

THURSDAY, OCTOBER 6, 1904.

## THE NORTH POLAR SEAS.

*The Norwegian North Polar Expedition, 1893-1896. Scientific Results.* Edited by Fridtjof Nansen. Vol. iv. Published by the Fridtjof Nansen Fund for the Advancement of Science. Pp. 232; 32 plates. (London: Longmans, Green and Co., 1904.) Price 21s. net.

THE present volume, in continuation of those previously published,<sup>1</sup> contains three articles, which may be noticed in sequence, although the contribution by Dr. Nansen constitutes the principal portion of the work.

In article xi. H. H. Gran deals with "Diatomaceæ from the Ice-floes and Plankton of the Arctic Ocean." It is pointed out that the plankton samples collected on previous expeditions to the Polar seas contained a considerable quantity of algæ, especially diatoms; whereas the samples brought home by Nansen indicate that the deep Polar Sea is deficient both in species and specimens. When found in quantity, they were principally oceanic diatoms; but the author remarks that it is difficult to understand how all the crustaceans (*Calanus finmarchicus*, &c.) that swarm in the upper portions of the Polar Sea can find means of sustaining life. The samples of diatoms taken upon the drift-ice, partly upon the ice-floes and at their edge, partly from channels in the ice, are of greater botanical interest. Most of them must have lived and multiplied on the ice; others, including a few fresh-water forms, were probably transported casually on to the ice. At present little is known concerning the distribution of ice-diatoms, but the samples examined indicate that those of North Siberia and East Greenland are directly connected with one another; and the study of these organisms appears likely to prove of value in determining the drift of the ice.

In article xii. Johan Kiær describes "The Lower Silurian at Khabarova." Fossiliferous calcareous slates were discovered by Nansen in 1893 on the south side of Yugor Strait, near Khabarova, south-west of the Yalmal peninsula. The fossils, though badly preserved, could be identified as belonging to the brachiopods *Leptaena sericea*, *Orthis* and *Strophomena*; and to the trilobites *Asaphus*, *Megalaspis*, and *Remopleurides*. They indicate the zone of *Asaphus platyurus*, which belongs to the middle part of the Ordovician.

In article xiii. Nansen contributes an elaborate essay on "The Bathymetrical Features of the North Polar Seas, with a Discussion of the Continental Shelves and Previous Oscillations of the Shore-line." This work, illustrated by 29 maps and profiles, embodies the more important observations and conclusions of the great explorer; and it will be of considerable interest to geologists, as well as to geographers, as some aspects of the subject have been vigorously discussed by Prof. Hull, Dr. J. W. Spencer, Mr. Hudleston, and Sir Archibald Geikie.

<sup>1</sup> Notices of previous volumes appeared in NATURE for June 14, 1900, p. 146; June 13, 1901, p. 151; and December 4, 1902, p. 97.

As pointed out by the author, the general idea prevailing before the expedition was that the North Polar ocean, between Siberia and North America, was a shallow sea, with a comparatively rapid deposition of sediments carried into it by the Siberian and American rivers, or brought from the coasts by drifting ice. The expedition has shown that the sea occupies a basin with depths approaching 4000 metres, and that at present there is no rapid deposition in it of sediments. Even the dust carried by the winds, or otherwise derived from the atmosphere by precipitation, settles on the floating ice, giving it a dirty brown appearance, and is transported to more southern latitudes, where the ice melts. Proof has likewise been obtained that Franz Josef Land is a group of comparatively small islands, and that probably no extensive land-masses exist to the north of the New Siberian Islands. The deep basin appears to be separated from the Norwegian sea by a shallow suboceanic ridge extending from Spitsbergen to Greenland.

As the *Fram* was heavily laden, Nansen had not encumbered her with the equipment necessary for sounding in very deep water. In the course of his drift across the North Polar basin he soon discovered that his arrangements for sounding were insufficient, and new line had to be made from one of the ship's thick steel-wire cables. Eventually, after much arduous labour, a fairly good sounding line, 4450 metres long, was constructed. According to the soundings thus made, and to those known from other expeditions, a chart has been prepared to show the bathymetrical conditions of the northern seas, but much naturally remains to be done to delineate in detail their submarine contours. The most striking feature in this region is the broad and shallow continental shelf extending northwards from the Eurasian continent, and on which are situated Bear Island, Spitsbergen, Franz Josef Archipelago, and Novaya Zemlya. Continued as it is along the American borders, it forms the most extensive submarine shelf. Davis Strait, with the deep Baffin Bay, and the Norwegian sea with the deep depression of the North Polar basin, form, with their many branches (e.g. the Barents Sea), enormous fjords penetrating this platform. Soundings show that its depths are, on the whole, very uniform.

The Siberian continental shelf is regarded as a submerged tract that was originally sculptured with furrows which were the continuations of the sounds, fjords, and valleys of the borderland. These depressions may have been filled up by ground moraines during the Glacial epoch, and also by the deposition of glacial sediments outside the margin of the Siberian ice-sheet, as well as by comparatively recent silting up by deposits from the rivers and shores. Floating ice also assisted in the process.

After describing the American Arctic continental shelf, the author discusses the features of the Barents, Murman, and Kara seas, in which he infers evidence of sculpturing by subaerial agents, fluvial and glacial. It is interesting to read (p. 28) that "the possibility exists that there has

been no oscillation of sea level, but that the channels may have been excavated by glaciers to their present position below the sea surface"; and, although the author does not regard this possibility as of much weight, we may recall attention to the interesting suggestion (quoted in *NATURE*, July 7, p. 218) made by Mr. G. K. Gilbert, from his observations on Alaska, that glaciers, under certain conditions, may excavate beneath sea-level.

The continental shelf of the Norwegian coast is somewhat irregular, the depth of the edge below sea-level differing much between 80m. and 300m., and it is only at a few places that it is as deep as 360m. (200 fms.). The great valleys and fjords of the land are often continued as submarine valleys or fjords across the submerged continental shelf, and at some points they open out at its edge, forming distinct incisions in the continental slope; but they are not as a rule traceable beyond the 400 metres line, and seldom even so far.

The Norwegian submarine channel at the southern end of Norway is regarded as part of the bed of the ancient "Baltic River," which drained the Baltic basin and southern Scandinavian tracts. It is pointed out that Prof. Amund Helland attributed this channel to the erosion of the Scandinavian glacier during the Great Ice Age, and the author, while admitting the influence of that glacier, considers that the present relative depth is due to the adjacent areas having been to a great extent filled up with glacial drift.

After dealing briefly with the regions of the Færoës and Iceland, and with the continental shelves of Britain, France, and North America, the author summarises his views on the general subject of the origin of continental shelves. He discusses also various explanations that have been given.

Regarding the continental shelves as having been shaped prior to the submerged valleys, and considering the great extent of these shelves, and the improbability of regular and extended vertical movements of the lithosphere, the author in 1901 had concluded that they must be due to oscillations of the hydrosphere. He now considers that the general level of the sea must have remained near its present position, despite many oscillations of the land, during the later geological periods. The eroded parts of the continental shelves must have been developed when the shelves were near to sea-level, owing their features partly to conjoint action of subaërial erosion and marine denudation, partly to deposition of terrigenous waste, and even locally to organic agents.

Attention is directed to the extensive coast platforms that occur in part a little below sea-level and extend above it, evidencing small oscillations of the shore-line. The Norwegian coast platform has a surface formed chiefly by solid rocks, and the depressions in it are not filled up to any great extent by waste or glacial drift. This platform was in the author's opinion formed by marine denudation after the fjords and channels now traversing it were cut; but the sculpturing may have been facilitated by

the clearing away of débris by glacial action. He believes that marine denudation is most potent when coasts are being slowly submerged; but that the Norwegian platform can hardly have been formed during one period of submergence. These platforms were formed in comparatively recent times, whereas the continental shelves were to a great extent developed during Pliocene and Pleistocene times.

With regard to the oscillations of the land, the author leaves the explanation in a somewhat vague state, observing in conclusion that

"whatever the causes of the oscillations of the shore-line may have been, the above facts seem to prove that, after each disturbance in the relation between land and sea, the earth's crust has a remarkably strong tendency to return to a certain position of perfect equilibrium, which is probably determined by the buoyancy of the crust floating on the underlying magma."

H. B. W.

#### FOREST ENGINEERING.

*A Manual of Forest Engineering for India.* By C. G. Rogers. Vol. i., pp. xx+321, price 6s. Vol. ii., pp. xix+267, price 6s. Vol. iii., pp. xii+392, price 7s. 6d. (Calcutta: Office of the Superintendent of Government Printing, India.)

THE manual under notice was written by order of the Indian Government. The work covers the syllabus of the course of study at the Imperial Forest School of Dehra Dun, but, in addition to this, there is much useful information included, giving the book a wider scope than the necessarily limited one of a syllabus of systematic instruction. The manual has been divided into eight parts. The separate parts deal with the following subjects:—(1) building materials; (2) building construction; (3) road making; (4) bridges; (5) transport of timber; (6) wells; (7) construction of embankments and water channels, river training works; (8) demarcation of forests.

In part i. we have a vast amount of information of the most useful kind on such materials as stone, bricks, tiles, lime, and timber. The source, strength, durability, preparation, and preservation of those various materials have been fully dealt with, each under its own heading. The last section of this part is devoted to carpentry and joinery, which, although not coming strictly under the heading of building materials, fit very well into this place as the most convenient for reference. Part ii., which is devoted to building construction, includes much eminently sound and useful information concerning foundations, walls, arches, floors, stairs, roofs, &c. All the best authorities have been consulted, and no suggestion or recommendation has been made which cannot be easily and successfully put into practice by the forester with such materials as he may find ready to hand and most suitable for his purpose, situated as he often is in out-of-the-way parts of the world, where not only the advice of a specially trained engineer, but also manufactured building materials are unobtainable. These two parts complete the first volume of the manual.

Parts iii. and iv., which deal respectively with road making and bridges, form vol. ii.; here again the parts have been subdivided into sections. The various problems and practical operations are dealt with in a very explicit and satisfactory manner. In this volume, as well as in the others, many useful figures and illustrations are given which supplement and enhance the value of the text. Parts v. to viii. are included in the third and last volume of the manual. As the author points out, this volume deals with those subjects which are of special interest to the forest manager. In dealing with the transport of timber, the author has given a complete account of the different methods of transport by roads, slides, forest tramways, wire-rope ways, and water. Each method has its own particular advantage, according to circumstances, which vary from place to place, but, with this volume as a guide, the forester need have no difficulty in selecting the method best suited to his own local conditions.

