large number of megaspores in the megasporangia, another interesting feature unknown in the modern representatives of the group.

FIG. 2.—Tangential section through the leaf-base of *Sigillaria scutellata*, Brongn., showing the two xylem groups. After Arber and Thomas.

These specimens, however, are mere impressions. Fortunately, however, Miss Benson [1] has recently extended our knowledge of these plants by describing the anatomy and fructification of *Miadesmia membranacea*, Bertr., the first instance in which we have any information as to the structure of a *herbaceous* Palæozoic Lycopod. The fructification of this plant proves to be a primitive seed-like organ, recalling Lepidocarpon among fossils, and Isoetes among living plants.

Numerous other memoirs on Palæozoic Lycopods have also appeared, which it is impossible to discuss here. Among these may be mentioned Prof. Weiss's [2] description of a Stigmaria with centripetal wood, Mr. Watson's [3] discovery of the cone of *Bothrodendron mundum* (Will.), and Mr. David White's [4] *Archaeosigillaria primaeva*, an interesting impression from the Devonian rocks of New York State.

Although, as has been stated, no further attributions of seeds to the Palæozoic fern-like plants or Pteridospermeæ have been made during the last few years,[5] our knowledge of this group has been extended in other directions. Scott [6] has described a new stem, *Sutcliffia insignis*, Scott, a member of the Medulloseæ, characterised by concentric petiolar bundles, and a stem of very simple structure with a single main stele; a unique case of dialystely without siphonostely.

The structure of isolated seeds of pteridospermous affinity has also received attention, Scott and Maslen's [7] studies of Trigonocarpus, of which the first part has appeared, and Oliver's [8] memoir on *Physostoma elegans*, Will., being notable contributions in this direction.

Turning next to the studies of Mesozoic plants, Wieland's elucidation of the cone of Bennettites, to which we have already alluded, has been followed by the very important discoveries by Nathorst [9] of the male organs of Williamsonia, Anomozamites (now called Wielandiella), and several other genera of Triassic or Jurassic age, also belonging to the Bennettitales. Nathorst's specimens were impressions and not petrifactions, but by means of his new methods for studying carbonised impressions [1] he has been extremely successful in obtaining, from mere impressions, information which, until a few years ago, would have been regarded as quite impossible.

Nathorst finds that the flowers of Williamsonia, unlike those of Bennettites, are unisexual, a very important point. The male sporophylls (Fig. 3) were arranged in a whorl, and were fourteen or fifteen in number. They were united laterally for nearly half their length. The microsporangia were borne on the inner side of the sporophyll on segments which were somewhat divided. The male organs may be of a similar nature to the extraordinary "male-fronds" of Bennettites, but in Williamsonia they are very greatly reduced.

In Wielandiella, however, the cones are amphisporangiate, and the male sporophylls are still more reduced, and form a palisade-like ring near the base of the cone. The cone was markedly protogynous (Fig. 4).

The fact that the male sporophylls of some members of the Bennettitales have now been found, which are very much reduced as compared with those of Bennettites itself—an event which was confidently expected to occur—has an important bearing on the question of the origin of the Angiospermous stamen.[2]

Wieland [3] has also recently described a male flower of a Williamsonia, which does not, apparently, agree exactly with that discovered by Nathorst in Yorkshire last summer. On this specimen Wieland has founded a theory of the phylogeny of the Gamopetalæ, which, however, will probably not meet with general acceptance.

Mesozoic plants are now attracting a more considerable share of attention than they have in the past. The great drawback to studies of this nature has always been the absence of petrified material. Impressions alone are available, though there has been no lack of large, isolated stems or trunks of Gymnospermous or Angiospermous affinity in certain deposits belonging to this period. Such petrifactions, however, do not tell us very much, and we have hitherto failed to find plant-bearing concretions, similar to the coal-balls of the English Carboniferous rocks, with their wealth of fragments of leaves, cones, or other organs, from which so much can be ascertained, both from an anatomical and a phylogenetic standpoint. Stopes and Fujii [4] have now, however, discovered such concretions in the Upper

FIG. 3.—The Male Flower of *Williamsonia spectabilis*, Nathorst, from the Lower Oolite of Whitby, Yorkshire. After Nathorst.

1 Benson, Phil. Trans. Roy. Soc. B, vol. cxcix., p. 409, 1908.
2 Weiss, Ann. of Bot., vol. xxii., p. 221, 1908.
3 Watson, Mem. and Proc. Manchester Lit. and Phil. Soc., vol. lii., No. 3, 1908.
4 White, New York State Mus. Bull. cvii., p. 327, 1907.
5 Nathorst has shown that the fructifications figured by Arber as *Carpolithus Nathorsti* (Ann. of Bot., vol. xxii., p. 57, 1908) are not seeds.
6 Scott, Trans. Linn. Soc. Lond., Ser. 2, Bot., vol. vii., p. 45, 1906.
7 Scott and Maslen, Ann. of Bot., vol. xxi., p. 89, 1907.
8 Oliver, Ann. of Bot., vol. xxiii., p. 73, 1909.
9 Nathorst, K. Svenska Vetenskap. Akad. Handl., vol. xlv., No. 4, 1909.

1 Nathorst, Arkiv. für Botanik, vol. vii., No. 4, 1907; K. Svenska Vetenskap. Akad. Handl., vol. xliii., No. 6, 1908.
See also Bather, Geol. Mag., Dec. v., vol. iv., p. 437, 1907; vol. v., p. 454, 1908.
2 See Arber and Parkin, *ante*.
3 Wieland, Bot. Gaz., vol. xlviii., p. 427, 1909.
4 Stopes and Fujii, Phil. Trans. Roy. Soc. B, vol. cci., p. 1, 1910.

Cretaceous of Japan, which in several respects appear to be quite analogous to our English coal-balls. In their paper published a few months ago, they describe a varied series of fossil plants from these nodules, such as the sporangia of a fern of Schizæaceous affinities, a leaf, Niponophyllum, with parallel nerves, several stems and cones of Gymnosperms, especially Yezonia, a trunk in which the wood consists of thick- and thin-walled tracheids arranged on the same radii, and which is regarded as a representative of a new family of Coniferæ. Among the Angiospermous remains are woods allied to the Saururaceæ, to the Juglandaceæ, the Sabiaceæ, and Cupuliferæ. But perhaps the most interesting specimen is that discussed as being a flower of Liliaceous affinity, and termed *Cretovarium japonicum* (Fig. 5). This is regarded by the authors as the first fossil flower known in the petrified state. It is described as a trilocular ovary with axile placentation, though the ovules are absent.

FIG. 4.—The amphisporangoic cone of *Wielandiella angustifolia*, Nathorst, from the Rhætic of Sweden. (1) The axis with the "palisade-ring" of male sporophylls below. (2) The ring of male sporophylls enlarged. After Nathorst.

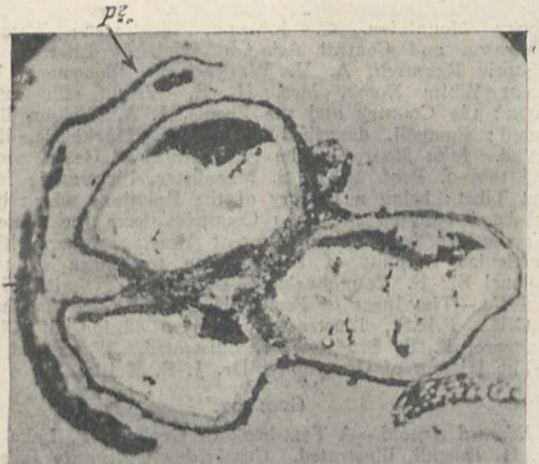


FIG. 5.—Transverse section of the ovary of an angiospermous flower *Cretovarium japonicum*, S. and F., the first flower to be discovered in the petrified state. p and p^2, perianth. After Stopes and Fujii.

Traces of a perianth (?) are seen fused to the lower part of the carpels, which were slightly inferior.

E. A. N. A.

FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE.

Edward Arnold.—The Development of British Forestry, A. C. Forbes, illustrated. *Constable and Co., Ltd.*—To Work a Grass Holding at a Living Profit and the Cheap Cottage Problem, H. B. M. Buchanan. *Duckworth and Co.*—Agricultural Bacteriology: Theoretical and Practical, Prof. J. Percival. *John Murray.*—The Feeding of Crops and Stock, A. D. Hall, F.R.S. *Kegan Paul and Co., Ltd.*—Weeds of the Farm and Garden, Prof. L. H. Pammel, illustrated; Commercial Fertilisers, Dr. L. L. Van Slyke; Field and Garden Peas, G. C. Seavey, illustrated; Profitable Stock Raising, C. A. Shamel; Profitable Poultry Production, M. G. Kains; Farm Crops, C. W. Burkett.

ANTHROPOLOGY.

Macmillan and Co., Ltd.—The Golden Bough: a Study in Magic and Religion, Dr. J. G. Frazer, third edition, in five parts: Part i., The Magic Art and the Evolution of Kings; Part ii., The Perils of the Soul and the Doctrine of Taboo; Along the Old North Trail: or Life, Legends and Religion of the Blackfeet Indians, W. McClintock, illustrated. *John Murray.*—The Castes and Tribes of Eastern India, Sir H. Risley; Shans at Home: their Customs, Habits of Life, Industries, Folk-lore, Mrs. L. Milne, with two chapters on Shan History and Literature by the Rev. W. W. Cochrane, illustrated. *Swan Sonnenschein and Co., Ltd.*—Bushman Folk-lore, L. C. Lloyd, with a preface by Dr. G. McCall Theal, illustrated; The Native Races of South Africa, the late G. W. Stow, edited by Dr. G. M. Theal, illustrated. *Watts and Co.*—History of Anthropology, Dr. A. C. Haddon, F.R.S., illustrated.

BIOLOGY.

Edward Arnold.—Hereditary Characters, C. E. Walker; Practical Photomicrography, J. E. Barnard, illustrated; A Gamekeeper's Note-book, O. Jones and M. Woodward, illustrated; Fly-leaves from a Fisherman's Diary, Capt. G. E. Sharp, illustrated. *John Bale, Sons and Danielsson, Ltd.*—A new edition of Lectures on Biology, Dr. C. Thesing, translated by W. R. Boelter. *G. Bell and Sons, Ltd.*—The Inherent Law of Life: a New Theory of Life and of Disease, F. Kleinschrod, translated and edited by L. C. Appel; A Text-book of Plant Physiology, Prof. F. W. Keeble, illustrated. *A. and C. Black.*—First Principles of Heredity, S. Herbert, illustrated. *W. Blackwood and Sons.*—The Elements of British Forestry, J. Nisbet. *Cambridge University Press.*—The Coming of Evolution, Prof. J. W. Judd, C.B., F.R.S.; Heredity, L. Doncaster; Plant-Animals, Prof. F. W. Keeble. *W. and R. Chambers, Ltd.*—Britain's Birds and their Nests, A. L. Thomson, illustrated. *J. M. Dent and Sons, Ltd.*—Physiology, Prof. Sherrington, F.R.S.; Zoology, Prof. Herdman, F.R.S.; Mendelism, Dr. Drinkwater, illustrated; The Book of the Animal Kingdom (Mammals), W. P. Westell, illustrated; Orchids for Everyone, C. H. Curtis, illustrated. *Duckworth and Co.*—Toy Dogs and their Ancestors, Hon. Mrs. N. Lytton, illustrated. *Dulau and Co., Ltd.*—The Influence of Parental Occupation and Home Conditions on the Physique of the Offspring, E. M. Elderton; On the Marriage of First Cousins, E. M. Elderton. *C. Griffin and Co., Ltd.*—New editions of Micro-organisms and Fermentation, A. Jörgensen, translated by S. H. Davies, illustrated; Open-air Studies in Botany: Sketches of British Wild Flowers in their Homes, R. Lloyd Praeger, illustrated. *Gurney and Jackson.*—A History of British Mammals, G. E. H. Barrett-Hamilton, 24 parts, illustrated. *T. C. and E. C. Jack.*—Present-day Gardening, edited by R. H. Pearson: Carnations and Pinks, T. H. Cook, J. Douglas, and J. F. M'Leod; Rhododendrons and Azaleas, W. Watson; Lilies, A. Grove; Orchids, J. O'Brien; Roses, H. E. Molyneux; and volumes on Annuals, Apples and Pears, Cucumbers, Melons, Tomatoes, &c., illustrated. *Longmans and Co.*—Lives of the Fur Folk: the Biographies of Redpad the Fox, Fluff-button the Rabbit, Grimalkin the "Gone Wild" Cat, Stubbs the Badger, M. D. Haviland, illustrated; The Essentials of Morbid Histology, Dr. A. S. Grünbaum, illustrated. *Macmillan and Co., Ltd.*—The Age of Mammals, Prof. H. F. Osborn, illustrated; Text-book of Human Physiology, Dr. L. Luciani, translated by Frances A. Welby, and edited by Dr. M. Camis, with a preface by Prof. J. N. Langley, F.R.S., illustrated, in 4 vols., vol. i. *The Methodist Publishing House.*—Sunbeam's River: a Child's Nature Story Book, N. Parsons, illustrated; In Nature's Nursery, S. N. Sedgwick, illustrated; The Boy's Book of Angling and Rambling, W. J. Claxton, illustrated. *Methuen and Co.,*

Ltd.—Preliminary Physiology, W. Narramore. *John Murray.*—The Genus Rosa, E. Willmott, illustrated. *Kegan Paul and Co., Ltd.*—Biology, Rev. E. Wasmann, illustrated; The Problem of Evolution, Rev. E. Wasmann. *Swan Sonnenschein and Co., Ltd.*—Plant Life: a Manual of Botany for Schools, Prof. E. Warming, translated by E. Rehling and E. M. Thomas, illustrated. *Witherby and Co.*—The Home-life of a Spoonbill, a Stork, and a Heron, B. Beetham, illustrated; The Birds of Australia, G. M. Mathews, illustrated; Liverworts, British and Foreign, Sir Edward Fry, G.C.B., F.R.S.