As the title indicates, the manual is intended for the use of forest officers in India, to whom it cannot fail to be of the greatest service and value. Great care has been taken to make the work as accurate and up to date as possible, and with this end in view the author sent proofs of the different parts of the manual to the Inspector-General of Forests to the Government of India and all conservators of forests for circulation among such forest officers as they might select for the purpose of recording any suggestions which they had to make; hence before publication the book was subjected to a thorough, practical, and critical examination, which renders it a standard authority and trustworthy source of reference.

While not replacing any of the standard works on civil engineering, the manual fills a big gap in the literature, and it is written in such a way that even those who have not had a special training in engineering may understand and appreciate its use. This work merits, and will no doubt attain, a wide circulation outside India. As a work of reference it should be in the hands of all whose profession brings them in contact with such engineering operations as do not require the skill of a highly trained expert.

There is a marked absence of technical terms, and where the use of these is unavoidable the author takes good care to make their meaning thoroughly clear. The illustrations form a very valuable feature of the manual, and greatly increase its practical utility. In most cases a detailed description has been appended, so that each figure may be clearly understood without any further reference to the text. The majority of these illustrations were drawn specially for the manual, a fact which adds much to their value. For the few illustrations which have been borrowed from other sources ample acknowledgment is made.

It will thus be seen that the manual embraces a wide range of subjects, all of which are pretty intimately associated with forestry. The third volume is of special interest to the forest manager, while vols. i. and ii. cannot fail to be also of great utility and value to those concerned in agriculture, horticulture, and planting in all their branches.

It has been the endeavour of the author, as he in-

forms us in the preface, to make the manual a book of reference for the practical man as well as a textbook for the use of students. With this end in view, the information given on each subject has been made as complete and compact in itself as possible, thus obviating the necessity of cross references. In adapting the work to serve this double purpose, the author has exhibited a great amount of skill in the selection, treatment, and arrangement of the information given under the various headings.

#### NATURAL HISTORY OF COMMON ANIMALS.

*The Natural History of Some Common Animals.* (Cambridge Biological Series.) By Oswald H. Latter. Pp. x + 331. (Cambridge: University Press.) Price 5s. net.

THIS is an excellent book, written by a man who is equally in his element whether he writes as an outdoor naturalist or as a laboratory student. This combination is by no means a common one, and it is just the combination that is wanted for a book of this kind.

The common animals chosen are earthworms and leeches, the crayfish, the cockroach and its allies, dragonflies, wasps, the fresh-water mussel, snails and slugs, frogs, toads and newts, and some common internal parasites of domestic animals. The treatment of the "earthworm" is first rate. Its structure is well described, and always as the structure of a live animal, the function of each part being never lost sight of. For instance, the use of the setæ in locomotion is made clear, and the simple experiment of putting the earthworm on a polished horizontal surface is suggested. The familiar phenomenon of earthworms appearing on the surface of the soil after heavy rain is explained, and, no less successfully, what is less familiar, their method of coping with bacteria.

The "crayfish" seems to be the least successful of the papers. Only twenty-two pages are allowed to it, and of these five and a half are devoted to a discussion of the function of the otocysts. There is no lack of interest in the five and a half pages, but much that has been omitted might have claimed precedence. There is little about the appendages, from the swimmerets to the eye-stalks—a field rich in interest to the evolutionist. When the work of the scaphognathite is described, a parenthetic explanation, not easy to understand without previous knowledge, of what the scaphognathite is has to be inserted.

With insects Mr. Latter is thoroughly at home. He has made a great many observations of his own, and he has read the literature of his subject, so that he is able to give the best of what has been discovered. The result of reading his account of the wasp and its mode of life is that one wishes to read more. He has much to say about its sting, its "homing" faculty, its parasites. He enters equally into the life of the fresh-water mussel and its young glochidia sticking to fish and trailing after them. In the maw of a fresh-water mussel were found, among other things, a number of rotifers, a very interesting fact, especially

to one who has long tried to discover what preys on these small succulent creatures. Those that are bigger of build prey upon the smaller, and a large infusorian will swallow a small rotifer, but the fresh-water mussel is a giant who devours great and small impartially.

The paper on snails and slugs is good throughout, and might with advantage have been extended beyond the thirty pages allotted to it. The want of space is due to the attempt to make the book useful to the systematist and the collector, as well as to the observer and student of the lives of animals. No less than eleven pages are devoted to the definitions of the different species of British land and fresh-water gastropods, and, after all, they are too brief to be of much use to the collector. Why, then, insert them at all? In the same way no less than eight pages are expended on the specific characters of dragonflies. Where, as in the case of the British Amphibia, there are but few species, the descriptions are fuller and well suited to what I take to be the aim and purpose of the book, viz. to help and encourage the genuine student and observer as distinguished from the mere collector. Altogether the book is an admirable one. Though the waste of space which has been pointed out is to be regretted, it does not interfere with the excellence of the rest. The illustrations, fifty-four in number, are good. F. W. H.

#### OUR BOOK SHELF.

*The Purification of Sewage.* By S. Barwise, M.D., B.Sc. Pp. xiv+220. (London: Crosby Lockwood and Son, 1904.) Price 10s. 6d. net.

THE author has in the present edition attempted to bring the information available upon this important subject up to the present state of knowledge and practice, and he has added to the former edition an appendix in which the processes in common use for the chemical examination of sewage and sewage effluents are briefly described. The work bears evidence that it has been written by one who is in touch with the practical side of the recent methods of sewage purification; the text also indicates considerable acquaintance with the advances which have been made in the treatment of sewage in various centres of population in this country.

The matters dealt with briefly but usefully include:—the nature, varieties, and chemical nature of sewage; pollution of rivers by sewage; and the treatment of sewage by land, by precipitation, and by the "septic tank," followed by either the intermittent or the percolating bacteria bed. These processes are illustrated by good reproductions of photographs, and by sectional and diagrammatic drawings. The appendix on chemical processes of analysis is also illustrated, but the directions are such as can only be usefully followed by one who has received a training in chemical analysis.

The book will undoubtedly be of use to those who are responsible for directing and advising on the treatment of sewage. The information furnished, as a whole, is reasonably accurate and up-to-date, but there are portions of the book in which the author appears to show lack of information of published results. Thus his statement on p. 125 of the relative advantages of intermittent and percolating beds leaves out of consideration the very potent aëration of the intermittent bed by the process of gaseous diffusion, since results published by the London

County Council show that even at the bottom of a twelve-foot bed a fair proportion of oxygen was present in the interstitial air; he also appears to hold the opinion that such a bed has a serious tendency to become choked, which is not noticed in properly worked beds; and he speaks of four feet being "the maximum efficient depth" for such a bed, when he should know that a 12-foot bed has been worked with entirely satisfactory results. In these and in other respects the intermittent bed appears at an unfair disadvantage with the percolating bed. It should be understood that these two methods of subjecting sewage to aërobic purification are at present under trial, and as a verdict is still scarcely obtainable, a cautious statement of their relative merits is desirable.

*Physiologie des Menschen.* By Dr. Luigi Luciani. Ins Deutsche übertragen und bearbeitet. By Dr. Baglioni and Dr. Winterstein. Erste und zweite Lieferungen. Pp. vii+322. (Jena: Fischer, 1904.) Price 4 marks each.

THIS translation into German of Luciani's text-book of physiology aims at occupying an intermediate position between the student's text-book and the larger handbooks, being more complete than the former and less encyclopædic than the latter. The translators have brought the book up to date by additions summarising more recent work.

The present first two parts of the work, which is expected to extend to twelve parts, deal with general or cellular physiology, the physiology of the blood and circulation, and the physicochemical phenomena of respiration.

Very interesting and complete accounts are given of the mechanism of the heart beat, and of the physiology of the cardiac muscle and nerves, to our knowledge of which the author himself has added much. The detailed description of practical methods has been wisely printed in smaller type.

Useful summaries of the chief sources of the literature of physiology are given at the close of each section.

A special feature of the work lies in the excellence of the historical introductions to the sections dealt with. The account of the discovery of the circulation is exceptionally complete and interesting.

So far as one can judge from the two parts already published, the difficult task of the collection of facts and their fusion into an interesting whole has been carried out with admirable skill, and the text-book promises to form a most useful and philosophic presentation of the chief facts of physiology. The author and translators are to be congratulated on the production of a work which is distinguished not only by its mastery of detail, but by its eminently readable character and attractive literary form. The appearance of the later parts will be looked forward to with much interest.

*Kritische Nachträge zur Flora der Nordwestdeutschen Tiefebene.* By Dr. F. Buchenau. Pp. vi+74. (Leipzig: W. Engelmann, 1904.) Price 1s. 6d.

THE "Flora der Nordwestdeutschen Tiefebene" was published in 1894, and was well received. Since that time the author has personally, and with the help of other botanists, collected a number of new localities for plants enumerated in the flora, and new plants have been discovered. As the publishers could not at present undertake a second edition, Dr. Buchenau has prepared this small pamphlet, which forms an appendix. It contains a full numbered list of all the species of the area, but diagnostic characters are given only for new species or varieties, and the additions and eliminations are tabulated at the end of the book.

## 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.]

## Radio-activity and London Clay.

I VENTURE to think your readers may be interested in the following results.

The recent tube operations in London have brought to the surface specimens of the London Clay from different districts. Samples of this clay taken from such different points as Hyde Park Corner, Brompton Road, and Haverstock Hill have been tested in the physical laboratory of the South-western Polytechnic for the presence of a radio-active gas by Mr. H. Cottam, and he has been unable to detect with his apparatus any marked quantity of active gas from the clays.

With the same apparatus he has detected quite easily the radio-active gas from the water of a deep well, belonging to Messrs. Eastman, Latimer Road, W., which goes below the clay to the greensand. We have come to the conclusion that the London Clay forms a floor through which the radio-active gas does not penetrate; or it may be said that the radio-active substance only travels when the water with which it is associated can travel. This is an argument in support of Prof. J. J. Thomson's view, that the radio-active gas, which he found in deep well waters, arises from the splitting up of a trace of soluble radium salt which comes up with the water.

S. SKINNER.

South-western Polytechnic, Chelsea.