CHEMISTRY.

Edward Arnold.—An Introduction to Bacteriological and Enzyme Chemistry, Dr. G. J. Fowler, illustrated. *A. and C. Black.*—Chemical Analysis, Qualitative and Quantitative: a Text-book for Technical Schools and Colleges, G. G. Gardiner, vol. i. *C. Griffin and Co., Ltd.*—A new edition of Dairy Chemistry, for Dairy Managers, Chemists, and Analysts, H. D. Richmond, illustrated; and a new edition of Chemistry for Engineers, B. Blount and A. G. Bloxam, illustrated. *Longmans and Co.*—Lectures on the Chemistry of Paints, Dr. J. N. Friend; An Elementary Chemistry for Mining Students, L. T. O'Shea. *Methuen and Co., Ltd.*—A Short History of Chemistry, T. P. Hilditch. *Mills and Boon, Ltd.*—A First School Chemistry, F. M. Oldham. *Kegan Paul and Co., Ltd.*—Crystals, Dr. A. E. H. Tutton, illustrated. *Williams and Norgate.*—A new edition of The Chemist's Pocket Manual: a Practical Handbook containing Tables, Formulas, Calculations, Information, Physical and Analytical Methods for the Use of Chemists, Chemical Engineers, Assayers, Manufacturers, and Others, R. K. Meade.

ENGINEERING.

Edward Arnold.—The Practical Design of Motor-cars, J. Gunn, illustrated; Cement, Dr. C. H. Desch, illustrated; Modern Methods of Water Purification, J. Don and J. Chisholm, illustrated. *Cassell and Co., Ltd.*—Electrical Engineering, H. H. Simmons, illustrated. *Constable and Co., Ltd.*—Solenoids, Electromagnets and Electromagnetic Windings, C. Underhill, illustrated; The Encyclopædia of Municipal and Sanitary Engineering, edited by W. H. Maxwell and J. T. Brown, illustrated; A Treatise on Testing for Engineers, Part i., Materials, C. A. Smith; The Construction and Working of Internal-combustion Engines, being a Practical Manual for Gas-engine Designers, Repairers and Users, R. E. Mathot, translated by W. A. Tookey, illustrated; Electric Furnaces and their Industrial Application, J. Wright, illustrated; Irrigation Works: a Course of Lectures delivered at Oxford under the Auspices of the Common University Fund, N. F. Mackenzie; The Practical Design of Irrigation Works, W. G. Bligh, illustrated; Gas Engines, W. J. Marshall and H. R. Sankey. *C. Griffin and Co., Ltd.*—Transformers, Profs. H. Bohle and D. Robertson, illustrated; Electric Crane Construction, C. V. Hill, illustrated; The Design and Construction of Ships, Prof. J. H. Biles, vol. ii.; Modern Methods of Sewage Purification, G. B. Kershaw, illustrated; A Manual of Civil Engineering Practice, Specially Arranged for the Use of Municipal and County Engineers, F. N. Taylor, illustrated; and new editions of A Text-book on Gas, Oil, and Air Engines, vol. ii., B. Donkin, revised by T. G. Smith, with new chapters by Prof. Burstall, illustrated; Mechanical Engineering for Beginners, R. S. M'Laren, illustrated. *Crosby Lockwood and Son.*—The Modern Manufacture of Portland Cement, P. C. H. West, in 3 vols., vol. i., dealing with "Machinery and Kilns," illustrated; Drying Machinery and Practice: a Handbook on the Theory and Practice of Drying and Desiccating, with Classified Description of Installations, Machinery, and Apparatus, including also a Glossary of Technical Terms and Bibliography, T. G. Marlow, illustrated. *Whittaker and Co.*—The Steam Turbine: its Principles of Design and Construction, R. Kennedy; The Practical Design of Reinforced Concrete Beams and Columns, W. N. Twelvetrees; The Modern Practice of Coal Mining, D. Burns and G. L. Kerr, part iv.; Electric Wiring Diagrams, W. P. Maycock; Elementary Telegraphy, H. W. Pendry; and a new edition of Electric Wiring, Fittings, Switches and Lamps—Electric Circuits, W. P. Maycock.

GEOGRAPHY AND TRAVEL.

D. Appleton and Co.—Up the Orinoco and Down the Magdalena, H. J. Mozans, illustrated. *Edward Arnold.*—Unexplored Spain, A. Chapman and W. J. Buck, illustrated; Twenty Years in the Himalaya, Major the Hon. C. G. Bruce, M.V.O., illustrated; Recollections of an Old Mountaineer, W. Larden, illustrated. *Cambridge University Press.*—Worcestershire, L. J. Wills; East London, G. F. Bosworth; West London, G. F. Bosworth; Cumberland, Dr. J. E. Marr, F.R.S.; Huntingdonshire, Rev. W. M. Noble; Berkshire, H. W. Monckton; The Isle of Man, Rev. J. Quine; Ayrshire, J. Foster; Fifeshire, E. S. Valentine (Cambridge County Geographies). *Cassell and Co., Ltd.*—In the Heart of Africa, the Duke of Mecklenburg, illustrated. *Constable and Co., Ltd.*—From Haussaland to Egypt, Dr. K. Kumm, illustrated; Across the Roof of the World: being an Account of Travel, Exploration and Sport on the Pamirs and in Chinese Turkestan, Mongolia and Siberia, Lieut. B. T. Etherton, illustrated; The Call of the Snowy Hispar: a Narrative of Exploration and Mountaineering on the Northern Frontier of India, Dr. W. H. and Mrs. Workman, illustrated; Adventure, Sport and Travel in the Tibetan Steppes: an Account of the Travels of C. H. Mears and J. A. Brooke, edited by W. N. Fergusson. *W. Heinemann.*—Hunting Camps in Wood and Wilderness, H. H. Prichard, illustrated; A Voice from the Congo, H. Ward, illustrated; Amurath to Amurath, G. Lowthian Bell. *Hodder and Stoughton.*—The North Pole, Commander R. E. Peary, illustrated. *Hutchinson and Co.*—The New New Guinea, B. Grimshaw, illustrated; Somaliland, A. Hamilton, illustrated; Sixty Years' Travel and Adventure in the Lands of the Far East, J. D. Ross, illustrated. *Macmillan and Co., Ltd.*—Overland to India: a Popular Narrative of a Journey from Trebizond to Quetta, Dr. Sven Hedin, 2 vols., illustrated; The Glory of the Shia World: the Tale of a Pilgrimage, translated and edited from a Persian manuscript by Major P. M. Sykes, C.M.G., assisted by Khan Bahadur Ahmad Din Khan, illustrated; Highways and Byways of the Rocky Mountains, C. Johnson, illustrated; Through Khurasan and Central Asia: a Book of Literary and Historic Research, A. V. W. Jackson, illustrated; The Great White North, Mrs. H. S. Wright, illustrated; Cuba: the Country and the People, I. A. Wright, illustrated; Pompeii, described by W. M. Mackenzie, illustrated. *John Murray.*—The Excavations of Gezer, 1902–5 and 1907–9, Prof. R. A. S. Macalister, illustrated; India and Tibet: being a History of the Relations which have subsisted between the Two Countries from the Time of Warren Hastings to the Present Year, together with a Particular Account of the Mission to Lhasa of 1904, Colonel Sir F. Younghusband, illustrated. *Smith, Elder and Co.*—The Incas of Peru, Sir Clements R. Markham, K.C.B., F.R.S., illustrated; a new edition of Chota Nagpore, F. B. Bradley-Birt, illustrated. *Watts and Co.*—The History of Geography, Dr. J. S. Keltie.

GEOLOGY.

Edward Arnold.—A Text-book of Geology, P. Lake and R. H. Rastall, illustrated. *Cambridge University Press.*—The Natural History of Coal, E. A. N. Arber. *J. M. Dent and Sons, Ltd.*—Geology, Prof. J. W. Gregory, F.R.S. *C. Griffin and Co., Ltd.*—Geology for Engineers, Major Sorsbie, illustrated; A Bibliography of the Mineral Wealth and Geology of China, C. Y. Wang. *Longmans and Co.*—The Prehistoric Period in South Africa, J. P. Johnson, illustrated. *Watts and Co.*—The History of Geology, H. B. Woodward, F.R.S.

MATHEMATICAL AND PHYSICAL SCIENCE.

D. Appleton and Co.—A High School Course in Physics, F. R. Gorton, illustrated. *A. and C. Black.*—Practical Physics: a Text-book for Technical Schools and Colleges, A. McLean, vol. i. *Cambridge University Press.*—Scientific Papers, Sir G. H. Darwin, K.C.B., F.R.S., vol. iv.; The Collected Mathematical Papers of James Joseph Sylvester, F.R.S., vol. iv.; The Calculus for Beginners,

J. W. Mercer; Practical Measurements, A. W. Siddons and A. Vassall; Clouds, C. T. R. Wilson, F.R.S.; Aviation, A. Ferguson. *Cassell and Co., Ltd.*—Practical Electricity, the late Prof. Ayrton, F.R.S., and Prof. T. Mather, F.R.S. *C. Griffin and Co., Ltd.*—Physico-chemical Tables, J. Castell-Evans, vol. ii., Chemical Physics, Pure and Analytical Chemistry; and a new edition of General Physics: being vol. i. of an Elementary Text-book of Physics, Dr. R. W. Stewart, illustrated. *Longmans and Co.*—Physical, Chemical and Mathematical Tables, G. W. C. Kaye and Prof. T. H. Laby; A School Course of Heat, R. H. Scarlett; Bird Flight as the Basis of Human Flight, O. Lilienthal, translated by A. W. Isenthal, illustrated; Anharmonic Coordinates, Lieut.-Col. H. W. L. Hime. *Macmillan and Co., Ltd.*—Crystallography and Practical Crystal Measurement, Dr. A. E. H. Tutton, F.R.S., illustrated; Elementary Dynamics, Prof. A. Gray, F.R.S. *Mills and Boon, Ltd.*—A New School Geometry, R. Deakin; Practical Mathematics, W. E. Harrison, illustrated; A Practical Course in First Year Physics, E. T. Bucknell. *G. Philip and Son, Ltd.*—A new edition of Popular Guide to the Heavens, Sir R. S. Ball, F.R.S. *G. P. Putnam's Sons.*—Astronomy in a Nutshell, G. P. Serviss, illustrated; A Beginner's Star-book, K. McKready, illustrated. *Whittaker and Co.*—Elementary Aëronautics, A. P. Thurston.

MEDICAL SCIENCE.

D. Appleton and Co.—Nutrition and Dietetics, W. S. Hall; Text-book of Bacteriology, P. Hanson Hiss, jun., and H. Zinsser; Symptomatic and Regional Therapeutics, G. H. Hoxie; Surgical Diagnosis, A. B. Johnson, 3 vols., illustrated; Plastic and Cosmetic Surgery, F. S. Kolle, illustrated; Principles of Therapeutics, A. Manquat, translated by M. S. Gabriel; Clinical Symptomatology, A. Pick and A. Hecht, translated by K. K. Koessler, with special reference to the Life Threatening Symptoms and their Treatment; A Text-book in Psychotherapy: including the History of the Use of Mental Influence, Directly and Indirectly, in Healing and in the Principles for the Application of Energies derived from the Mind to the Treatment of Disease, J. J. Walsh; Conquest of Disease through Animal Experimentation, J. P. Warbasse. *Baillière, Tindall and Cox.*—Medical Supervision in Schools: being an Account of the Systems at Work in Great Britain, Switzerland, Germany, Canada, and the United States, Dr. E. M. Steven, illustrated; Hæmoglobinuria, Dr. A. E. L. Charpentier; Veterinary Parasitology, R. H. Smythe; and new editions of Military Hygiene, Lieut.-Col. R. Caldwell, illustrated; Physiological Principles in Treatment, Dr. W. L. Brown; Manual of Physiology, with Practical Exercises, Prof. G. N. Stewart, illustrated. *John Bale, Sons and Danielsson, Ltd.*—The Diseases of China, including Formosa and Korea, Drs. W. H. Jefferys and J. L. Maxwell, illustrated; Amœbic or Tropical Dysentery: its Complications and Treatment, Dr. W. C. Brown; Reports from the Clinical and Research Laboratories, St. George's Hospital, London, 1910. *A. and C. Black.*—A new edition of Text-book of Operative Surgery, Dr. T. Kocher, translated by Dr. H. J. Stiles, illustrated. *J. and A. Churchill.*—A Manual of Skin Diseases, Dr. J. H. Sequeira, illustrated; and new editions of The Principles and Practice of Medical Jurisprudence, edited by Dr. F. J. Smith, 2 vols.; Serum and Vaccine Therapy, Bacterial Therapeutics and Prophylaxis Bacterial Diagnostic Agents, Prof. R. T. Hewlett, illustrated; The Microscopical Examination of Foods and Drugs, Prof. H. G. Greenish, illustrated. *Constable and Co., Ltd.*—Primitive Psychotherapy and Quackery, Dr. R. M. Lawrence. *C. Griffin and Co., Ltd.*—Transactions of the Medico-Legal Society for the Year 1909–1910, edited by D. Cotes-Preedy, assisted by W. A. Brend. *T. C. and E. C. Jack.*—The Bacillus of Long Life: a Manual of the Soured Milk Industry, L. M. Douglas, illustrated. *John Lane.*—The Rheumatic Diseases, Dr. J. O. Symes; Hysteria and Neurasthenia, Dr. J. M. Clarke; X-Rays in General Practice, Capt. A. E. Walter; A Short Practice of Aural Surgery: for the Use of Students and Practitioners, Dr. J. A. Jones. *Longmans and Co.*—Dental Surgery and Pathology, J. F. Colyer, being the third edition of Diseases and Injuries of the Teeth, by Morton Smale and J. F. Colyer, illustrated; Sanitary Law in Question and Answer, C. Porter. *Macmillan and Co., Ltd.*—New editions of A System of Medicine, by Many Writers, edited by Sir Clifford Allbutt, K.C.B., and Dr. H. D. Rolleston, vol. viii., Diseases of the Brain and Mental Diseases; Deformities: a Treatise on Orthopædic Surgery, intended for Practitioners and Advanced Students, A. H. Tubby, 2 vols., illustrated. *Methuen and Co., Ltd.*—Methuen's Health Readers, vol. i., C. J. Thomas. *G. P. Putnam's Sons.*—The History of Medicine, Philosophical and Critical, D. A. Gorton, 2 vols., illustrated; and new editions of Dust and its Dangers, T. M. Prudden, illustrated; and The Story of Bacteria and their Relations to Health and Disease, T. M. Prudden. *The Walter Scott Publishing Co., Ltd.*—Elements of Physiology, Prof. Osborne; Eating for Health, Dr. Abramowski.

TECHNOLOGY.

G. Bell and Sons, Ltd.—Exercises in Metal-work: for Trade Preparatory Schools, A. J. Kersey. *Constable and Co., Ltd.*—Textiles, A. F. Barker, with chapters on The Mercerised and Artificial Fibres, The Dyeing of Textile Materials, Silk Throwing and Spinning, The Cotton Industry and the Linen Industry, illustrated; Wood Pulp, C. F. Cross, E. J. Bevan, and R. W. Sindall. *C. Griffin and Co., Ltd.*—The Principles and Practice of Textile Printing, Dr. E. Knecht and J. B. Fothergill; The Principles of Bleaching and Finishing, S. R. Trotman and E. L. Thorp, illustrated; Tests for Coal-tar Colours in Aniline Lakes, G. Zerr, translated by Dr. C. Mayer; and new editions of The Metallurgy of Steel, F. W. Harbord, with section on The Mechanical Treatment of Steel, by J. W. Hall, illustrated; The Art of the Goldsmith and Jeweller: a Manual on the Manipulation of Gold and the Manufacture of Personal Ornaments, T. B. Wigley, assisted by J. H. Stansbie, illustrated; Lectures on Iron-founding, Prof. T. Turner, illustrated. *Sir Isaac Pitman and Sons, Ltd.*—Rubber: from the Raw Material to the Finished Product, H. P. Stevens; Sugar: Cane and Beet, G. Martineau, illustrated; Oil: Animal, Vegetable, Essential and Mineral, C. A. Mitchell, illustrated; The World's Commercial Products: a Descriptive Account of the Economic Plants of the World and of their Commercial Uses, W. G. Freeman and S. E. Chandler, in parts, illustrated. *Whittaker and Co.*—A new edition of Colour in Woven Design, Prof. R. Beaumont.

MISCELLANEOUS.

D. Appleton and Co.—The Psychology of Reasoning, Prof. W. B. Pillsbury. *Cambridge University Press.*—Experimental Psychology, Dr. C. S. Myers; eleventh edition of the Encyclopædia Britannica, 28 vols. *Chapman and Hall, Ltd.*—The World of Life: a Manifestation of Creative Power, Directive Mind, and Ultimate Purpose, Dr. A. R. Wallace, F.R.S. *Chatto and Windus.*—A History of Babylonia and Assyria from Prehistoric Times to the Persian Conquest, L. W. King, illustrated; vol. ii., History of Babylon from the Foundation of the Monarchy, about B.C. 2000, until the Conquest of Babylon by Cyrus, B.C. 539; vol. iii., A History of Assyria from the Earliest Period until the Fall of Nineveh before the Medes, B.C. 606. *Wells Gardner and Co., Ltd.*—The Natural History Museum, W. P. Pycraft, illustrated. *C. Griffin and Co., Ltd.*—An Introduction to the Theory of Statistics, G. U. Yule; The Official Year-book of the Scientific and Learned Societies of Great Britain and Ireland, compiled from Official Sources, twenty-seventh annual issue. *H. Holt and Co. (New York).*—Leading American Men of Science, edited by Prof. D. S. Jordan. Biographies and critical estimates of the work of Benjamin Thompson, Count Rumford, by E. E. Slosson; Alexander Wilson, by W. Stone; John James Audubon, by W. Stone; Benjamin Silliman, by D. C. Gilman; Joseph Henry, by S. Newcomb; Louis Agassiz, by C. F. Holder; Jeffries Wyman, by B. G. Wilder; Asa Gray, by J. M. Coulter; James Dwight Dana, by W. N. Rice; Spencer Fullerton Baird, by C. F. Holder; Othniel Charles Marsh, by G. B. Grinnell; Edward Drinker Cope, by M. Benjamin; Josiah Willard Gibbs, by E. E. Slosson; Simon Newcomb, by M. Benjamin; George Brown Goode, by D. S. Jordan; Henry Augustus Rowland, by I. Remsen; William Keith

Brooks, by E. A. Andrews. *Hutchinson and Co.*—Photography (Concise Knowledge Library), edited by H. P. Maskell and others; The Wonders of the World, in parts, illustrated. *Crosby Lockwood and Son.*—Short Specifications of Materials, Labour, and Goods for Works Connected with Building, J. Cubitt; Houses, Villas, and Bungalows for Britishers and Americans Abroad, G. G. Samson. *Longmans and Co.*—A History of the Cavendish Laboratory, Cambridge, Various Writers, illustrated. *Macmillan and Co., Ltd.*—Tennyson as a Student and Poet of Nature, Sir Norman Lockyer, K.C.B., F.R.S., and W. L. Lockyer, with an introduction and notes; The Conservation of Natural Resources in the United States, C. R. Van Hise, illustrated. *John Murray.*—British Weights and Measures, as described in the Laws of England from Anglo-Saxon Times, Col. Sir C. M. Watson. *Kegan Paul and Co., Ltd.*—Educational Psychology, Prof. E. L. Thorndike. *Swan Sonnenschein and Co., Ltd.*—A translation of Hegel's Phenomenology of Mind, J. B. Baillie, 2 vols.; Thought and Things: a Study of the Development and Meaning of Thought or Genetic Logic, Prof. J. M. Baldwin, vol. iii., Real Logic; Matter and Memory, H. Bergson, translated under the author's supervision by N. M. Paul; Adolescence, J. W. Slaughter; Physiological Psychology, Prof. W. Wundt, a translation of the fifth and wholly rewritten German edition by Prof. E. B. Titchener, in 3 vols., vol. ii., illustrated; and new editions of The History of Æsthetic, Dr. B. Bosanquet; Riddles of the Sphinx: a Study in the Philosophy of Humanism, Dr. F. C. S. Schiller; Darwinism and the Humanities, Prof. J. M. Baldwin (Ethical Library). *Williams and Norgate.*—A popular edition of Herbert Spencer's First Principles, 2 vols.

THE INTERNATIONAL CONGRESS ON RADIOLOGY AND ELECTRICITY.

THE second congress on radiology and electricity was held at Brussels on September 13–15. That two congresses have already been held to consider questions relating to radio-activity and allied subjects affords evidence of the rapid progress in this branch of science of recent years; but that some five hundred workers in physics and medicine should have assembled to discuss the bearing of modern electrical theory and radio-activity upon the various investigations on which they are engaged is a striking proof of the influence which these new ideas have exercised on the progress of science. It is now universally felt to be desirable, if not necessary, that those engaged on investigations in radio-activity in different parts of the world should have occasional opportunities of meeting each other, and perhaps one of the most important results of the recent congress has been the formation of an influential international committee to arrange the time and place of subsequent congresses. The continuation at regular intervals of meetings such as the one which has just taken place is therefore now assured, and thanks are due to the Belgian men of science and to the Belgian Government, under the patronage of which the congress was held, for organising the two successful meetings, the first at Liége in 1905 and the second at Brussels this year. It may be added that the meeting was rendered the more successful and pleasant by the hospitality offered to members by the town of Brussels. In this connection may be mentioned the reception at the Bourse and at the Town Hall by the Municipality, and also the admirable performance at the Théâtre Royal de la Monnaie, at which members were invited to be present.

The work of the congress began on Tuesday, September 13, with a meeting at the Palais des Fêtes in the exhibition grounds, when members assembled to hear an address by the president, Prof. de Heen, on æther and matter. The large gathering included eminent men of science from all parts of the world. The opening meeting finished, members dispersed to spend the remainder of the morning in the exhibition, after which they reassembled in the buildings of the Free University for a meeting which proved of exceptional interest. The proceedings began with a discussion, opened by Prof. Rutherford, on the question of fixing a suitable nomenclature in radio-activity and of establishing radio-active standards adapted to the requirements of quantitative measurements to be made for physical and medical purposes. After a short discussion it was decided that the matter could best be settled by a small committee acquainted with the needs of the different branches of the subject, and that this committee should meet and report to the congress the results of their deliberations at a subsequent meeting. The report of the committee is of such special interest that it is not possible to deal adequately with it within the limits of this article, but a full account of the recommendations was given by Prof. Rutherford in NATURE of October 6. While the necessary arrangements were being made for the formation of this committee the president called upon Madame Curie to give an account of the recent experiments made in Paris to isolate metallic radium. It will be remembered that this metal has hitherto not been separated from its salts, although a radium amalgam was obtained some years ago by Coehn. The beautiful experiments described by Madame Curie, resulting in the isolation of metallic radium, must be regarded as a triumph in chemical manipulation when it is remembered that, in addition to the fact that on account of its chemical properties radium is difficult to isolate, the operations had to be carried out with minute quantities of material in such a way as to avoid loss of the precious substance during the process. These experiments should remove all possible doubt that radium is, in fact, an element belonging to the same group of metals as barium.