## Cecil's Gas Engine.

THE earliest practical gas engine appears to be unknown to the leading writers on internal combustion engines. I think that it may be a matter of interest to those who are antiquarians in their subject—as Maxwell used to say—to know that a working gas engine was shown in Cambridge in the year 1820. It was the invention of the Rev. W. Cecil, fellow of Magdalen College, Cambridge. A full account of his engine is given in vol. i., p. 217, of the *Proceedings* of the Philosophical Society of Cambridge (paper read November 27, 1820). The paper is long, and contains excellent matter; a new form of parallel motion is described, and what the author calls "ardent spirit" and turpentine, and vapour of oil, are suggested as possible substitutes for the gas employed by the inventor of the engine.

F. J. JERVIS-SMITH.

Trinity College, Oxford, September 29.

## The Iris and the Colour Sense.

MR. VINCENT NAPIER'S communication in your issue of September 1 on "Adaptive Colours of Eyes" moves me to record an observation which I have never seen formulated. It is that persons who exhibit a fondness, in dress, for striking colours, or display exceptional taste in colour combination, have eyes of a pronounced and positive colour. One naturally notices this chiefly in women, but I believe it holds good for men also. In the matter of harmonious costuming, perhaps it would not be too much to say that many women dress conformably to the tint of the iris.

New York, September 17.

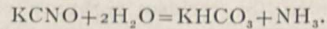
W. P. G.

## Electrolytic Oxidation.

I NOTICE with interest that in your issue of September 22 (p. 511) a brief account is given of a memoir published by Paterno and Pannain in the *Gazzetta* on the electrolysis of alkaline aqueous solutions of potassium cyanide. The chief result of their work appears to be the production of potassium cyanate. In the summer of 1899 a friend and I were working in the same direction. From the commencement of our experiments, on both aqueous and semi-alcoholic solutions of potassium cyanide, we were struck by the almost entire absence of oxygen in the electrolytic gases. The aqueous solutions became strongly alkaline and ammoniacal. The semi-alcoholic solutions became strongly alkaline, but

not ammoniacal. Acetamide was, however, detected in a distillate, the presence of which may explain the absence of free ammonia. The alcoholic solutions also yielded, on evaporation, white crystals, which proved to be potassium carbonate.

We therefore assumed, without direct proof, that oxygen had been absorbed by the potassium cyanide to form potassium cyanate. This assumption, which now receives confirmation, was based on the detection of its hydrolytic products, which we considered to have been formed according to the following equation:—



It is possible that continued electrolysis would have led to the production of potassium formate from the bicarbonate (*Berichte*, xxxvii., 2836), if this change had not, to some extent, already occurred.

We obtained evidence of the formation of more complex bodies, but have been unable, up to the present, to prosecute further experiments.

HERBERT A. KITTLE.

Leatherhead, Surrey, September 26.

DEVELOPMENTS OF THREE-COLOUR PHOTOGRAPHIC PROCESSES.<sup>1</sup>

## I.

IN reviewing the recent progress of the various processes, direct and indirect, of the reproduction of colours by photography, it is obvious that there is no very remarkable advancement to report. The ultimate aim of those who do fundamental work at this subject is to formulate a method that shall automatically reproduce the colours of the original, just as by means of a camera and lens the form of the original is automatically drawn in true perspective. The realisation of this desideratum does not seem at hand. There is no method of producing colour prints known that does not need so much control in the working of it or alteration of its results, that it would be incorrect to regard the final products as simple photographs. The skill and sometimes the taste of the operator, and the nature of the appliances that he makes use of, have an important effect upon the work. This fact may lead to the idea that photographic methods of colour reproduction are of little use. But by the aid of photography results may be obtained that were impossible before, either in their character or in the economy of their production. Photography in portraiture is not considered useless because the negative goes through the hands of the retoucher.

Of the direct methods of heliochromy, the interference method that was practically worked out by Lippmann remains nothing more than an interesting illustration of certain physical phenomena. The many restrictions that limit its applications and the difficulties that beset its practice are such that it can never be expected to develop into a practical process. After a dozen years or so, Lippmann photographs are still regarded as curiosities, and are interesting only as examples of the method. None appear to have been made for the sake of the subject. The restrictions as to size and the angle under which they must be viewed, the need for getting rid of reflections from the surface of the film, the slowness of their production, and, above all, the uncertainty of the colours produced and the fact that they change with any alteration in the condition of the film, render the process useful to the physicist rather than the photographer.

The only other method of direct colour photography that appears at all likely to develop into a practically

<sup>1</sup> "The Water-Colour Drawings of J. M. W. Turner, R.A., in the National Gallery." By T. A. Cook. Pp. vi+86 and 58 plates. (London: Cassell and Co., Ltd., 1904.) Price 3 guineas net.

"Three-Colour Photography." By A. F. von Hubl. Translated by H. O. Klein. Pp. 148. (London: A. W. Penrose, Ltd., 1904.)

"Photography in Colours." By R. C. Bayley. 2nd edition. Pp. 151. (London: Hliffe, Ltd., 1904.) Price 1s. net.

useful process, that is, a method in which the coloured image that falls upon the prepared surface produces on it its own colours at once, is that suggested about twenty-five years ago by Charles Cros. The receiving surface is coated with a red, a yellow, and a blue dye of suitable tint, each of which fades quickly when exposed to white light. As it is the light that is absorbed that causes the fading and not the reflected light, on exposure to light of any given colour the only dye or dyes that remain unbleached are those that reflect the same colour as the incident light: a red light, for example, causes the yellow and blue dyes to fade, but not the red, and this colour therefore remains in those parts upon which it impinges. The primary difficulty is to prevent further change in the resulting picture, for the very essence of the process consists in the fugitive nature of the dyes employed. This principle of work has recently engaged the attention of several investigators, but no satisfactory method has yet been arrived at.

All practical methods of colour photography, that is, methods that are practised for the sake of the results that they furnish, are indirect. The light from the coloured object does not produce colour at all. By dividing the light into three suitable parts or colours each may be photographed separately so as to give a record of the distribution of its own colour, and by the use of these records a compound print may be made with three suitable colours. Three colours are used for the same reasons that led to the theory that the normal eye can distinguish only three colours—the three colour sensations—all the vast variety of tints being due to the excitation of one or more of these simultaneously and in due proportions. Although it has been proved that three colours are sufficient, four, and even five, have occasionally been used to overcome the difficulties of the simpler method. But none of these methods must be confused with the procedure in chromolithography, in which a dozen or more colours may be used, their choice being chiefly, if not entirely, empirical.

If any two or all three of the colour sensations are excited to the same extent, the same colour effect will be produced whatever the character of the light that causes the excitation. Therefore, the fact that two colours are not distinguishable from each other by the naked eye is no proof that they are really the same; spectroscopic analysis of the two coloured lights may reveal a great difference between them. In reproducing colour by photography, therefore, it is not necessary (and not often possible) to reproduce the original colours; it is sufficient to produce a colour that the eye cannot distinguish from the original, that is, one that affects to the same extent each of the three sensations. It was by the application of this principle that Ives worked out the essential conditions for his chromoscope. It has been stated that Ives's actual apparatus does not illustrate this principle as completely as has been claimed, but whether this is so or not does not affect the principle itself nor the usefulness of it.

The conditions obtaining in Ives's chromoscope, and in the method of making coloured transparencies (or lantern slides) which Sanger-Shepherd has made a commercial success, are the two simplest illustrations of three-colour photography. In the first case the three lights are added, for each is transmitted to the eye independently of the others, while in the second case the colours are superposed and the light that passes is only that which is absorbed by neither of the three. In the first case the result is the sum of the transmitted lights, while in the second it is the sum of the absorptions that has to be considered. Practically speaking, though not quite actually, the colours used in the second case have to be complementary to those in the

first case. The first thing to be done is to settle on the three fundamental colours. Ives and others have sought to follow the three-colour sensation spectrum curves founded on the Young-Helmholtz theory of colour, as drawn by Clerk-Maxwell and later by Sir William Abney. Colonel A. F. von Hübl, in his "Three-Colour Photography," just published in English (translated by Mr. H. O. Klein), arranges a diagram in which the normal spectrum forms a circle with purple between the violet and red, white being at the centre of the circle, and the remainder of the space being filled with whitish tints of the periphery colours. He says that an infinite number of systems of three theoretically correct fundamental colours may be selected by taking any three that are  $120^\circ$  distant from each other. But as blue is the darkest colour it must be one of the three fundamentals, and, of course, red and green follow. Hübl asserts that Ives's curves are entirely different from those which the theory of Helmholtz requires, and are based on Maxwell's colour-mixing experiments, in which three spectrum colours were assumed as fundamentals. Hübl, by means of a similar diagram, but with black (total absorption) at the centre, finds the three fundamental colours for superposition. "Three narrow-banded colours, situated in the colour circle at  $120^\circ$  from each other, form a suitable colour system for trichromatic printing, and a great number of such theoretically possible systems can be ascertained." But here again we are limited to one system. As "yellow cannot be produced by pigment mixtures . . . this colour must form one of the fundamental colours." "The yellow must be absolutely correct and must not be of a reddish tint," or any neutral pure yellow would be missing in the print. Both methods, therefore, in both cases give no choice for a perfect system, and the practical results as obtained by those who have worked them out on these rather different plans are very similar.

But it is not simply a matter of dividing the light into three suitable parts. The object of the division is to get a photographic record of each, and as no photographic plate yet made has a sensitiveness to various colours proportional to their brilliancy to the eye (or rather will give densities by exposure and development proportional to these brilliancies), the colour screens or filters that divide the light into the selected fundamental parts have to compensate for the deficiencies of the plates used. Now, this compensation can only be done by reducing the light that produces an excessive effect; it therefore always leads to the necessity for a lengthened exposure. Practically, a lengthened exposure means a more costly procedure, if only because, for the same capital outlay in apparatus and accommodation, less work can be done in a given time. But, even disregarding such considerations as these, ordinary plates are so little sensitive to red that it would be hardly possible to get a photograph on them of the red image, because the very protracted exposure would give the opportunity for all sorts of interfering circumstances to produce their characteristic errors. The sensitising of the plates to be used for the green and red elements becomes, therefore, an essential part of the procedure. About two years ago, Dr. Miëthe, of Berlin, showed some results of three-colour work that attracted considerable attention, the superiority of which was partly due to the use of ethyl red, a cyanine derivative, instead of the cyanine invariably used until then. Plates treated with this sensitiser give with the prismatic spectrum an almost even density from nearly C to the violet, the deficient sensitiveness in the green that most sensitisers (including cyanine itself) give being hardly appreciable. Last year a still better sensitiser was introduced, namely, "orthochrome T," and a few months ago this was found to be surpassed by

"pinachrome," both these being cyanine derivatives. Dr. E. König, who has investigated the comparative merits of these three sensitizers, states that if the sensitiveness conferred by ethyl red to red light is regarded as 100, "orthochrome T" gives a sensitiveness of 160 to 180, and "pinachrome" 450 to 500. But the density that the best of these sensitizers gives on development in the red and green of the spectrum is not proportional to the luminosity of these colours, therefore the exposure for these colours has to be longer than for the blue, but only about three times as long.