After some other communications the meeting adjourned until the following day, when the congress met in three sections to deal with the large number of papers on the physical and medical aspect of radiology. The work of the physical section was of great interest. It began with a lecture, remarkable for the clear and vivid style of its delivery, by M. Perrin, who described his experiments on Brownian movement and their bearing on the determination of atomic magnitudes, followed by a review of the present position of our knowledge of these matters. Dr. Hahn next gave an account of the method of preparation of some highly active samples of radiothorium and mesothorium, of which specimens were shown. The phosphorescent effects produced by them on a zinc-sulphide screen could be clearly seen from all parts of the lecture-room, and there can be no doubt that these products, which are now to be had from Messrs. Knöffler and Co., of Berlin, will prove of great use for many purposes as an alternative to radium. Mr. Soddy followed with a description of the results of his work on the rate of production of helium from a Portuguese specimen of autunite. From his experiments it is possible to assign limits between which must lie the "life" of ionium, that stable product discovered by Boltwood, and known to be the parent of radium.

The papers which remained to be read on the last day were so numerous that it was found necessary at the last moment to subdivide the meeting further, and a separate section was quickly formed under the presidency of Prof. Rutherford for the discussion of purely radio-active questions. A number of important papers on various subjects were read. The proceedings were opened by Prof. Bragg with a discussion of the nature of the γ rays, in which he showed how it is possible to assign a "range" to the path of β rays in different metals on the assumption that the γ rays are material particles, and that the ionisation produced by them is due to β rays produced in their path. The paper was immediately succeeded by one by Prof. Barkla, who explained how each element submitted to a stream of homogeneous X-rays emits several beams of homogeneous X-rays characteristic of the element. Each homogeneous radiation was excited by a primary radiation of greater penetrating power according to Stokes's law for fluorescence, so that it was possible to draw a close comparison between light and X-rays in this respect. Dr. Hahn then gave an account of his experiments with Dr. Baeyer on the magnetic deflection of β rays. Photographs were shown indicating that the deflected rays from a single radio-active product gave rise to definite lines on the photographic plate, showing that during the decay of radio-active substances, just as for the α particle, the β particles leave the atom with a velocity characteristic of the particular product. The question of the recoil of

radio-active matter during the expulsion of an α particle was next discussed by Dr. Makower. Experiments made by Dr. Russ, Mr. Evans, and himself on the electric and magnetic deflection of radium B when it recoils made it possible to determine the charge carried by the atoms of radium B, and to determine its atomic weight. The results showed that the atomic weight had approximately the value to be expected on the disintegration theory of radio-active changes. M. Wertenstein followed with a description of his work on the absorption by air of radium B when it recoils. Dr. Kovarik then gave a short account of his investigations on the absorption and scattering of β rays. It was shown how entirely erroneous results might be obtained in determining the absorption of β rays by matter unless certain precautions were taken in making the measurements. Dr. Kleeman next brought before the meeting some theoretical considerations regarding the absorption of α, β, and γ rays in passing through matter, after which M. Moulin described his interesting experiments on the saturation currents obtained in air ionised by α rays when the electric field is inclined at different angles to the trajectories of the rays.

It has only been possible to deal even shortly in this article with the papers on radio-activity, which formed perhaps the most important part of the work of the congress; but communications were presented on almost all branches of modern physics, amongst which some of the most interesting may be mentioned. Dr. Conway gave a paper on the theory of electronic conduction; Prof. Becquerel described his experiments on magneto-optic phenomena in crystals; Prof. Wien discussed the existence of positive and negative ions in canal rays; Prof. Arrhenius dealt with the solubility of the active deposit of actinium; Prof. Weiss spoke of molecular magnetic fields; and Prof. Exner gave a description of the new Radium Institute at Vienna.

The papers read before the biological section of the congress were so decidedly medical in character that an account of them would scarcely be of interest to readers of NATURE. W. M.

THE OPENING OF THE MEDICAL SESSION.

THE custom of opening the winter session, the commencement of the medical year, at the medical schools with addresses has much to commend it. The attention of the public is directed to the work, scientific and charitable, of the great hospitals; if the address is delivered by a layman, the lay views on medical education and things medical are expressed, often with advantage; if by a medical man, the students hear words of wisdom culled from a ripe experience.

In the absence of the chairman, Prince Francis of Teck, the gathering at the Middlesex Hospital was presided over by Lord Grenfell, and the address was delivered by Lord Kitchener, who naturally dealt with the relation of medicine to the army and with army medical organisation. He directed attention to the improved sanitary condition of the army and to the vast field still remaining for research. As regards India, he said:—"That scourge of the army—enteric fever—is now at last definitely yielding to improved sanitary methods and to the system of inoculation which has recently become almost universal. Enteric will before long, I feel sure, join the formerly dreaded cholera in total banishment from our barracks. To bring home to you the measure of success which has attended their work in India, I need only point out that during the last ten years the ratio of 'constantly sick, invalided, and deaths' has been reduced by no less than 50 per cent. But there still remains in that country a vast field for your energies and painstaking research."

As regards army medical organisation, Lord Kitchener pointed out that the training which turns out competent medical men for civil work is quite inadequate in equipping medical officers for the special needs of the army in war time.

At St. Mary's Hospital Sir Arthur Conan Doyle gave an address to the students on "The Romance of Medicine." After relating some of his medical experiences in his early days, he pointed out that "there were, perhaps, some dangers which came from a medical training, but there was a great post-graduate course called life, and in that course one learnt to correct these weaknesses. One was an undue materialism. He was educated in a materialistic age, before psychical research, scientific hypnotism, telepathy, and other such agencies emphasised the possibilities which lie outside the things that we can see, handle, and explain. They looked upon mind and spirit as secretions from the brain in the same way as bile was a secretion of the liver. Brain centres explained everything, and if you could find and stimulate the centre of holiness you would produce a saint—but if your electrode slipped and you got on to the centre of brutality, you would evolve a Bill Sikes. That was, roughly, the point of view of the more advanced spirits among them."

In the concluding portion of his address Sir Conan Doyle dealt with medicine and history and some of the modern developments of medicine, particularly the *rôle* of opsonins. The starting point of the opsonin investigation was when it was shown that a white corpuscle taken out of the blood plasma would not digest microbes, and would only renew its activities when it was moistened with that fluid. This experiment showed that in that fluid there was suspended some invisible stuff which increased the activity of the white corpuscle, and made it devour microbes—some sort of sauce, in fact, which made the microbes more attractive to it. This substance was named opsonin. It had been found that, normally, opsonins are present in fixed quantity, but that in microbial infections the opsonins are generally diminished in amount. By the injection of dead microbes the activity of the white blood corpuscles is stimulated, more opsonin is formed, and the disease process tends to be cured.

At Charing Cross Hospital the Huxley memorial lecture constituted the opening address, and was delivered by Dr. Mott, F.R.S., the subject being "The Hereditary Aspects of Nervous and Mental Diseases." He remarked that in certain nervous diseases it is generally recognised that heredity plays a part, but these are due to characteristic morphological defects. As regards insanity, there are few alienist physicians who do not hold a strong belief in hereditary causation. The matter is now being investigated statistically, and a report will shortly be published. Consanguinity does not appear to produce insanity or nervous disease provided both stocks are free from taint. Chronic alcoholism figures largely in the pedigrees of patients admitted to asylums, but the idea that a desire for alcohol is transmitted from parent to offspring is erroneous—what is transmitted is lack of will power and moral sense.

The Dean of Salisbury delivered the address at University College Hospital. He emphasised the importance of complete development in a sound education. An address on "Woman's Sphere in Medicine" was given by Mr. E. W. Roughton at the London School of Medicine for Women. Mr. Roughton said that there were cogent reasons why there should be a female section of the profession. So far as he was able to judge, in suitability, adaptability and other characters, and in intellectual capacity, women would compare equally with men in the profession. There were, of course, some divergences between the sexes; women, for instance, did not, as a rule, seem to be so handy as men in looking after pieces of mechanism.

At the London Hospital Dr. Robert Hutchison gave the annual "Schorstein" lecture to the students of the medical school, the subject being "Congenital Pyloric Stenosis." Prof. Marett Tims delivered the address at the Royal Veterinary College. He pointed out the growing importance of biology with regard to the problems of medical and veterinary science, and suggested the establishment of a bureau at the Royal Veterinary College for the collection of statistics, the working out of all questions of inheritance in animals, not only the inheritance of disease, but also of data desirable from the point of view of the breeder, especially in the question of horse-breeding.

Prof. Howard Marsh, master of Downing College, Cambridge, distributed the prizes in the University of Leeds. In his address he dealt with the problems of medical education. He said that as medicine had now become a department of biology, its pursuit necessarily demanded a sound acquaintance with the broad principles of those

departments of biological science with which it was intimately connected, the foundations on which it rested, chemistry, anatomy, physiology, and pathology. The difficulty which the student experienced was to keep pace with his subjects. With the average man the whole business had, from the first, been hopeless. He thought that a conference of those interested in medical education might be useful.

THE BERLIN UNIVERSITY CENTENARY.

THE celebration of the hundredth anniversary of the foundation of the University of Berlin began on Monday with a reception of the representatives of universities and other bodies and a torchlight procession of students. The principal ceremony was held on Tuesday in the new Great Hall of the University. The Emperor and Empress, with the Prussian Princes and a brilliant retinue, attended, and his Majesty delivered an address. The festivities will be continued until Thursday night. A Reuter message from Berlin states that all the German and the principal foreign universities of the world are represented by special delegates. The representatives appointed by British universities are (in alphabetical order):—Aberdeen, Principal G. A. Smith; Cambridge, Sir J. J. Thomson; Cape Town, Prof. Marais; Dublin, Prof. Mahaffy; Durham, Vice-Chancellor Dr. Jevons; Edinburgh, Prof. H. J. Eggeling and Sir W. Turner; Glasgow, Principal Macalister; London, Sir H. E. Roscoe and Sir W. Ramsay; Melbourne, Prof. Masson; Montreal, Lord Strathcona; Oxford, Mr. R. W. Macan, the Master of University; Toronto, Prof. McCurdy. The British Academy is represented by Lord Reay; the Royal Society by Sir Joseph Larmor; and the University of Paris by M. Henri Poincaré.

Reuter's correspondent remarked on Monday:—"The patriotic aspect of the fêtes will be more strongly marked than is usual in the case of academic celebrations. The decision to found a university in Berlin was taken while the capital was still in the occupation of French troops, when Prussia's national fortunes were at their lowest ebb. It is now a matter of justifiable pride to the Germans that in those disastrous days there was still courage and energy enough in Prussia to set coolly about the task of rebuilding the intellectual and educational life of the country and giving it a national centre. Since then Berlin University has grown with the growth of Prussia and Germany, and a glance at its records from the handful of professors and the few scores of students who attended the opening winter term of 1810 to the 500 professors and lecturers and the 12,000 students who now throng the University buildings, provides no bad barometer by which to gauge the marvellous progress of Prussia and Germany during the past century."

We hope to give in a later issue an account of the celebration, by one of the delegates attending it. The issues of the *Morning Post* for October 11 and 12 contain particulars of the opening functions, and two valuable leading articles in which German thoroughness and system in educational and scientific work are described. From the latter issue we reprint some interesting extracts from the German Emperor's address.

The German Emperor on Knowledge and Research.

Since the day of its foundation, the destiny of the Friedrich Wilhelm University has been most intimately bound up with that of the Prussian and German Fatherland. When my forefather King Frederick William the Third summoned it into existence, now a hundred years ago, his object was to restore to the State with intellectual what it had lost in physical forces. The University of Berlin was thus born of the same creative spirit from which Prussia's regeneration sprang. This spirit, which raised up Prussia and Germany, and which lived in Fichte, Schleiermacher, Savigny, and their friends, made the University in the course of years the centre of intellectual and scientific life in the Fatherland. The University of Berlin was at first, it is true, far from being a *Universitas Literarum* as conceived by Wilhelm von Humboldt, but it has approached ever nearer to this ideal. A stronghold of the sciences, it has to-day an international importance reaching far beyond the frontiers of Prussia and Germany. This is manifested outwardly in the interchange of teachers and auditors. Working in common with the other universities of the country, it constitutes now the general teaching establishment which it was intended to be by its founders.

Humboldt's great plan demands side by side with the Academy of Sciences and with the University independent research institutions as integral parts of a whole scientific organism. The foundation of such institutions has not kept pace in Prussia with the development of the universities, and this deficiency, especially in our natural scientific equipment, becomes ever more keenly felt in consequence of the mighty advancement of the sciences. We need institutions which, outside the compass of the universities, shall serve solely for research. It appears to me to be the sacred task of the present time to summon such institutions into life at the earliest possible moment, and I consider it my patriotic duty to solicit universal interest in the undertaking. This great aim requires large means, and can be attained only if all circles interested in the progress of science and the welfare of the Fatherland are ready to cooperate in fulfilling this most important task and in making sacrifices for it.

I should like, therefore, to bring before everybody's eyes and lay at everybody's heart this new aim with the fervent exhortation: "Tua res agitur." I hope and firmly trust that the work will succeed, for, although the plan has been made known only in a narrow circle, enthusiastic expressions of concurrence have already reached me from various parts of the country, and the very considerable sum of between nine and ten million marks [between 450,000*l.* and 500,000*l.*] have been placed at the disposal of the enterprise. I feel it a cordial necessity to express my warmest thanks from this place to the self-sacrificing givers. In order to ensure the permanent furtherance of the enterprise, it is my wish to found under my protectorate and name a society which shall make it its task to establish and maintain research institutions. To this society I will gladly transfer the funds offered me. That State help will not be wanting to institutions about to be established my Government will take care.

I have one other wish for the University to take with it into the new century. May it in faithful remembrance of the time of its origin preserve its Prussian-German character. Science, it is true, is the common good of the whole civilised world, and its achievements no longer halt before any boundary line. And yet—as each nation must preserve its own peculiarity if it wishes to maintain an independent existence, and its value for the whole—may the "Alma Mater Berolinensis" always remain conscious of the fact that she is a German university. As heretofore, may it also be in all the future the seat of German manners and customs and of the German nature. . . . May, therefore, the University also henceforward hold the splendid privilege of cultivating the true science which, as Humboldt admirably says, comes from the interior and is planted in the interior which remoulds and creates the character. Let her do this with noble freedom which gives laws to itself and in that intense feeling of being the trustee of a treasure which is bestowed on all mankind. "Communis hominum thesaurus situs est in magnis veritatibus." All truth, however, is from God, and His spirit rests on every work that springs from truth and strives after truth. May this spirit of truth also fill you students; may it penetrate my dear University in its entire efficacy. Then will its old age be as its youth, and it will continue to be the town on a hill to which the nations make pilgrimage, and the ornament and safeguard of the Fatherland.

THE BRITISH ASSOCIATION AT SHEFFIELD.

SECTION L.

EDUCATIONAL SCIENCE.

OPENING ADDRESS BY PRINCIPAL H. A. MIERS, M.A., D.Sc., F.R.S., PRESIDENT OF THE SECTION.

To preside over this Section is to incur a responsibility which I confess somewhat alarms me; for the President may, by virtue of his temporary office, be regarded as speaking with authority on the subjects with which he deals.

Now, it is my desire to speak about University education, and for this purpose I must say something of school education; but I would have it understood that I really know little about the actual conduct of modern school teaching. One may read books which describe how it should be conducted, but this is a very different thing from seeing and hearing the teacher in his class; and I fear that personal recollections of what teaching in preparatory and public schools was like from thirty to forty years ago do not qualify one to pose as an intelligent critic of the methods which now prevail.

Human nature, however, has not changed much in the last forty years, and if, in considering the relations between University and school education, I can confine myself to general principles, based upon the difference between boys and men, I trust that I may not go far wrong.

I propose first to consider some general relations between teachers and their pupils, and then explain what, in my opinion, should be the change in the method of teaching, or at any rate in the attitude of teacher to pupil, which should take place when the scene changes from school to University.

First as to general relations between teachers and their pupils.

Educational systems necessarily prescribe the same methods for different teachers, and, being made for the mass, ignore the individual. But happily, in spite of the attempts to formulate methods of instruction and to make precise systems, there are many, and those perhaps some of the most successful, in the army of earnest school teachers who are elaborating their own methods.

Now among all the changes and varieties of system and curriculum there is one factor which remains permanent and which is universally confessed to be of paramount importance—the individuality of the teacher and his personal influence upon the pupil. It is therefore a healthy sign when school teachers who have been trained on one system begin to develop their own methods, for in this they are asserting their individuality and strengthening that personal influence which is the real mainspring of all successful education.

Personal influence is, of course, not only a matter of intellectual attainments; it appears to me, however, that at the present time so much is made of the duty of schools to aim at the formation of character that there is an unfortunate tendency to regard this duty as something distinct from the other functions of a master, and as independent of intellectual qualifications. Among the first qualities now demanded of a master in a public school for boys are manliness, athletic skill, and a hearty and healthy personality, and these are often regarded as compensating for some lack of intellectual equipment. I suspect that there is a similar tendency in schools for girls. And yet I think it will be found that the only permanent personal influence is really wielded by teachers who exercise it through intellectual channels, and that those who acquire intellectual authority will generally succeed in training the characters as well as the minds of their pupils.

On the other hand, the master who is not up to the proper intellectual standard will soon be found out by his cleverer pupils, and will lose influence, whatever may be the personal charm of his character.

The formation of character, so far as it can be distinguished from intellectual training, is largely worked out by the boys themselves in any public school in which healthy tradition and a sound moral atmosphere are maintained, although it is true that these traditions depend upon the character and personality of the teachers.

The educational value of the personal and intimate association with one and the same teacher throughout the school or University career is officially recognised in the tutorial system at Eton, Oxford, and Cambridge. It has generally led to excellent results, provided that the tutor possesses the right qualities and that pupil and tutor do not happen to be two incompatible personalities; but the results may be well-nigh disastrous where there happens to be antagonism between the two, or where the tutor does not realise his opportunities and responsibilities. I have known some tutors who only excited a distaste for learning in their pupils, and others who entirely neglected or abused the high trust which had been committed to them; but far more, I am glad to say, who have not only exercised the most profound influence for good on their better and cleverer pupils, but also inspired intellectual interest in the most unpromising of them. Although such a tutorial system does not enter fully into the scheme of other schools and Universities, and therefore a student does not usually remain long under any one teacher, it must be within the experience of most persons to have come for a time at least under the influence of a teacher who has inspired real enthusiasm for learning and from whose lips the instruction, that might from others have been a trial, has become an intellectual treat.

It is given to comparatively few to exert this powerful and subtle influence in a high degree, for it is a gift confined to a few rare natures. All the more important is it, therefore, to ensure that an effective personal influence may play its part in the intercourse between ordinary teachers and ordinary pupils in the customary routine of school and University life.

How, then, is the proper personal and sympathetic relation to be established between teacher and pupil, so that the individuality of the one may call out the character and the effort of the other? Those who inquire of their earliest school reminiscences will probably recollect that the teachers who obtained a real hold upon them did so by virtue of the power which they possessed of arousing their intellectual interest. I would ask you for a moment to analyse the character of this interest.

In the young child I believe that it will be found to be mainly that of novelty: with him "this way and that dividing the swift mind," sustained thought, or even sustained attention, has not yet become possible; the inquisitive and acquisitive faculties are strong; and every new impression awakens the interest by its novelty quite apart from its purpose. You have only to watch and see how impossible it is for a young child to keep its attention fixed even upon a game such as cricket or football to realise how still more difficult it is to keep his attention fixed upon an intellectual purpose.

To quite young children, except to those who are unfortunately precocious, even an impending examination is not a permanent object of anxiety.

Now contrast the aimless interest which can be aroused in any young child's mind by the pleasure of a new impression, a new activity, or a new idea, with that which appeals, or should appeal, to the more mature intellect of an older student. With him it is not enough that the impression or the idea should be new; if it is to arouse interest it must also direct his mind to a purpose. This is to him the effective interest of his games or sport; in the game the desire to succeed or to win is the animating purpose, just as the expectation of catching a fish is the interest which keeps the angler's attention fixed for hours upon his line. In both the desire is fostered by the imagination, which maintains a definite purpose before the mind.

It is sometimes forgotten that as he grows the pupil is no longer "an infant crving for the light," but has become a man with "splendid purpose in his eyes."

While, therefore, it should be the aim of a teacher of young children to set before them the subjects of their lessons in an attractive manner, so that the novelty is never lost, and not to weary their active and restless minds with too sustained an effort, it should at a later stage be the teacher's aim to keep the object and purpose of the new fact or idea as constantly as possible in view, and not to distract the ardent mind with purposeless and disconnected scraps of learning.

I ask you to bear this distinction in mind, for it is a principle which may guide us in differentiating University methods from school methods of education.

The distinction need not involve us in a discussion of the "Ziel-Angabe" in elementary education, for that is rather a question of keeping the interest alive during each lesson than of maintaining a permanent purpose in view throughout a course.

The much discussed heuristic method as applied to very young children does, no doubt, fulfil this object so far as it provides the inquisitive mind with novelty instead of a set task, but so far as it makes the purpose more

prominent than the process it may become a method more suited to the adolescent or the adult mind than to that of the young child.

I can fully realise that a most difficult and anxious time for the teacher must be that of the maturing intellect, in the interval between childhood and the close of the school career, when the method and spirit of the teaching must to some extent gradually change with the changing mental characteristics of the pupil. But, whatever may be the right methods of teaching children of ten and young men and women of twenty, many of our failures are due to one or both of two prevalent mistakes: the first, the mistake of teaching children by methods that are too advanced; the second, that of teaching University students by methods that are better adapted for school children. It is with the latter that I wish to deal in this address; but we may in passing remind ourselves that when young men and young women are sent straight from the University to teach children with nothing but their University experience to guide them, it is not surprising that they often proceed at first on wrong lines, and as though they were dealing with University students.

The difficulty of divesting oneself of the mental attitude and the form of expression familiar in University circles, if one is to become intelligible even to the higher classes in a school, is betrayed by the unsatisfactory nature of many of the papers set by University examiners to school children. The teachers complain, and rightly complain, that there is often an academic style and form about them which just make them entirely unsuitable for the child.

It is, of course, hopeful that a diploma in pedagogy or some evidence that they have received instruction in method is now generally required of those who are to become teachers in schools. It seems to me, however, somewhat curious that, while efforts are now being made to give instruction in educational method to such persons, no similar effort is made to give instruction in more advanced methods to those who are called upon at the close of their undergraduate career to become University teachers, and that in consequence many of them have no method at all.

This may be a matter of comparatively small importance to those who possess, not only the necessary knowledge, but also the natural gift of personal influence and the power of inspiring those whom they teach. But for those who are not blessed with these powers it may be almost as difficult to fall into the ways of successful University instruction after the sudden transformation from student into teacher as it is for those who become teachers in schools.

Granting, then, that there should be a radical difference between the ways of school and University teaching, and that there is at present an unfortunate overlapping between the two, let me next consider how the distinction between the intellectual interest of a child and the intellectual interest of a man may guide us in adjusting our methods of teaching when students pass from school to the University.

A tenable, perhaps even a prevalent, view concerning a liberal school education is that its chief purpose is not so much to impart knowledge as to train the mind; indeed, some teachers, influenced, perhaps, in the first instance by the views of Plato, go so far as to think that no subject which is clearly of direct practical use should be taught as such at school. This view they would carry to the extent of excluding many obviously appropriate subjects from the school curriculum, whereas almost any subject may be made an intellectual training; this being a question not of subject, but of the manner in which it is taught. In any event, if the scheme of intellectual training be adequately fulfilled, the period of mental discipline should come to an end with the close of school life, and the mind should then be able to enter upon new studies and to assimilate fresh knowledge without a prolonged continuation of preparatory courses. Indeed, the professed object of entrance examinations to the University is to exclude those whose minds are not prepared to benefit by a course of University study, and to admit only those who are sufficiently equipped by previous training to do so. An entrance examination, then, should not be merely a test of whether a boy or girl has learnt sufficient of certain subjects to continue those subjects in particular at the University; and yet it has unfortunately come to be regarded more and more as performing this function instead of being regarded as a test whether the student is generally fit to enter upon *any* University course. The result is that an entrance examination tends to become a test of knowledge rather than a test of general intelligence; merely one in an organised series of examinations which endeavour to ascertain the advancing proficiency in a limited number of subjects, and therefore tend really to encourage specialisation. Specialisation is not to be prevented by insisting on a considerable number of subjects, but rather by teaching even one subject in a wide spirit. Another result is that the entrance examination belongs properly neither to the school course nor to the University course; if it is taken at the age of sixteen, the remainder of the school career tends to be devoted to University work, which should not really be done at school; if it is taken after leaving school this means that work is being done at, or in connection with, the University which ought to be done at school. It is certainly true that for various reasons a vast deal of education is now being carried on at the Universities which should belong to school life, and, moreover, is being carried on by methods which are identical with those pursued at school. It is equally true that, owing to the early age at which matriculation examinations or their equivalents may be taken, many schools are now asking that at the age of eighteen or nineteen a school examination may be held which shall be an equivalent, not for matriculation, but for the first degree examination at the University. This would really imply that schools should be recognised as doing University work for two years of their pupils' careers—surely a most illogical procedure, and one which supports my contention that there is now very serious overlapping, for it assumes that the work for the first degree examination can be carried on either at the school or the University, and therefore that there is no difference in the methods of the two.