Theoretically perfect colour screens or filters are therefore useless, because a perfect plate, so far as the interpretation of colour is concerned, has not yet been produced. The colour screens and plates must be tested together, and for this purpose it is necessary to have recourse to the spectroscope, making photographs, of course, under the various conditions. But

that should be obtained when this is photographed, using the given plate and each of the three colour screens in turn. To facilitate the use of the chart, an extra copy is provided in a pocket on the cover of the book. A grey scale of different shades, made on platinum printing paper, is exposed and developed with the colour chart, and the three prints should show this grey scale alike, when the differences due to the colour screens should be as shown in the three prints supplied.

CHAPMAN JONES.

(To be continued.)

#### REFLEXIONS IN WATER.<sup>1</sup>

THERE are few studies more fascinating than that of the reflexions formed naturally in the sea, and in rivers and lakes. In the first place, this study is naturally pursued in the open air; further,



FIG. 1.—Old Harbour Side, Scarborough. From "Light and Water."

spectroscopic results are so liable to deceive observers who are not thoroughly accustomed to such work that less discriminative methods of testing are generally preferred. The colour sensitometric methods that Sir William Abney has done so much to perfect are often employed for this purpose. A series of small pieces of suitably coloured material are arranged in such a manner that when the plate is exposed through its screen and this sensitometer a definite and easily recognisable result will be obtained if the plate and screen are mutually correct. Or the colours may be arranged on a rotating disc concentrically with a grey produced by the mixture of definite proportions of black and white, so that the colour and the grey will give an equal density in a photograph of it taken in the camera through the screen on the plate. Colonel Hübl, in the volume above referred to, gives a colour chart that consists of small patches of nine pigments, with the results

the effects observed are often of surprising beauty; and lastly, most, if not all, of the phenomena observed can be explained in accordance with a few simple principles, so that it is possible for almost anyone possessing a trained faculty of observation to add to our knowledge in this direction. In writing a book on reflexions in water, Sir Montagu Pollock has entered an almost untrodden region within the borders of both art and science; with the exception of some passages in the works of Mr. Ruskin, it would be difficult to refer to any other work dealing with the same subject. It is no small accomplishment to produce a book in which so many intricate effects are traced to their causes, using language

<sup>1</sup> "Light and Water: a Study of Reflexion and Colour in River, Lake, and Sea." By Sir Montagu Pollock, Bart. Pp. xii+115; with 39 plates and 28 explanatory figures. (London: George Bell and Sons, 1903.) Price 10s. 6d. net.

of the simplest, and yet sacrificing nothing in the way of accuracy and clearness; and, although the book was written to aid artists in their study of nature, it will none the less be welcomed by men of science and those amongst the general public who attach importance to accurate observation.

There are some artists who make no secret of their disdain for scientific methods as an aid to their work; but even these, on reading Sir Montagu Pollock's book, will be forced to admit their indebtedness. Some sort of scientific method is indispensable for accurate observation of reflexions in water. Even reflexions in still water differ from what would be expected by an untrained observer; the reflected image is indeed generally a counterpart of the object, but it not uncommonly presents an entirely different aspect. Many striking instances of this are discussed and explained in the first chapter; one of the most remarkable is afforded by the reflexion of a rainbow in a lake, which is really the image of a bow quite distinct from the one seen directly. When we come to the study of reflexions in rippled water, further complications arise; in the second chapter, the reader is led on from the most simple and elementary facts to appreciate and understand complicated effects such as are reproduced in the accompanying illustration (Fig. 1). In such cases some amount of scientific training is absolutely necessary to one who would give a faithful pictorial representation of nature; for the appearance presented changes every instant, and without the aid of some sort of clue one can scarcely avoid obtaining inharmonious effects. But even in still water, where there is no incessant change to distract the attention, there are yet many opportunities for the artist to go wrong; without a very accurate knowledge of fundamental principles, it would be impossible, for instance, to deduce the nature of the reflexions shown in Fig. 2 from the actual appearance of the objects reflected. Notice, for instance, that while the reflected image of the spire of the distant church is seen, the body of the church and the dark hill behind it are not present in the reflexion; there is even no image to be seen of the shore between the church and the water.

The third and fourth chapters are devoted to a study of the colours in still and rippled water. This part of the subject is exceedingly complicated, and it is difficult to make any general statement which will help us to predict the exact colours to be seen under given conditions. The observed colour of the water is due, partly to light reflected from the surface of the water; partly to light scattered by minute particles floating on the surface; partly to the

inherent colour of the water, modified, maybe, by the presence of fine suspended particles; partly to the colour of the stones, sand, or mud at the bottom of the water; and, lastly, the whole effect is complicated by "contrast," which may modify greatly the various colours observed. For instance, standing on one of the cliffs of Sark, and looking out over the sea, the latter often appears of a vivid green, dappled here and there with patches of intense purple. Careful observation shows that the purple patches mark the

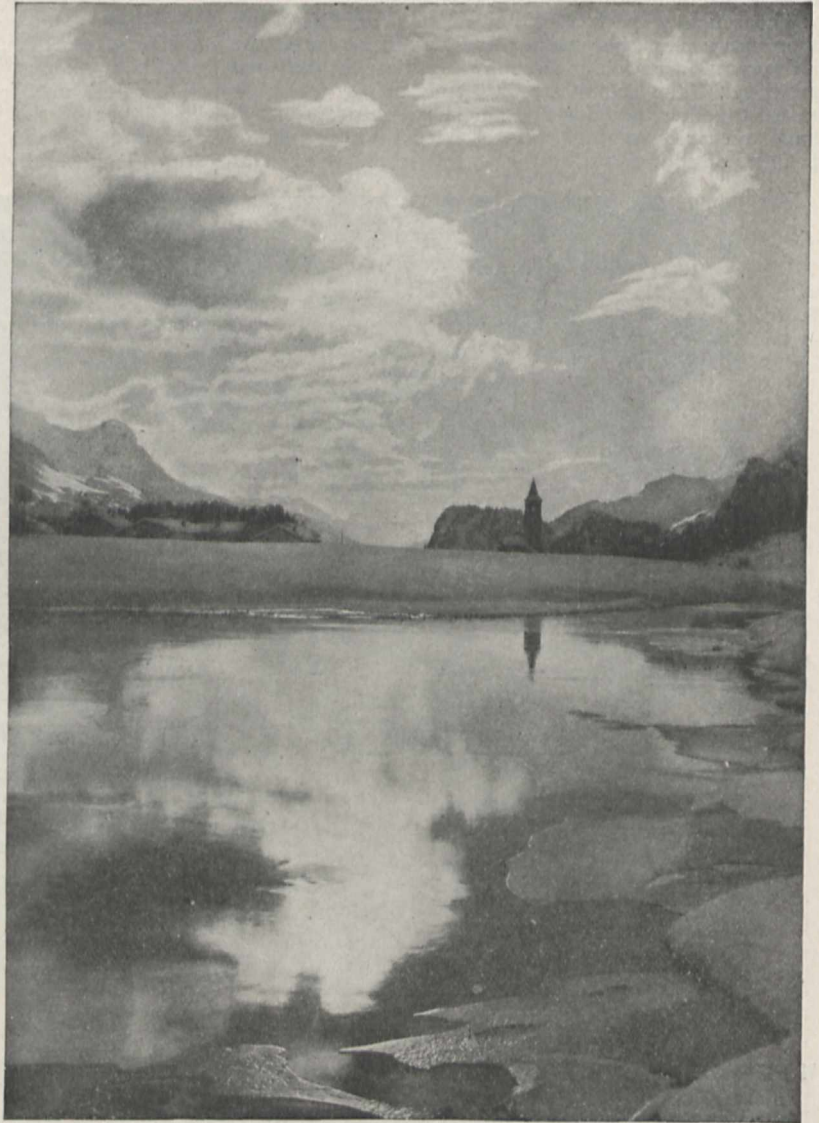


FIG. 2.—Siils Basaglia, Upper Engadine. From "Light and Water."

sites of submerged beds of sea-weed; but the weed is not itself purple, but of a dark olive-green colour, so that the colour of the patches is not easily explained. The most probable explanation appears to be as follows:—The sea-water is itself blue, *i.e.*, it is relatively opaque to red and partly opaque to yellow light. Yellow light is most copiously reflected from the sandy bottom of the sea, so that, on the whole, the greater part of the light reflected from the bottom of the sea which reaches our eyes is green. The beds of sea-weed merely act as general absorbers, and would give rise to dark patches were



it not for the effect of contrast; it is well known that a grey object lying on a vividly green ground appears to be of a reddish or purplish hue. It may here be remarked that this phenomenon yet awaits explanation; it was at one time thought that the eye insensibly travelled over the green expanse, the green colour sensation became fatigued, and faint white light afterwards provoked the complementary sensation. It has been found, however, that the same colour phenomena are observed when the illumination is instantaneous, so that this theory falls to the ground.

Finally, it may be stated that Sir Montagu Pollock's book is throughout of absorbing interest; the excellence of the illustrations can be inferred from an inspection of those used to illustrate this short notice, and the printing is everything that could be desired.

EDWIN EDSER.

#### NOTES.

WE understand that the second International Wireless Telegraph Conference, which was to have been held in Berlin on October 6, has been postponed until next spring. It will be remembered that the Wireless Telegraph Act which was passed at the end of last session was rushed through the House partly that the Government representatives might have a better basis for making agreements at this conference. It is stated that a considerable number of applications for licences under this Act have been received by the Postmaster-General. Some of these applications come from the submarine cable companies.

THE funeral of Prof. Niels Finsen at Copenhagen on September 29 was attended in person by King Christian, King George of Greece, Queen Alexandra, and all the other Royalties now in Copenhagen, as well as by the Danish Ministers of State, members of the Diplomatic Corps, the president of the Danish Parliament, the Burgomasters of Copenhagen and the chief provincial towns, and numerous representatives of foreign scientific institutions, universities, and societies. King Edward was represented by the British Minister, Sir W. E. Goschen. A number of Danish medical men have issued an appeal for the erection of a monument to Prof. Finsen by voluntary contributions.