An increasing number of candidates actually present themselves from secondary schools for the external intermediate examination of the University of London; in 1904 there were about 150; in 1909 there were nearly 500 such candidates. This is, of course, a debatable subject, and there are many who think the overlapping of school and university work a highly desirable thing.

There will always be exceptional boys and girls who reach a University standard, both of attainments and intelligence, long before they arrive at the ordinary school-leaving age. Let them either leave school and begin their University career early, or let them, if they remain at school, widen their knowledge by including subjects which are not supplied by the more rigid school curriculum designed for the average pupils; but let them not cease, save in very exceptional cases, to be taught as school pupils, *i.e.* with mental training as the chief object. It is equally certain that there will also be boys and girls whose development is so slow that they barely reach the University standard when they leave school; yet some among them are the best possible material and achieve the greatest success in the end. For such persons an entrance examination will be required at the age of eighteen or nineteen; but I think it is unfortunate that this should be the same as that which quicker pupils can pass at the age of sixteen or seventeen, for an examination designed for the one age can scarcely be quite satisfactory for the other.

I confess that the whole matter is inextricably involved with the question of University entrance examinations. But to enter upon this here would carry us beyond the limits that I have laid down for myself, and it will be more profitable to decide what should be done at school and the University respectively before discussing how the examinations are to be adapted to our purpose. It will be sufficient for me to say that I have been led to the conclusion that if they are to test the intelligence of those who are ready to enter upon a University course, matriculation examinations should be designed to suit the capacity of average pupils not less than seventeen years of age.

Starting, then, with the principle that the period of mental discipline is closed at the end of the school career,

and that those who pass to the University come with fair mental training and sufficient intelligence, let me inquire what should be the relation of University teaching to that which the student has received at school.

Under present conditions the schools which aim at sending students to the Universities endeavour to give a general education which will fit their pupils to enter either upon a University course or upon whatever profession or occupation they may select on leaving school. They do not confine the teaching of any pupil to preparation for a special profession or occupation, and they do not generally encourage special preparation for the University.

Now contrast what happens to the pupils leaving such a school to enter a profession or business with what happens to those who proceed to the University. The former pass into an entirely different atmosphere; they are no longer occupied with exercises and preparatory courses which serve a disciplinary purpose; they are brought face to face with the realities of their business or profession, and, though they have to gain their experience by beginning at the lower or more elementary stages, they do actually and at once take part in it.

The University student, on the other hand, too often continues what he did at school; he may attend lectures instead of the school class, but neither the method nor the material need differ much from what he has already done. Should not the break with school be as complete for him as for his schoolfellow who goes into business? Should he not be brought face to face with the actualities of learning? After his years of preparation and mental drill at school should he not, under the direction of his University teachers, appreciate the purpose of his work and share the responsibility of it?

Let me take, as an illustration, the subject of history. A student who comes to the University and takes up the study of history should learn at once how to use the original sources. It will, of course, be easier for him if he has learnt the rudiments of history and become interested in the subject at school; but, if he is really keen upon his University work, it should not be absolutely necessary for him to have learnt any history whatever. In any case, if he has received a good general education and has reached the standard of intelligence required for University work, he ought to be able to enter at once upon the intelligent study of history at first hand; his teachers will make it their duty to show him how to do this; their lectures and seminars will illustrate the methods of independent study, and will make the need of them clear to him. If, as is probable, some acquaintance with one or more foreign languages be necessary, he will take instruction in them as an essential part of his history course, in order that he may acquire the needful working knowledge, and to learn something of them with a definite purpose will be to him far more interesting and profitable than to study them only for linguistic training, as he would have been compelled to do at school. After all, this is what would be done by his schoolfellow who goes into business and finds it necessary, and probably also interesting, to acquire some knowledge of the particular foreign language required in the correspondence of his firm. It will, of course, be all the better for a University student of history to have acquired some training at school in the rudiments of history both ancient and modern, together with the knowledge of classics which is necessary for the former, and of modern languages which is necessary for the latter. But there is not space in the school curriculum for all the subjects that may be required either for the University or for the business of life; the best that can be done is to give a good all-round training and to foster a marked taste or ability where it exists by allowing the boy or girl to include the subjects which are most congenial to them in the studies of their last two years of school life, as I have already suggested, provided that mere specialisation is not encouraged at school even towards the end of the school career.

The University course might then become a more complete specialisation, but of a broad character—the study of a special subject in its wider aspects, and with the help of all the other knowledge which may be necessary to that purpose.

The University teacher will also differ from the school teacher in his methods, for it will be his business not so much to teach history as to teach his pupil so to learn and study history as though it were his purpose to become an historian; in so doing he will have opportunities to explain his own views and to contrast them with those of other authorities, and so to express his individuality as a University teacher should.

One might choose any other subject as an illustration. In science there should be all the difference between the school exercises, on one hand, which teach the pupil the methods of experiment, illustrate the principles laid down in his text-books, and exercise his mind in scientific reasoning, and, on the other, the University training, which sets him on a course involving the methods of the classical researches of great investigators and a study of the original papers in which they are contained, illuminated by the views of his own teacher. He also should awaken to the necessity of modern languages. A boy who, on leaving school, passes not to the scientific laboratories of a University, but to a scientific assistantship in a business or Government department, will very soon find it necessary to go to the original sources and acquire a working knowledge of foreign languages. It is regrettable that under existing conditions a scientific student sometimes passes through his University without acquiring even this necessary equipment. I believe this to be largely due to the fact that he is compelled to spend so much of his time in preparatory work of a school character during the early stages of his University career.

In the literary subjects, and especially in classics, there is, of course, not the same scope for the spirit of investigation which it is so easy to encourage in experimental science. Here the only new advances and discoveries which can appeal to the imagination in quite the same way are those which are being made every year in the field of archæology, and it is therefore not surprising that this subject attracts many of the most ardent students; the methods of the archæologist are more akin to those of the scientific investigator, and his work is accompanied by the same enthralling excitement of possible discovery. For the more able pupils and those who had a natural taste for language and literature no subjects have been more thoroughly and systematically taught for very many years at school, as well as at the University, than the classics; but for the less intellectual children or those who had no natural taste for such studies no methods could well be more unsuitable than those which used to prevail at schools. The grammatical rules and exceptions, the unintelligent and uncouth translation, the dry comparison of parallel passages, the merely mechanical construction of Greek and Latin verse, produced in many minds nothing but distaste for the finest literature that exists.

With the improved methods now in use Greek and Latin may be, and are, presented to the ordinary boy and girl as living literature and history, and school training in them may be made as interesting as anything else in the curriculum. Upon such a foundation the University should surely be able to build a course devoted to literary, philosophical, historical, or philological learning even for the average student, provided that the University teacher undertakes the task of helping his pupils to learn for themselves, and to pursue their studies with a purpose, not merely as a preparation.

The spirit of inquiry which drives the literary student to find for himself the meaning of an author by study and by comparison of the views of others is really the same spirit of inqury which drives the scientific student to interpret an experiment, or the mathematical student to solve a problem. Only by kindling the spirit of inquiry can teaching of a real University character be carried on. Give it what name you will, and exercise it in whatever manner you desire, there is no subject of study to which it cannot be applied, and there are no intelligent minds in which it cannot be excited.

The first question which a University teacher should ask himself is, "Am I rousing a spirit of inquiry in my pupils?" And if this cannot be answered in the affirmative it is a confession that the University ideal is not being realised.

Some assert that this principle should also guide school education, and that it should be the first aim of the school teacher to stimulate the spirit of inquiry. My own

view is that with young children this should be less necessary; they all possess it, and are by nature inquisitive. It should rather be the object of the teacher not to spoil the spirit of inquiry by allowing it to run riot, nor to stifle it by making the work uninteresting; if the lesson interests them, their inquisitive minds will be quick enough to assimilate the teaching. We are, in fact, brought back to what I have already emphasised—that the real difference between the inquisitive mind of the child and the inquiring mind of the adult is that the former is yearning for information quite regardless of what it may lead to, whereas the latter must learn or investigate with an object if the interest is to be excited and maintained.

I have often thought it an interesting parallel that among original investigators and researchers there are two quite distinct types of mind, which have achieved equally valuable results. There is the researcher who pursues an investigation with a constant purpose, and to whom the purpose is the inspiration. But there is also the investigator who has preserved his youthful enthusiasm for novelty, and has in some respects the mind of a child; passionately inquisitive, he will always seek to do something new, and very often, like a child, he will tire of a line of research in which he has made a discovery, and take up with equal enthusiasm a totally different problem in the hope of achieving new conquests. I think that a man well known in Sheffield, the late Henry Clifton Sorby, must have been a man of this character. The latter is, perhaps, the most fertile type of original investigator, but it is not the type that produces the best teacher, except for very exceptional and original-minded students; and such teachers do not often found a school of learning and research endowed with much stability. For ordinary students, the investigator who pursues his researches so far as possible to their conclusion is the safer guide.

It seems to me suggestive that there are to be found, even amongst the famous researchers, these two types of mind, that somewhat correspond to the mental attitude of the school pupil and the University student. It is as though these great men have preserved a juvenile spirit, some from the days of their childhood, others from early manhood.

It will now be clear that the principle which I am advocating is a very simple one, namely, that the business of direct mental training should be finished at school, and that at the University the trained mind should be given material upon which to do responsible work in the spirit of inquiry. Preparatory exercises belong to school life, and should be abandoned at the University.

All this seems so obvious that it might appear to be hardly worth saying were it not that the methods which actually prevail are so far removed from this ideal.

When, for example, a boy who has not learnt Greek or chemistry at school comes to the University and proposes to take up one of these subjects, he is generally put through a course of exercises which differ in no essential respect from those which are set before a boy of twelve. In other words, our University method for the trained mind does not really differ from our school method, which is supposed to be adapted to the mind in course of training. Again, boys who have been learning certain subjects for years at school, but are weak in them, have their education continued at the University in the same subjects by the same school methods until they can be brought up to the requirements of a first University examination, which in its character does not differ much from the examinations held at school. Where in this process is to be found the introduction of that spirit of inquiry and investigation which ought to characterise the University course?

It may be asked, In what manner is this change to be introduced, and how is it possible under present conditions, where so many students are all pursuing ordinary degree courses and have no time or opportunity for special work, to provide teachers who can educate them in this spirit, if it is also their duty to get pass students through their examinations? The answer, I think, is that in a University the professors and higher teachers should be, without exception, men who, whatever may be their teaching duties, are also actively engaged in investigation. Their assistants should be teachers who, even if the whole or part of their time is occupied in routine teaching, have yet had some experience in, and possess real sympathy with, modern advanced work under such professors. This is only to be secured by insisting that teachers in a University should all have had some experience of original work, and, just as one of the necessary qualifications for an elementary teacher is some education in method, so a necessary qualification for a University teacher should be some education in research. Anyone desirous of qualifying for University teaching should be compelled to devote a certain portion of his student career to research, and the funds of a University cannot be better applied than to the retention of the better students at the University for the distinct purpose of enabling them to pursue investigation under the professor for a period of one year after they have completed their degree course, if they have not been able to do so during their undergraduate period. It is not, however, too much to hope that the majority of those who are endeavouring to qualify for the higher educational posts will be assisted to obtain this special experience during their degree course. Under the present system at most Universities, unless the student has been fortunate enough to come in contact with a teacher imbued with the spirit of research who is carrying on his own investigations, it rarely happens that he has the time or the means which would enable him to obtain any insight into the meaning of investigation before he leaves to take up teaching work. The need of post-graduate scholarships for this purpose is very widely felt, and is now frequently expressed. To insist upon such qualifications for all University students is, of course, under present conditions impossible; but there should be no insuperable difficulty in insisting upon them for those who are to be allowed to enter a University as teachers.

Researchers are born, not made, and it is not by any means desirable that all University students should be cast adrift to make new researches and seek discoveries even under the direction of experienced teachers and investigators. This must depend to some extent upon the character of the pupil as well as of the teacher.

The mere publication of papers may mean nothing, and much that is dignified with the name of research is of no account. To turn a lad on to research, unless it be in the right spirit, may be only to set him a new exercise instead of an old one; to leave him to prosecute an investigation for himself may be to condemn him to disappointment and failure. On the other hand, to carry on any piece of work, whether it be new or old, in the zealous spirit of inquiry, with faith in a purpose, is to insure the intellectual interest of the student; and I cannot see why this spirit should not animate all University education, whether it be accompanied by original research or not. The essential condition is that the chief University teachers should themselves create an atmosphere of investigation.

So deep-seated is the belief that nothing must be undertaken without a preparatory course of training that even the best and most brilliant students are frequently discouraged from undertaking a new study until they have been subjected to the mental discipline of an elementary course in it.

I cannot refrain from quoting an example which came within my own experience, although I have already alluded to it in another address delivered last year.

When I was at Oxford a young Frenchman of exceptional ability, whose training had been almost exclusively literary and philosophical, and who was at the time engaged on a theological inquiry, expressed to me his regret that he had never learnt to understand by practical experience the meaning of scientific work. And when I assured him that nothing was easier than to acquire practical experience by taking up a piece of actual investigation under the direction of a scientific worker, he explained to me that when he had applied for admission to scientific laboratories he had been told that it was useless to do so until by preparatory courses he had acquired an adequate knowledge of mathematics, physics, and chemistry. I offered to make the trial with him, and began with a problem that happened to interest me and that required a new method of simple experimental research. I soon found that a well-trained mind, able to grasp the meaning of the problem and eager to investigate it, could begin without delay upon the experiments, and in the

desire to interpret them could find a pleasure and a purpose in seeking the necessary chemical and physical knowledge; whereas to have begun by acquiring this in a preparatory course, with no definite object in view, would have been to set back a mature mind to school methods of training, and very possibly to have stifled instead of kindling any real scientific interest.

This is, again, an illustration of my contention that the most special study, if carried on in the true University spirit, is very far removed from ordinary specialisation, and involves very wide extension of interest and learning; whereas, if carried on in a preparatory spirit, it is necessarily limited.

In a very short time this student had published three original papers which seem to me of considerable importance, though perhaps on a somewhat obscure subject, and I see that they are now quoted as marking a substantial advance in knowledge.

Of course, this is the exceptional case of the exceptionally able student; but I think it illustrates two things—first, the prevalence of the conventional attitude that preparation on school lines is necessary even for the post-graduate student; secondly, the fact that what is really necessary to the University student is the purpose, and that with this before his eyes he may safely be introduced to new fields of work.

One result of the conventional attitude is that those who have distinguished themselves at school in some subject are often assumed to have a special aptitude in it, and to be destined by Nature to pursue the same subject at the University, whereas their school success may only prove that they are abler than their fellows, and that this ability will show itself in whatever subject they may take up. Such students would sometimes on coming to the University be all the better for a complete change of subject, without which the continuance of the school studies too often means a perpetuation of the school methods. Those who are wedded to the idea of a systematic progression from secondary to university education run the risk of closing the door to this possibility, or at any rate of seriously prejudicing it.

Another result is that when teachers are always playing a somewhat mechanical part in a systematised course, receiving duly prepared pupils and preparing them again for the next stage, such an atmosphere of preparation is produced that many persons continue to spend the greater part of their lives in preparation without any reasonable prospect of performance.

I am well aware that, on the other hand, there always have been, and are now, many earnest and accomplished University teachers who are pursuing the methods that I advocate, whose teaching is always inspired with a purpose, whose pupils are stimulated to learn in the spirit of inquiry, and who consequently exercise a personal influence that is profound and enduring. I am deeply conscious how much I owe to some such teachers with whom I have studied and to others whom I have known. But still it does remain true that this is not yet the atmosphere of ordinary University education, that it does not yet invigorate the ordinary University student, and that to him the passage from school to the University does not necessarily mean a transition from mental discipline and preparation to mental activity and performance.

The distinction that I have in my mind between University and school teaching may be expressed in this way. At school no subject should be taught to a class as though it were intended to be their life-work; to take an example, it too often happens at present, owing really to excessive zeal on the part of school teachers, that mathematics is taught as though each member of the class were destined to become a mathematician; consequently only the few scholars with a real aptitude for mathematics become interested, and the remainder are left behind. On the other hand, at the University each subject should be studied as though it really were the life-work both of teacher and student. Thus, to take the same subject as an illustration, the mathematical student will attend the full courses of his professors and will follow them with the interest of a mathematician; whereas for the scientific student it will only be in those branches of mathematics which concern him that the interest of his special science will put him on terms of equality with the mathematical student. If I may choose an illustration which is familiar to myself, any student of mineralogy can easily be interested in and benefit by a course in spherical trigonometry, because it is one of the tools of his trade, but to send him to lectures on differential equations would be only to discourage him. On the other hand, the student of chemistry would rather be interested in the latter. To each of them certain branches of mathematics as taught by an ardent teacher afford a real intellectual training, but neither would gain much if compelled to follow a general University course of mathematics designed for mathematicians.

It will be observed that I have endeavoured to confine myself to the subject of University education, and not to say much, except by way of contrast, concerning school teaching.

I must, however, return to it for a moment, if only to emphasise the danger of that specialisation, which, since it takes place at school and not at the University, is bound to be narrow, and which is often encouraged in pupils of special aptitude preparing for University scholarships.

That a boy or girl should for a year or even two years before leaving school be practically confined to one subject and should before entering the University be examined in that alone, appears to me to be contrary to all the best traditions of school teaching, and to the often expressed desire of the Universities to ensure a good general education in those whom they admit. There should, I think, be no scholarship examination which does not include several of the subjects of a normal school curriculum, however much additional weight may be given to any of them. Although it may be necessary that University entrance scholarships in one subject should be given either to encourage its study or to discover those who have a special aptitude, yet, so far as scholarships are intended to be rewards for intellectual pre-eminence, they should, I think, be directed to general capacity, and not be used as an encouragement to limited study. From what I have already said it will be clear that I do not attach much importance to special preparation at school for those who intend to proceed to the University. If a boy has a very special taste or aptitude, it should have abundant opportunity for displaying and exercising itself at the University, provided only that it has not been stifled, but has been given some encouragement in the school curriculum. I understand, for example, that those who teach such a subject as physiology at the University would prefer that their pupils should come to them from school with a general knowledge of chemistry and physics rather than that they should have received training in physiology. With the present modern differentiation into a classical and modern side, or their equivalents, the ordinary school subjects should be sufficient preparation for any University course if they are not mutually strangled in the pressure of an overcrowded curriculum.

To be fair, however, I must state another view. A very experienced college tutor who has had previous valuable experience as a master in a public school tells me that in his opinion the real problem of the public schools is the "arrest of intellectual development that overtakes so many boys at about the age of sixteen." "There are few public schools," he says, "whose fifth forms are not full of boys of seventeen or eighteen, many of them perfectly orderly, well-mannered, and reasonable, in some sense the salt of the place, exercising great influence in the school and exercising it well, with a high standard of public spirit, kindly, and straight-living, in whom, nevertheless, it is difficult to recognise the bright, intelligent, if not very industrious, child of two or three years before."

He thinks that there is a real danger of degeneration at this age, owing, for one thing, to the manner in which the boys are educated *en bloc*; up to a certain age boys can be herded together and taught on the same lines without great harm being done, but after a certain time differentiation begins to set in. The school curriculum, however, does not admit of being adjusted to suit the dawning interests of a couple of hundred boys; and he sees no cure for this difficulty except a considerable increase in the staff and a corresponding reduction in the size of the forms. But he thinks that much may be done by an alteration in the system of matriculation examination, which sets the

standard at the public schools. He would make this consist of two parts: an examination coming at about the age of sixteen and well within the reach of a boy of ordinary intelligence and industry, and comprising the ordinary subjects of school curriculum at this age; he would then let the boy leave the subjects from which he is not likely to get much further profit and begin to specialise for the remaining two or three years, say, in two subjects, which would then be the material of the second examination. In this way they would make a wholly fresh start at a critical age, and he thinks that the bulk of the boys would probably find this a great advantage.

I quote this opinion because it shows that an experienced schoolmaster regards it as highly desirable that at a certain period in a schoolboy's career a real change should be made in his curriculum, and I have expressly stated that I find it difficult to express an opinion upon this particular educational period.

What should be the exact nature of the teaching before and after the age of sixteen or seventeen for the mass of ordinary boys I would prefer to leave to the decision of those who are best able to judge. I think it highly probable that there should be a considerable alteration of curriculum at the critical age. But, if a break and change of subject are required at this age, I believe that a yet more complete change is required at the later stage when the boy goes to the University, and that school methods should then be entirely replaced by University methods—not because there is then a natural change in the mental powers of the student, but because it is the obvious stage at which to make the change if we are to abandon preparatory training at all. Should it be proposed that the change ought to be made at sixteen, and that after that age something of the nature of University methods should be gradually introduced, my fear is that this would only lead to the perpetuation of school methods at the University.

An interesting question which deserves to be very seriously considered is the question, What sort of school education affords the best preparatory training for the University? I have often heard it asserted that, if a boy is capable of taking up at the University a course which is entirely different from his school course, he will generally be found to have come from the classical side and not from the modern side. An ordinary modern-side boy is rarely able to pursue profitably a literary career at the University, whereas it often happens that ordinary classical-side boys make excellent scientific students after they have left school. I am bound to say that this is, on the whole, my own experience. It suggests that a literary education at school is at present a better intellectual training for general University work than a scientific education. If this be so what is the reason?

There are no doubt many causes which may contribute. In some schools the brighter boys are still retained on the classical side while those who are more slow are left to find their way to other subjects; and some whose real tastes have been suppressed by the uniformity of the school curriculum turn with relief to new studies at the University and pursue them with zeal. But the facts do also, I think, point to some defect in the present teaching of school science whereby a certain narrowness and rigidity of mind are rendered possible. This may be partly due to the lack of human interest in the teaching of elementary science; the story of discovery has a personal side which is too much neglected, though it is more attractive to the beginner and might with advantage be used to give some insight into the working of the human mind and character. Moreover, it would form an introduction to the philosophy of science which is at present so strangely ignored by most teachers.

But another noteworthy defect is the absence of that mental exercise which is provided by the thoughtful use and analysis of language.

I believe that the practice of expressing thoughts in carefully chosen words, which forms so large a part of a good literary education, constitutes a mental training which can scarcely be surpassed, and it is unfortunately true that in the non-literary subjects too little attention is paid to this practice. In school work and examinations in science a pupil who appears to understand a problem is often allowed full credit, although his spoken or written answer may be far from clear. This is a great mistake. A statement which is not intelligibly expressed indicates some confusion of thought; and, if scientific teaching is to maintain its proper position as a mental training, far more attention must be paid to the cultivation of a lucid style in writing and speaking.

The various Universities seem fairly agreed upon the subjects which they regard as essential to an entrance examination—subjects which may be taken to imply the groundwork of a liberal education. Among these is English: and yet of all the subjects which children are taught at school, there is none in which such poor results are achieved. It may be taught by earnest and zealous teachers; the examination papers are searching, and seem to require a considerable knowledge of English literature and considerable skill in the manipulation of the language, and yet the fact remains that the power of simple intelligible expression is not one that is possessed by the average schoolboy and schoolgirl. It is the most necessary part of what should be an adequate equipment for the affairs of life, whether the pupil passes to the University or not, and yet it is, on the whole, that which is least acquired.

Although it is true that the intelligent reading and study of the great masters should assist in the acquisition of a good style, it is equally true that, if they come to be regarded as a school task, they are not viewed with affection, especially in these days of crowded curricula, when there is little leisure for the enjoyment of a book that requires deliberate reading. If the modern strenuous curriculum of work and games has abolished the loafer, it has also abolished leisure, and has therefore removed one of the opportunities that used to exist for the cultivation of literary and artistic tastes and pursuits by those to whom they are congenial. The art of expressing one's ideas in simple, straightforward language is to be acquired not so much by study as by practice. There is no essential reason why children should write worse than they speak; they do so because they have constant practice in the one and little practice in the other. Our grandparents felt less difficulty in expressing themselves clearly than we do ourselves: of this their letters are evidence. It may have been partly due to the fact that they had more time and encouragement for leisurely reading, though they had not so much to read; but I believe that the letters which they wrote as children were their real education in the art of writing English. Much would be gained if boys and girls were constantly required to express their own meaning in writing. The set essay and the *précis* play a useful part, but do not do all that is needed. Translation does not give quite the necessary exercise. What is required is constant, with certain periods of conscious, practice, and that is only to be obtained by making every piece of school work in which the English language is used an exercise in lucid expression. Very few paragraphs in anything written by the ordinary schoolboy—or, for the matter of that, by the ordinary educated Englishman—are wholly intelligible, and teachers cannot devote too much pains to criticising all written work from this point of view. If we first learnt by practice to express our meaning clearly we should be more likely to acquire the graces of an elegant style later. I must add that I believe the training in the manipulation of words would be improved if all children were required to practise the writing of English verse—not in efforts to write poetry, but narrative verse used to express simple ideas in plain language—and I believe that this would enable them the better to appreciate poetry, the love of which is possibly now to some extent stifled by the pedantic study of beautiful poems treated as school tasks.