A NEW association, the Institute of Hygiene, has been formed having for its object the dissemination of knowledge on the subject of personal and domestic hygiene. It aims to be self-supporting, and in order to accomplish this has organised a permanent exhibition of hygienic products and appliances, e.g. foods, clothing, filters, stoves, &c., open free to the general public, and a special section devoted to drugs and medical and surgical appliances to which medical men alone are admitted. The revenue gained from the rents paid by exhibitors will be devoted to educational work, which will take the form of local lectures, with examinations and certificates. The exhibition, which was formally opened by Sir Joseph Fayrer on September 30, is housed at 34 Devonshire Street, W.

A VISIT by a party of French physicians and surgeons is about to be paid to London. The party is to arrive on October 10, and will comprise some 150 gentlemen. A committee, of which Sir William Broadbent is president and Sir Thomas Barlow treasurer, has been organised to make arrangements for their reception and entertainment, Dr. Dawson Williams and Dr. Jobson Horne being the honorary secretaries. They will be entertained at a banquet at the Hotel Cecil on October 12.

PROF. KOCH has retired from the post of director of the Institute for Infectious Diseases at Berlin owing to the increasing demands which other bacteriological work make upon his time and energies. The Berlin correspondent of the *Times* states that in the course of the winter Prof. Koch will proceed to German East Africa in order to continue those studies of tropical and other diseases which he had not completed during his recent visit to Rhodesia. In particular he will continue to investigate the part played by ticks in conveying the infection of various cattle diseases.

A CONFERENCE on agricultural education will be held in the Shire Hall, Gloucester, on Saturday, October 15, under the presidency of Sir John Dorington, M.P. At the morning session Lord Onslow will deliver an address, and the other speakers will include Sir W. Hart Dyke, Prof. T. H. Middleton, and Lord Monteagle. At the afternoon session Sir T. Dyke-Acland, Sir John Cockburn, Mr. A. D. Hall, and others will address the conference.

THE deaths are announced of Prof. E. von Martens, vice-director of the Berlin Zoological Museum, and Dr. P. van der Vliet, formerly professor of physics at the University of St. Petersburg.

THE Physico-Mathematical Society of Kazan has awarded the Lobatchewsky prize to Prof. D. Hilbert, of Göttingen, for his book on "Die Grundlagen der Geometrie" and other researches. The Lobatchewsky gold medal has been conferred on Prof. Poincaré, and Profs. Mansion, Laisant, and Peano have been elected honorary members of the society.

THE twenty-fifth annual "Fungus Foray" of the Essex Field Club will be held on Saturday, October 15, at High Beach, Epping Forest. The referees will be Dr. M. C. Cooke and Mr. George Masee, of the Kew Herbarium. Mr. Masee will read a paper on some diseases of trees. Any botanists wishing to attend should communicate with the secretary, Buckhurst Hill, Essex.

PROF. FEHR, of Geneva, editor of *L'Enseignement mathématique*, is circulating among mathematicians an inquiry form containing a number of questions relating to their manner of working. These questions refer to such points as when and where the mathematician answering them acquired his taste for mathematics, whether his researches are suggested by the study of mathematical literature or the ideas come to him spontaneously, whether he publishes his ideas immediately or leaves them for a time, whether he observes regular rules in his living, whether he finds the morning or evening best for work, and so forth. The answers are to be analysed by Prof. Th. Flournoy and Dr. E. Claparède, both experienced psychologists.

THE system of "normal piling" which forms the basis of Prof. Osborne Reynolds's "Theory of the Universe," is discussed by the late Prof. J. D. Everett in the *Philosophical Magazine* for July. In the review of Prof. Reynolds's work, which appeared in *NATURE*, attention was directed to the fact that the arrangement of spheres consistent with minimum volume is not unique. Prof. Everett's paper states that every system of maximum compactness consists of parallel tiers in triangular arrangement, but each tier can be fitted over the one below in two ways. When two tiers have been placed the piling will be normal if the spheres of the third tier are *not* vertically above those of the first; but another arrangement, giving rise to what Prof. Everett called *antinormal* piling, may be obtained by placing the third tier in the spaces above the first.

AMONG recent contributions to aeronautics, considerable interest attaches to Mr. A. F. Zahm's paper on atmospheric friction, published in the *Bulletin* of the Philosophical Society of Washington, xiv., pp. 247-276. It is commonly assumed by experimenters that skin friction in ordinary gliding models is a negligible quantity, but Mr. Zahm finds that the frictional resistance is not improbably as great for air as for water in proportion to their densities, and, indeed, that it constitutes one of the chief obstacles to bodies and aërosurfaces gliding at high speeds. By plotting the relations between velocity and resistance on logarithmic squared paper, the author found for plane surfaces that the frictional resistance varied as the power of the velocity with index 1.85. Prof. M. Smoluchowski-Smolán, in his paper in the *Philosophical Magazine* for June on the principles of aerodynamics, discusses the equations of motion of a compressible fluid when account is taken of thermodynamical effects, and he applies the principle of dynamical similarity to certain physical problems. The *Scientific American* for September 10 contains two illustrations of gliding machines. The idea of attaching a machine to a bicycle in order to attain the requisite speed has doubtless frequently suggested itself to experimenters, and Mr. S. V. Winslow contributes a photograph of a "bicycle aeroplane," which he alleges "has proven perfectly successful so far as balancing is concerned." The figure of Prof. Botts's circular aeroplane, furnished with vertical screws in the centre, reminds one of the illustrations in the well known "Histoire des Ballons" of Tissandier, and it may be safe to predict that a small model of this pattern would constitute a pretty toy, and would sail well through a room.

In the *Journal* of the Royal Microscopical Society for August, a simple direct proof of Abbe's theorems on the microscopic resolution of gratings is given by the late Prof. J. D. Everett, F.R.S.

In the *Physical Review* for July Mr. N. A. Dubois describes a simple method of employing allotropic silver for the preparation of conducting fibres for quadrant electrometers and other similar apparatus. The author finds that dried films of allotropic silver, although poor conductors, become very good conductors on being treated with gaseous hydrochloric acid, and that the method can be applied to the most delicate apparatus in a few minutes without risk of injury.

MESSRS. E. L. NICHOLS and E. Merritt describe some interesting studies on fluorescence in the *Physical Review*, xix., 1 (July). The authors found that eosin, naphthalin roth, fluorescein, quinine sulphate, chlorophyll, canary glass, green and white fluorspars, and other substances exhibited the same types of fluorescence, the spectrum consisting of a single band near the infra edge of the corresponding absorption band. The position of the maximum and the distribution of intensity was independent of the wave-length or composition of the exciting light. Fluorescence near the red or violet ends was traceable further towards the opposite end than is the case with bands near the middle of the spectrum, because of the increased luminosity in these directions. In no case did Stokes's law hold. Fluorescent substances having absorption bands of shorter wave-length than that with which fluorescence was associated were excited by light in that band, but the same was not the case when the wave-length was longer. Finally, where more than one fluorescence band existed, it was considered probable that each was due to a different fluorescent material, as no case of multiple fluorescence occurred where only one fluorescent substance was present.

THE first two numbers (July and August) of a new magazine—*Le Radium, La Radioactivité et les Radiations*—received from MM. Masson and Co., Paris, contain many useful and interesting articles on radio-activity and allied subjects. These articles are not original contributions, but are readable and well illustrated accounts of very recent original work. Several deal with recent attempts to use radio-active bodies for therapeutic purposes. There are in addition reviews of recent papers, notices of new books, and a correspondence column. While such a magazine may not be essential to those who are able to keep in touch with the recognised scientific journals, it will probably be found useful by many interested in the subject.

THE meteorological observations and results relating to the Bremen Observatory for 1903 have been published by Dr. Paul Bergholz. The volume forms one of the series of the *Deutsches meteorologisches Jahrbuch*; it therefore follows that the work leaves nothing to be desired. The tables show the actual readings at three hours daily, with monthly and yearly means, and daily means for each hour. In addition, there are phenological and other observations for Bremen, and rainfall summaries for several stations in connection with the observatory.

WE have received the report on rainfall registration in Mysore for 1903, by Mr. J. Cook, director of meteorology in that province. The number of Government stations is 194. In addition to the tables, the report includes useful maps showing average monthly, yearly, and geographical rainfall for thirty-four years (1870-1903). During 1903 some heavy falls in twenty-four hours are recorded:—11 inches in the district of Shimoga, in July; 11.5 inches in Kolar, in November; 12.65 inches in Kadur, in July. Mr. Cook states that a station which escapes inspection even for a single year is most likely to be defective in some particular; a yearly inspection would obviously entail a large amount of expense in travelling, and its necessity would seem to point to want of interest by the observers in their work.

WE have received a copy of a second edition of Mr. Conway Belfield's "Handbook of the Federated Malay States," which has just been published. The book has been thoroughly revised, and the statistics brought down to the end of the year 1902.

PROF. J. CVIJIĆ contributes to the *Mitteilungen* of the Vienna Geographical Society an important paper summarising the results of recent research on the glacial phenomena of the Balkan peninsula, and correlating them with the results of similar investigation in the Alps and Carpathians.

WE have received the third *Bulletin* of the International Council for the Study of the Sea, containing the observations made during the cruises of the different vessels in February, 1904; also No. 14 of the council's *Publications de Circonstance*, on surface temperature observations in the North Sea, by Dr. Evan Everdingen and Dr. C. H. Wind.

A SERIES of gazetteers of the States is being published by the U.S. Geological Survey. During the last few weeks gazetteers of Virginia, Maryland, Delaware, and Texas have appeared, each giving a general description and an account of special features. Another valuable publication of the same department is a third edition of the *Bulletin* on the "Boundaries of the United States and of the Several States and Territories."

THE Central Meteorological Observatory of Japan has issued the first of a new series of *Bulletins*, in which it is

intended to publish the results of researches on meteorology and allied sciences made by members of the staff of the observatory. The present *Bulletin* contains valuable papers on earth temperature at Tokio, the mean annual temperature of the surface of the sea in the Western Pacific Ocean, the epochs of the first ice in Japan for 1902, and evaporation in Japan.

A VALUABLE contribution to the theory of oceanic currents is made by Prof. Otto Pettersson in a paper on the influence of ice-melting upon oceanic circulation, published in the September number of the *Geographical Journal*. Prof. Pettersson describes the results of some remarkable experimental work, and gives an account of recent theoretical inquiries by himself and others, applying the results to the elucidation of the complex circulation in the Norwegian Sea and the north polar basin. An interesting point is the suggestion that the problem of forecasting the monsoons of India may ultimately be solved by a systematic survey of the hydrographic conditions in the Indian Ocean.