In such a subject as English composition, in which reform is so badly needed, something, perhaps, would be gained by an entire break with existing traditions—a break of the sort which would be required if it became suddenly necessary to provide for an entirely new type of student.

Now there is one new and interesting development in which, for the first time, an opportunity offers itself of dealing with a body of students who, although possessed of more than average intelligence and enthusiasm, have not received the conventional training which leads to a University course. The tutorial classes for working people which have now been undertaken by several Universities, and which already number about 1200 students, are

attended by persons carefully selected for the purpose and anxious to pursue a continuous course of study of an advanced standard. In these classes the Universities will be compelled to begin new subjects for students of matured minds who have not received the usual preparation, and will therefore necessarily deal with them in a new way. Here, if anywhere, the difference between school methods of teaching and University methods ought to be apparent; and I feel sure that, if University teachers attempt conventional methods with these students, they will be condemned to failure. It is certain that these classes will increase enormously and rapidly, and I have great hope that they will for this reason influence the methods of University teaching in a very healthy manner. In the tutorial classes the teachers will be confronted with the entirely new problem of students who have thought much, and of whom many are experienced speakers, well able to express their thoughts by the spoken word, but who, nevertheless, have received little training, and have had still less experience, in expressing their ideas in writing. Many of the students whom I have met have told me that this difficulty of writing is their real obstacle, and the matter in which they feel the want of experience most acutely. It will be a very valuable exercise for those who conduct these classes to instruct their students in the art of writing simple and intelligible English, and I hope that the necessity of giving this instruction will have a good effect upon the conventional methods of teaching English in schools as well as in Universities.

I am conscious that this address is lamentably incomplete in that it is concerned only with the manner of University teaching, and scarcely at all with its matter, and that, to carry any conviction, I should apply myself to the task of working out in detail the suggestions that I have made. But this would lead me far beyond the limits of an address, and I am content to do little more than touch the fringe of the problem. Reduced to its simplest terms, this, like so many educational problems, involves an attempt to reconcile two different aims.

The acquisition of knowledge and the training of the mind are two inseparable aims of education, and yet it often appears difficult to provide adequately for the one without neglecting the other. If childhood is the time when systematic training is most desirable, it is also the time when knowledge is most easily acquired; if early manhood is the time when special knowledge must be sought, it is also the time when training for the special business of life is necessary. To withdraw from the child the opportunities of absorbing knowledge may be as harmful as it is unnatural; to turn a young man or young woman loose into a profession without proper preparation is cruel, and may be disastrous.

And so we get the battle of syllabus, time-table, scholarships, examinations, professional training, technical instruction, under all of which lies the disturbing distinction between training and knowledge.

But, if we inquire further into these matters, I think we shall find that the fundamental question is to a large extent one of responsibility. Left to himself, a boy or a man will acquire a knowledge of the things which interest him, even though they be only the arts of a pickpocket, and will obtain a training from experience such as no school or college can give. If education is to achieve the great purpose of interesting and instructing him while young in the right objects, and also of training him for the proper business of his life before it is too late, is it not mainly a question of deciding when and how far to take for him, or to leave to him, the responsibility of what he is to learn and how he is to learn it? If the teacher bears the responsibility during the period of school training, should not the student have a large share of responsibility in the quest of knowledge at the University?

Now it is of the essence of responsibility that there should be something sudden and unexpected about it. If, before putting a young man into a position of trust, you lead him through a kindergarten preparation for it, in which he plays with the semblance before being admitted to the reality, if you teach him first all the rules and regulations which should prevent him from making a mistake, you will effectually smother his independence and stifle his initiative. But plunge him into a new experience and make him feel the responsibility of his position, and you will give him the impulse to learn his new duties and the opportunity to show his real powers. It is because I feel that this sudden entrance into an environment of new responsibility is so necessary that I would regard with suspicion any attempt to provide a gradual transition between school and University methods.

In matters of discipline and self-control it is possible and advisable to place responsibility upon school children; in intellectual matters it is not advisable, except for the few who are matured beyond their years. It is, therefore, all the more necessary that this should be done at the moment when they enter the University.

This should be the moment of which Emerson says: "There is a time in every man's education when he arrives at the conviction that he must take himself for better or worse as his portion; that, though the wide universe is full of good, no kernel of nourishing corn can come to him but through his toil bestowed on that plot of ground which is given him to till. The power which resides in him is new in Nature, and none but he knows what that is which he can do, nor does he know until he has tried."

The spirit of independent inquiry, which should dominate all University teaching and learning, is not to be measured, as I have already said, by the number of memoirs published, but it is to be tested by the extent to which University students are engaged upon work for which they feel a responsibility. Visit the Universities at the present moment, and, in spite of all the admirable investigation which is being carried on, you will find the majority of students engaged in exercises in which they feel no responsibility whatever. In my opinion this indicates that for them the spirit of true University education has never been awakened. It is, after all, very largely a question of attitude of mind. Any subject of study, whether it be a scientific experiment or an historical event, or the significance of a text, is a matter of interpretation, and to approach it in the University spirit is to approach it with the question, "Is this the right interpretation?" Upon that question can be hung a whole philosophy of the subject, and from it can proceed a whole series of investigations: it embodies the true spirit of research and it opens the door to true learning.

In discussing University education I have not, of course, forgotten that many persons have taught themselves up to a University standard entirely without the aid of professors; indeed, the University of London long ago provided an avenue to a University degree which has been successfully followed by many such persons with the best possible results. But I have endeavoured to remind you that at the University, as at school, for most students the personal influence of the teacher is the important thing; that at the University, as at school, success in teaching depends mainly on the extent to which the interest of the student is aroused; and that at the University this is only to be done by providing him with a purpose and a responsibility in his work in order that he may understand to what conclusions it is leading him. Until this is done we shall still have University students complaining that they do not see the object of what they are learning or understand what it all means. This complaint, which I have often heard from past and present students of different Universities, suggested to me that I should on the present occasion deal with this defect in our customary methods.

In the hope that the attention of University teachers may be turned more fully to this aspect of their work I have ventured to make it the subject of my address.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—At Emmanuel College research studentships of the value of 150*l.* each have been awarded to G. E. K. Braunholtz and A. Ll. Hughes. Grants of the following amounts have also been made:—S. Mangham, 60*l.*; R. H. Snape, 40*l.*; C. S. Robinson, 20*l.* The exhibition of 50*l.* offered to an advanced student commencing residence this October has been awarded to J. Ivon Graham, London, Royal College of Science for Ireland. Additional exhibitions of 30*l.* have also been awarded to A. J. Grove, Birmingham University, and F. Smith, Manchester University.

The Clerk Maxwell scholarship is vacant by the

resignation of Mr. Wellisch. Candidates are requested to send in their applications to Sir J. J. Thomson (the Cavendish Laboratory) on or before November 5.

At Trinity College the following have been elected into fellowships:—G. N. Watson, G. I. Taylor, H. T. J. Norton, and A. V. Hill.

OXFORD.—Dr. Arthur Vaughan, well known for his researches on the Carboniferous limestone, has been appointed lecturer in geology.

Mr. A. E. Richey has been appointed demonstrator in geology. Mr. Richey succeeds Mr. J. A. Douglas, who is now engaged on a geological expedition in Peru. The expedition has been sent out by Mr. W. E. Balston to take advantage, for geological research, of the excavations now in progress in the construction of new railways. Mr. Douglas is accompanied by Mr. Thomas, Rhodes scholar, who goes as a volunteer, and the general management of the expedition is undertaken by Prof. Sollas.

PROF. F. M. SANDWITH, Gresham professor of physic, will deliver four Gresham lectures on ancient and modern surgery on October 25 to 28. The lectures are free to the public, and will be delivered at the City of London School at 6 p.m. each evening.

THE China Emergency Appeal Committee asks for 100,000*l.* to be used as follows:—(1) 40,000*l.* for the establishment of union medical colleges; (2) 40,000*l.* for the establishment of educational schools of training; (3) 20,000*l.* in aid of literature societies and general translation work. A sum of nearly 14,000*l.* had been received or promised up to the end of August; and the following grants have already been made:—Union Medical College, Peking, 2000*l.*; Union Medical College, Hankow, 1000*l.*; Union Medical College, Moukden, 500*l.*; Union Normal Training College, Shantung University, 1500*l.*; Anglo-Chinese College, Tientsin, 1000*l.*; Chrisuian Literature Society for China, 1700*l.*; China Medical Missionary Association for the Translation of Medical Literature, 300*l.* Donations towards the 100,000*l.* required for the China Emergency Fund may be sent to Mr. Robt. L. Barclay, honorary treasurer (Messrs. Barclay and Co.), 54 Lombard Street, London, E.C.; or to the Rev. Edward T. Reed, secretary, China Emergency Appeal Committee, 28 Victoria Street, Westminster, S.W. The committee has arranged for a meeting to be held in the Guildhall on October 18, when addresses will be given on the opportunity of the educational movement in China by Dr. S. L. Hart, and on medical education in China by Mr. D. Main. An address will also be given by Sir Robert Laidlaw.

THE inaugural address at the opening of the winter session of the Birkbeck College was this year delivered by Prof. M. E. Sadler. After sketching the development of English education during last century, and showing how much was accomplished by men like Birkbeck, Prof. Sadler went on to say that both in science and in art the passion of modern study has been to see and to represent things as they really are. This at bottom is the basis of scientific thought, and the purpose of the painter's and draughtsman's expression. To keep one's mind clear as a mirror is the intellectual and also the moral condition of real advance both in science and in art. It is impossible, however, to see things as they really are without a long preliminary discipline, in which one learns to see and how to express. Therefore one side of the modern educational movement is to prolong for all students the period of preliminary preparation and discipline, which, having been accomplished, the student may go to that freer, more self-active task which is before those who have received thorough training and preparation. It is in giving that thorough training and preparation that we in England, compared with other leading modern nations, have been until lately grievously in arrear. It is because our system of intermediate or secondary education is meagre, starved, sectional, that the immense efforts bestowed on technical and adult education by such men as Dr. Birkbeck failed for so long to produce the harvest which they confidently expected. The work of strengthening this period of disciplinary preparation for advanced studies—strengthening our whole system of secondary education—is one of the greatest tasks which are before us now as British citizens.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 3.—M. Émile Picard in the chair.—The president gave an account of the life-work of the late M. Maurice Lévy.—Émile **Picard**: A singular functional equation of the Fredholm type of equation.—Charles **Lederer**: The organic compounds of tetravalent tellurium. By the interaction of tellurium tetrachloride and magnesium phenyl bromide in ethereal solution there is obtained chlorobenzene, diphenyl, the compound $Te(C_6H_5)_2$ already described by Kraft and Lyons, and a new derivative, triphenyl-telluronium chloride, the iodide of which, $(C_6H_5)_3TeI$, was prepared by adding potassium iodide. The bromide $(C_6H_5)_2TeBr_2$ is also formed in the reaction.—L. **Gay**: The osmotic equilibrium of two liquid phases.—A. and L. **Lumière** and M. **Seyewetz**: The action of quinones and their sulphonic derivatives on the photographic images formed by silver salts. Aqueous solutions of benzoquinone in presence of sulphuric acid are useful in reducing over-exposed negatives; the replacement of the sulphuric acid by potassium bromide gives a new intensifying solution. The suitable proportions are given in both cases.—Charles **Janet**: The sensitive organs of the mandible of the bee.—Paul **Godin**: Normal asymmetry of the binary organs in man.

DIARY OF SOCIETIES.

WEDNESDAY, OCTOBER 19.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Hicksonella, a New Gorgonellid Genus: Jas. J. Simpson.—(1) On the Resolution of New Detail in a *Coscinodiscus asteromphalus*; (2) A Micrometric Difficulty: E. M. Nelson.

ENTOMOLOGICAL SOCIETY, at 8.

CONTENTS.