THE analyses given in the Jamaica *Bulletin* of the Department of Agriculture (August) testify to the purity of the native sugars, but where the sugar is required for preserving fruit the addition of an antiseptic is found to be necessary in order to prevent infection with *Torula*. Experiments are being made with calcium bisulphite.

MORE than a dozen fungi have been recorded as destructive parasites on vine-roots, and to these an addition has been made by Dr. Istvánfi, who describes in the third volume of the *Annals* of the Royal Hungarian Viticultural Institute how he has traced the cause of disease in several districts in Hungary to the ravages of the Gasteromycete, *Ithyphallus impudicus*.

THE second part of "Plantæ Yucatanæ," forming vol. iii. of the botanical series of the Field Columbian Museum, Chicago, was issued in April, and deals with the Compositæ. The features of this work, which include only plants of the northern half of Yucatan, are the descriptive accounts, with occasional notes on native names and uses, by Dr. Millsbaugh and the excellent drawings of flower and fruit executed by Mrs. Chase for each species.

THE most striking features of the North American and Mexican deserts are discussed at some length in Schimper's "Plant Geography." In the *Botanical Gazette* (July) Dr. D. T. MacDougal gives an account of the expedition which he arranged to explore the delta of the Rio Colorado and that practically unknown portion of the Mexican desert which lies on both sides round the head of the Gulf of California. Amongst the xerophytes, which were found in the regions of extreme aridity, were many perennials containing latex and a large number of forms which secrete volatile oils or exude resinous gums; but plants with massive storage organs were absent, a fact which Dr. MacDougal attributes to the excessively small and even distribution of the rainfall throughout the year.

THE two articles in the September number of the *Zoologist* are devoted to ornithology, Mr. F. M. Littler treating of the birds of Tasmania, while Sergeant H. Mackay, of the 2nd Highland Light Infantry, discusses those of Jersey. It is highly satisfactory to find a non-commissioned officer of His Majesty's Service studying the zoology of the district in which he happens to be quartered.

THE report of the Indian Museum, Calcutta, for 1902-3, and that of the Albany Museum, Cape Colony, for 1903, are just to hand. Both institutions appear to be in a flourishing condition, although there are complaints from both of insufficient numbers on the staff to cope with the work.

The registered additions to the Indian Museum during the period covered by the report numbered 2096 specimens, of which 326 were archæological and the remainder zoological. It is satisfactory to note that the Albany Museum is making strenuous efforts to secure a representative series of the large mammals of the Cape Colony and adjacent districts, its present deficiency in the smaller forms being a matter of little consequence, as these are in no present danger of extermination.

THE prophylaxis of malaria was exhaustively discussed in the section of tropical diseases at the recent meeting of the British Medical Association (*Brit. Med. Journ.*, September 17, p. 629). Dr. Strachan, C.M.G., principal medical officer of Lagos, West Africa, emphasised the value of anti-mosquito measures and of the prophylactic use of quinine. Captain James and Lieut. Christophers, from their experience at Mian-Mir (see *NATURE*, lxi. p. 467, and lxx. p. 230), doubted the universal applicability of anti-mosquito measures for the reduction of malaria. Prof. Ronald Ross, F.R.S., criticised the work and conclusions of the last named observers on the following grounds:—(1) it is doubtful if mosquito propagation at Mian-Mir was really suppressed to the extent claimed; (2) the tests employed for detecting reduction in the number of mosquitoes were not conclusive; (3) the figures given regarding the variations in the amount of malaria are inconclusive; (4) the whole experiment is open to the final criticisms (a) that it might not have been continued long enough, and (b) that the radius of operations might not have been large enough. He considered that all that the experiments proved was that after operations (i.e. anti-mosquito measures) extending to a half-mile radius, lasting a year and a half, and apparently costing between two and three hundred pounds, no very large reduction in the number of mosquitoes or in the amount of malaria was apparent.

MESSRS. CHARLES GRIFFIN AND Co. have just published the sixth edition, revised and enlarged, of Mr. Andrew Jamieson's "Elementary Manual of Applied Mechanics."

MR. BALFOUR's presidential address delivered before the British Association at the recent meeting at Cambridge, and printed in *NATURE* of August 18, has been published in pamphlet form by Messrs. Longmans, Green and Co. The price of the pamphlet is one shilling net.

A CHEAP edition of Lord Avebury's book on the "Scenery of England" has been published by Messrs. Macmillan and Co., Ltd. The book contains nearly two hundred illustrations—many of them full-page and all instructive—and in its new form it should be the means of creating wide interest in the scientific significance of scenery.

THE first volume of *Technics*—a magazine for technical students—is full of useful articles and notes on many aspects of technology. There are descriptions of institutions where the work of higher scientific and technical education is being developed, articles on the education of engineers, educational systems, designs, materials and manufactures of various kinds, photography, bacteriology, and many other departments of pure and applied science. The magazine is well illustrated, and should be of real service to technical education in this country. The publishers are Messrs. George Newnes, Ltd.

MR. EDWARD ARNOLD announces an illustrated work on "English Estate Forestry," by A. C. Forbes.

THE list of announcements of the Cambridge University Press includes:—"Mathematical and Physical Papers by the late Prof. Sir G. G. Stokes, Bart., F.R.S.," vol. v.;

"The Collected Mathematical Papers of Prof. J. J. Sylvester, F.R.S.," vol. ii.; "The Dynamical Theory of Gases," by J. H. Jeans; "The Analytical Theory of Light," by J. Walker; "A Treatise on Analytical Dynamics," by E. T. Whittaker; "Alternating Current Theory," by A. Russell, in two vols.; "The Study of Chemical Composition," by I. Freund; "The Fauna and Geography of the Maldive and Laccadive Archipelagoes: being the Account of the Work carried on and of the Collections made by an Expedition during the years 1899 and 1900 under the leadership of J. S. Gardiner," vol. ii., part iv., illustrated; "Reports of the Anthropological Expedition to Torres Straits by the members of the Expedition," edited by Dr. A. C. Haddon, F.R.S.; "Studies from the Anthropological Laboratory in the University of Cambridge," by W. L. H. Duckworth, vol. i.; "On two Orders of Arachnida: Opiliones, especially the Suborder Cyphophthalmi and Ricinulei, namely the family Cryptostemmatoidae," by Drs. H. J. Hansen and W. Sørensen, illustrated; "Immunity in Infectious Diseases," by Prof. Metchnikoff, authorised English translation by F. G. Binnie, illustrated; "Morphology and Anthropology," by W. L. H. Duckworth; "The Origin and Influence of the Thorough-bred Horse," by Prof. W. Ridgeway; "Fossil Plants: a Manual for Students of Botany and Geology," by A. C. Seward, F.R.S., vol. ii.; "Trees: a Handbook for Students of Forest Botany," by Prof. H. M. Ward, F.R.S., in six volumes, vols. ii. to vi.; "The Morphology of Plants," by J. C. Willis; and "The Journal of Agricultural Science," edited by Prof. T. H. Middleton, T. B. Wood, R. H. Biffen, and A. D. Hall.

MESSRS. JOHN WILEY AND SONS (New York) and Messrs. Chapman and Hall, Ltd. (London), have in preparation:—"An Elementary Treatise on the Differential Calculus, Founded on the Method of Rates," by W. W. Johnson; "A Treatise on Concrete, Plain and Reinforced," by F. W. Taylor and S. E. Thompson; "Elements of General Drafting for Mechanical Engineers," by C. E. Coolidge and H. F. Freeman; "Conversations on Chemistry," by W. Ostwald, translated by E. C. Ramsay, part i.; "Machine Shop Tools and Methods," by W. S. Leonard; "Ordinary Foundations, including the Cofferdam Process for Piers, with numerous Practical Examples from Actual Works," by C. E. Fowler; "The Textile Fibres, their Physical, Microscopical, and Chemical Properties," by J. M. Matthews; "Manual of the Chemical Analysis of Rocks," by H. S. Washington; "Untechnical Addresses on Technical Subjects," by J. Douglas; "Techno-Chemical Analysis," by G. Lunge, translated by A. I. Cohn; "Application of some General Reactions to Investigations in Organic Chemistry," by Prof. Lassar-Cohn, translated by J. B. Tingle; "Notes on Assaying and Metallurgical Laboratory Experiments," by R. W. Lodge; "Elements of Mechanism," by P. Schwamb and A. L. Merrill; "An Introduction to Projective Geometry and its Applications, an Analytic and Synthetic Treatment," by A. Emch; and "Manual of Serum Diagnosis," by O. Rostoksi, translated by C. Bolduan.

#### OUR ASTRONOMICAL COLUMN.

THE SOUTH TEMPERATE SPOTS ON JUPITER.—In a letter to No. 348 of the *Observatory*, Mr. Denning directs attention to the need for further observations of the white spots which encroach on the south side of the south temperate belt of Jupiter.

On August 9 he saw two brilliant spots in this locality, having the longitudes  $254^{\circ}.1$  and  $290^{\circ}.1$  respectively, and has little doubt that these are identical with those he observed in 1903 and previously.

As Mr. Denning has suggested that the movements of these objects may cause the observed irregularities in the velocity of the great red spot—the velocity of which is a little less—it is important that they should be frequently observed, and the results of the observations published.

The spots lose about  $16^{\circ}.4$  per month relatively to Crommelin's System ii., and their positions for the next few months will be as follows:—

		I.			II.
		Long.			Long.
1904	Oct. 15	...	218.4	...	254.0
	Nov. 15	...	202.0	...	237.6
	Dec. 15	...	185.6	...	221.2
1905	Jan. 15	...	169.2	...	204.8
	Feb. 15	...	152.8	...	188.4

Mr. Denning will be pleased to receive records of new or old observations of these objects.

A RAPIDLY MOVING SOLAR PROMINENCE.—A fairly large prominence having a great velocity was observed by Mr. J. B. Coit, of Boston University, on May 23. Whilst setting the slit of his spectroscope on  $H\alpha$  he noticed a cloud-like arch, made up of radial filaments, stretching from  $P=89^{\circ}$  to  $P=100^{\circ}$ , the space below the arch being apparently quite blank. At 11h. 55m. the altitude of the prominence was  $90''$ , and it quickly increased to  $105''$ , after which it rapidly decreased until, at 11h. 58m., it was only  $70''$ . By this time all semblance to the original structure was lost, and only a few cloudlets remained. At 12h. 1m. nothing could be seen above the limb, and the chromosphere between  $89^{\circ}$  and  $100^{\circ}$  was quite tranquil, except for a few small shreds at the places where the ends of the arch had rested. Subsequent observations with a 5-inch equatorial showed no trace of spots or bright faculae on or near the limb in this region (*Popular Astronomy*, No. 7, vol. xii.).

PUBLICATIONS OF THE GRONINGEN ASTRONOMICAL LABORATORY.—Two numbers of these *Publications*, which are printed in English and edited by Prof. Kapteyn, have just been received. No. 12 is devoted to the results of an investigation by Dr. W. de Sitter of the systematic differences between the photographic and visual magnitudes of stars depending upon the galactic latitude. The investigation was carried out at the Cape Observatory, Dr. de Sitter taking the photographs and Mr. R. T. A. Innes making the visual observations.

The results show, among other things, that the colours of the stars near the galactic poles seem to be distributed at random, and, further, that no *average* colour exists for those in the galaxy, but rather that there are colour differences which vary irregularly with the galactic *longitude*. This interesting result calls for further investigation, and Dr. de Sitter suggests several methods which might be employed to elucidate the matter further.

No. 13 of the *Publications* contains a catalogue of the proper motions of 66 stars of the Hyades, derived from the comparison of thirty-four catalogues published between 1755 and 1900. This work was performed by Herr H. A. Weersma to facilitate the reduction of Prof. Duner's plates, which were taken for the purpose of determining the proper motions of the Hyades stars. The results are given in detail in the paper, which concludes with a general catalogue of the 66 stars, showing their magnitudes, their positions for 1900, and their proper motions.

THE GOODSSELL OBSERVATORY EXPEDITION TO THE ROCKY MOUNTAINS.—A short general description of the results obtained by Dr. H. C. Wilson and Prof. Payne during their sojourn at Midvale (Mont.), which is situated at an altitude of about 4800 feet in the Rocky Mountains, is given in No. 7, vol. xii., of *Popular Astronomy*.

The expedition was undertaken in order to photograph some of Herschel's suspected nebulous regions under exceptionally good atmospheric conditions. The heavy dews, caused by a difference of 40 or 50 degrees between the day and night temperatures, and the smoke from neighbouring forest fires somewhat interfered with the carrying out of the entire programme, but on the whole the photographs obtained were very successful. A full description of the work accomplished, the observing conditions, &c., is promised for a later publication.

### ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

THE address of the president, Mr. Henry Balfour, dealt with the subject of evolution in the material arts as illustrated by the work of the late Lieut.-General Pitt Rivers, and has been already printed in full in NATURE (September 1).

#### *Evolution in the Material Arts.*

The remainder of the programme on August 18 was appropriately reserved for communications which illustrated the application of the theory of evolution to special problems of art and technology, as follows:—

Prof. Oscar Montelius gave a demonstration of the evolution of the lotus ornament, which, though it brought forward no new points, gave a well illustrated survey of the work of Goodyear and others, and analysed the complicated results of the interaction of naturalistic and conventional treatments of the same original motive. The discussion which followed was mainly directed to secure recognition for other plant-motives, such as the fleur-de-lys, iris, papyrus, as being partly responsible for certain variations of the "lotus-ornament," and the inevitable skirmish followed the mention of the "Ionic capital."

Prof. Flinders Petrie's note on the entomology of scarabs distinguished five principal types of scarab-backs, designed in imitation of five genera of beetles, *Scarabæus*, *Catharsius*, *Copris*, *Gymnopleurus*, and *Hypselogenia*, and showed how the characteristic forms of the head, elytra, and legs of these genera have given rise to a large number of conventional variants. The use of other beetles besides the true *Scarabæus*, for magical purposes, is well attested both by the medical papyri and by the modern folk-lore of Egypt.

Prof. Flinders Petrie's description of his excavations at Ehnasya (*Herakleopolis Magna*), in Egypt, was chiefly noteworthy for his comparative study of the forms of the Roman lamps and terra-cotta figurines, which were obtained in large enough numbers to afford an intelligible series. Here, also, a very few principal types have degenerated into numerous conventional and unintelligible variations, which have often influenced each other and given rise to fresh types based on misinterpretation of the blurred forms. In this instance it is noteworthy that the older and purer forms can be proved to have survived alongside even the most corrupt; as if the latter, though well established, pursued a separate course, and failed to supplant their archetypes.

Another point of some interest in this connection is Prof. Petrie's discovery, near Ehnasya, of a modern Coptic cemetery which preserves, in its tomb-façades and enclosures, many architectural features which are characteristic of ancient Egyptian burial-places.

Mr. R. T. Günther read on August 22 a study of the *cimaruta*, a common Neapolitan charm representing in silver a sprig of rue with magical symbols appended. He brought together a large number of examples, and supplied full details of the successive developments which the originally naturalistic model has undergone, as well as of the significance of the emblems which have been added to the rue-plant to increase its prophylactic powers.

#### *Physical Deterioration and Anthropometric Surveys.*

The session of August 19 was devoted to a systematic discussion of the alleged physical deterioration of the people of these islands, with special reference to the recent report of the Privy Council Committee, and to the scheme proposed by the association's committee on anthropometric investigation for the organisation of an anthropometric bureau to collect and analyse more adequate data than those which are at present available.

The report of the committee on anthropometric investigation was read by the secretary, Mr. J. Gray. Some progress has been made in the determination of the necessary standards of measurement, and the chairman and secretary of the committee have given evidence before the Privy Council's Committee as to the data which already existed, and as to the best means of securing an adequate, continuous, and homogeneous series in future. The committee recommends a small permanent anthropo-

metric bureau, organised as a committee of the Privy Council, with an honorary consultative body, a director and deputy director (trained, one in anthropology, the other in statistical method), and an adequate body of surveyors, male and female, who would visit schools, factories, and other institutions, and secure representative sets of measurements. An appendix to the report takes account of the surveys already in progress in Scottish schools and lunatic asylums, in London hospitals, in Dorsetshire, and among the gipsies of the Scottish border.

Prof. D. J. Cunningham, F.R.S., who is chairman of the anthropometric committee, accepted the general conclusion of the "epoch making" report of the Privy Council Committee, that there was no serious physical deterioration in the nation at large, but held strongly that without proper environment and nurture, and particularly without proper air and food, it was impossible to maintain in the coming generation the mean national standard of physique to which a people tends naturally to approximate, so far as outward circumstances permit. Slow evolutionary changes in this physical standard are taking place, but except in regard to the teeth, which are degenerating rapidly, they may be neglected in practice. The recent improvement in the physique of women of the upper and middle classes is due to healthier conditions and habits, and illustrates their effects. In spite, however, of the labours of the British Association's Anthropometric Committee in 1878-83, the evidence on which all inferences have been based hitherto is fragmentary, ill coordinated, and quite inadequate, and a systematic survey such as is now proposed would put the whole matter on a quite different footing. The cost would be slight, and the national advantage incalculable.

Dr. F. C. Shrubbsall followed with a comparison of the physical characters of hospital patients with those of healthy individuals from the same areas, with suggestions as to the influence of selection by disease on the constitution of city populations. Blondes are found to suffer more than brunettes from rheumatic disorders, and less from tuberculosis, nervous disorders, and cancer. Blondes also suffer more from disease in childhood, and their numbers and proportion consequently diminish until the age of twenty to twenty-five, when the pulmonary tuberculosis of the brunettes begins rapidly to redress the balance. In cities, the most overcrowded and most unhealthy areas are consequently the most brunette, and also have the highest infant mortality through the extinction of blonde children by disease. Dr. Shrubbsall's paper was well illustrated with original tables and maps, and was evidently followed with close attention.

Mr. J. Gray then explained in detail the working of an anthropometric survey, and the valuable results which may be expected from it in anthropological science, and in practical economy and hygiene. Civilisation has brought so many new influences to bear on the more advanced races of mankind that more accurate and copious observations are required to detect in their inception deep-seated changes in the relation of man to his environment, the effects of which may be controlled if recognised in time.

The president of the association, who occupied the chair in the section throughout the session, opened the discussion by the inquiry, what is the precise nature and effect of the set of circumstances which we describe as "town life"? the most important of the temporary and obvious causes of physical deterioration, as opposed to the permanent and insidious causes indicated by Dr. Cunningham. Mere want of indoor ventilation, for example, does not produce deterioration, e.g. in the one-room cottages of the gigantic Lowlanders of Scotland; and both sanitation and quality of food are, on the whole, better in the towns than in the country. Among the causes which might produce permanent changes in the national physique, three seemed particularly noteworthy. Since marriage is later, and families are smaller, in the middle classes than in the lower, facilities for "rising," such as are given by modern education, cannot but diminish the proportion in the next generation of the offspring of the more efficient in this: Town life, too, by encouraging a brunette population, is altering the inherited characteristics of the nation at the expense of the traits which we owe to our blonde ancestry. Further, town life, by attracting the more energetic elements in the rural population, is throwing

upon the less efficient remainder the greater part of the burden of continuing the race. Town life, however, does not seem to be among the factors which it is possible to eliminate by legislation, and it is permanently selective agencies such as this which affect the actual quality of a race.

Sir John Gorst considered it proved that a large proportion of the nation lives in conditions unfavourable to normal development, and that the race is being propagated in undue proportion by the lowest and least fit. The general death-rate decreases, for instance, but not the death-rate for infants. Legislation might fairly prohibit marriage between the immature or the mentally unfit; but the main cause of the relative increase in the low-class birth-rate is, as the Royal Commission in New South Wales has shown, the luxurious reluctance of the well-to-do to take their share in bringing up the next generation. Meanwhile, in so far as it controls any part of a child's lifetime, as it does by compulsory education, the State is so far responsible for securing it sufficient air and food. There are many ways of securing these and of coercing neglectful parents, and local authorities might well be given permission to experiment in the manner suggested by the medical faculty of Scotland in regard to the Scottish Education Bill.

Prof. Rudolfo Livi, director of the Italian Military Survey, described its methods, and replied to Dr. Cunningham's criticisms of military measurements. Conscript statistics, however, yield more representative data than those of a voluntary army, and the Italian survey establishes clearly the correlation between prosperity and enlightenment and immunity from disease. In England, probably the mitigation of extreme social conditions favoured a relatively high physique.

Mr. E. W. Brabrook, secretary of the British Association Committee of 1878-83, urged the importance of uniformity of measurements, and assured the anthropometric committee of the cooperation of existing surveys.

Major McCulloch described the survey, recently ordered, of children in army schools, and discussed practical difficulties of uniform measurements. Prof. A. Macalister insisted on the necessity for large numbers of observations. Statistical conclusions from inadequate data are fallacious.

Mrs. Watt Smyth recommended the inclusion of simple anthropometric observations in the ordinary routine of school registration as an aid to the teacher in following the development of the child. In Boston, U.S.A., such daily observation greatly diminished the risk of infectious disease. The valuable results thus attained would facilitate a full national survey.

Other papers on anthropological organisation occupied the afternoon of August 19. Mr. Edgar Thurston described the progress of the ethnographic survey in Madras, of which he has been the principal organiser, going into details as to method and cost, the nature of the evidence which it is possible to collect, both in anthropometry and in ethnography, the photographic record of racial types, and the difficulties of combined museum and field work such as are unavoidable with an infinitesimal staff working among ignorant and timid populations. He concluded with a summary of the ethnography of the area covered by the survey, and a criticism of the published measurements of the Indian Coronation contingent.

The report of the committee on anthropological teaching described the method of inquiry, and gave details of the position occupied by anthropology or its main subdivisions in some seventy-five universities and colleges in Europe, the United States, and elsewhere, with many interesting data as to the ways in which this comparatively new study has won recognition as an offshoot of this or that recognised subject, and as to the practical applications which are found to emerge wherever a more enlightened policy has permitted a museum or university to provide adequate teaching.

Mr. J. F. Tocher described in detail the recent anthropometric work in Scotland outlined in the morning's discussion, and also the distribution and variation of the surnames in east Aberdeenshire in 1696 and 1896. Migration accounts for the disappearance of many names; but the extinction calculated by Galton and Watson is found to be approximately correct, and likewise the rate of change on Karl Pearson's theory of contingency.

#### Anthropography.

The experiment was made on Monday morning (August 22) of a separate subsection for the discussion of papers on human anatomy and kindred subjects. The lecture room of the zoological department was kindly lent for this, and Prof. A. Macalister presided.

Dr. G. Elliot Smith made a communication on the persistence in the human brain of certain features usually supposed to be distinctive of apes, based on a large series of simple human brains, chiefly African. Simian characters are most conspicuous in the occipital region, because the visual area is as well developed in apes as in man; but though the structure is identical, the shape of this area in man is much distorted by increase of the cortical area in front of it. Simian resemblance is more often retained in the left occipital region than in the right, because in man the visual centre retracts more towards the mesial surface on the right side, and this asymmetry often influences the cranial form. Large "Affenspalten" may occur in various races, but are rarely symmetrical, except in Negro brains, which are distinctly more pithecoïd. In discussion, Mr. Duckworth described similar simian features in Australian brains, with frequency of 50 per cent.; Prof. Grünbaum brought physiological evidence to corroborate the anatomical data; Prof. Windle and Prof. Macalister fully accepted Dr. Elliot Smith's conclusions.

Mr. Duckworth showed photographs of the brain of a foetal gorilla suggesting the artificial nature of the cerebral fissures. Prof. Grünbaum suggested histological examination, and Prof. Macalister summarised the history of the recent study of these features.

Mr. R. B. Seymour Sewell described some variations in the astragalus observed in 1000 specimens, mainly Egyptian. Their angle of collum and corpus is intermediate between the European and the anthropoid; changes in the articular surfaces are determined by the adoption of certain postures, and by the progressive eversion of the foot. Accessory facets are occasionally present, and facets are occasionally fused or absent. The os trigonum is very variable. Prof. Windle criticised Pfitzner's view of the os trigonum.

Mr. P. P. Laidlaw described some varieties of the os calcis, based on the Cambridge collections, namely:—(1) variability of the processus trochlearis, which seems not to develop from a separate ossicle; (2) external plantar tubercle; (3) calcaneus secundarius of Gruber; (4) os sustentaculi proprium; (5) processus trochlearis of Kyrtil, shown to be pathological; (6) variation of facets due to ossicles and other factors; (7) European reduced projection of the heel due to backward extension of the fascia articularis posterior. In discussion, he gave the length of the Egyptian heel-bone as 3 per cent. more than that of the European.

Mr. F. G. Parsons's paper on facial expression discussed the anatomy of the facial muscles, and illustrated their effects from historic portraits. Prof. Windle attributed alteration of expression to habitual action of certain muscles, probably recorded in the subcutaneous tissues; on this foetal evidence should be decisive. Mr. Parsons replied that subcutaneous thickening is already perceptible at the ninth month.

Mr. J. Gray proposed a new system of classifying the records in anthropometric identification. The Bertillon system with fixed subdivisions only identifies 61 per cent. on the first search. The system proposed substitutes progressive subclassification of the data of one measurement by the data of the next in order. Search is further simplified by the use of charts on which dimensions used as coordinates determine the position of a record-number. The discussion only emphasised the need of accurate measurement.

The committee on anthropometric investigations among the native troops of the Egyptian Army reported progress in coordinating Dr. Myers's data. The modern population of Kena province shows less variability in head length and breadth than the prehistoric population (at Nagada), but more in cephalic index. The greater variability of Theban mummies is explicable by racial admixture in a large city. The objections raised to inferences from conscript data seem to be invalid. The Coptic population is apparently more variable than the Mohammedan, apparently because variability increases the chance of survival, and so multiplies among the oppressed.

Dr. Myers's paper on the variability of ancient and modern peoples elaborated the last-named point in comparison with data from elsewhere. Ancient and modern peoples do not seriously differ in variability, provided the external conditions are similar, while favourable conditions tend to homogeneity, *i.e.* regression towards the mean; and *vice versa*.

Mr. Duckworth discussed the methods of graphical representation of the various racial human types employed by Keane, Flinders Petrie, Thomson, and Strentz, and proposed the simile of a protoplasmic origin modified into processes representing the various morphological types.

Prof. A. Macalister exhibited a series of Amorite crania from excavations at Gezer, in Palestine. The people of the first two strata practised cremation, and so destroyed their skulls, but the third and fourth strata show burials in contracted posture, accompanied by food vessels.

#### Linguistics.

On the morning of August 22 Sir Richard Temple, Bart., explained a plan for a uniform scientific record of the languages of savages, which starts from the sentence as unit-expression of a complete meaning, and classifies words according to their function in the sentence. The forms assumed by words grow out of these functions, and are determined by sundry functional affixes. The sentence considered as the elementary component of a language indicates the outlines of a classification of languages, and the conditions under which languages and linguistic groups develop. The plan has been successfully applied to several savage tongues, as well as to Latin, English, and Hungarian, and claims consideration as leading to rapid and accurate analysis and acquisition of language.

#### General Ethnology.

Mr. A. W. Howitt read on Monday a paper on group-marriage in Australian tribes. Among the tribes round Lake Eyre, two forms of marriage occur. One follows upon betrothal of children by their mothers, and the other is the subsequent marriage of the woman to a younger brother of her husband. On ceremonial occasions this latter form of marriage is extended in the tribe by the allotment to each other of men and women who are already allotted to each other under one or other of the two marriages. This group-marriage also occurs in other tribes in south-east Australia, either in the form which it has in the Lake Eyre tribes or as a survival of custom. It is shown by the system of relationship in the Australian tribes to have been at one time common to all. In the Lake Eyre tribes there is female descent with group-marriage. In other tribes in which group-marriage is merely a survival, or is merely indicated by the terminology of relationship, there has been more or less an approach to a form of individual marriage accompanied by a change from female to male descent. Changes such as these are attended also by alteration of the social organisation of the tribes. In one direction there has been a segmentation of the tribe from a division of two intermarrying exogamous moieties of the tribal community to four such divisions, and finally into eight, with a change also in the line of descent. In the other direction there has been a partial or complete loss of this division of the community into four and eight segments. The tribe has become organised on a geographical basis into a number of local groups, and these localities have become exogamous and intermarrying. In these changes in the organisation of the tribes the line of descent has passed from the female to the male line. In the Lake Eyre tribes a group of totems is attached to each exogamous moiety. These remain in existence in the segmentation into four and eight groups. In those tribes where the organisation of the tribe has become local, the totem groups have either become more or less extinct or have changed in extreme cases into magial names without influence in marriage.

Mr. R. S. Lepper offered a discussion of the passing of the matriarchate as observed in southern India, but devoted the time allotted to him to an exhibit of photographs of more or less matriarchal peoples.

On Wednesday M. E. Demolins submitted, under the title "Classification Sociale," an elaborate analysis of types of human society, based upon that of Le Play, but designed

to supersede it by a system based upon modern ethnological data. All human societies are either communistic, relying for social progress on the community rather than on the individual, or particularist, with the reverse tendency. The former dominates the east, and explains its immobility; the latter the west, and causes its progress. The communistic societies pass through the three stages of stability, instability, and chaos. In the third, communism is seen breaking down, as in ancient Greece and Italy, or in eastern Europe now. The particularist societies are in turn rudimentary, chaotic (*ébranlée*), and advanced; to the last, as illustrated in Greater Britain and the United States, belong the social types of the future. Within these main types social growth is conditioned by geographical considerations, which determine the dominant forms of human industry and the institutions which result. The paper, which was well illustrated by printed diagrams, gave rise to a lively discussion.

Dr. W. H. R. Rivers described the funeral ceremonies of the Todas. Among points not previously noted are:—(1) the laying of a cloth on the body by those who have married into the clan; (2) a purification-rite, in which a man in woman's ornaments touches the remains with a bow and arrow; (3) the Toda beliefs as to the incidents of the journey to the other world.

Mr. E. S. Hartland exhibited a votive offering from Korea, representing a tiger in roughly cast iron. The Korean mountains are infested by tigers, which were formerly worshipped, and every pass has its votive shrine; probably, therefore, this votive tiger belongs to some tiger-cult.

Mr. E. P. Martin's paper on the Fulahs of Nigeria, and Prof. Ridgeway's anthropological view of the origin of tragedy, were taken as read.

#### Ægean Archaeology.

The morning session of August 23 was devoted to the results of recent exploration in Crete, and the section adjourned to the New Theatre to secure accommodation for the more numerous audience.

The proceedings opened with a brief address from Dr. P. Kabbadias, Inspector-General of Antiquities in Athens, who discussed the reasons for the great rarity of Neolithic remains in Greek lands, and described the recent operations of the Greek Archaeological Society in Thessaly. Dr. Kabbadias's appearance was received with the utmost cordiality, and expression was given by Sir John Evans, Sir Richard Jebb, and by two successive directors of the British School of Archaeology in Athens to the general appreciation of his services to the cause of Greek antiquities and to the foreign students of all nationalities in Athens.

The report of the Cretan Exploration Committee summarised the course of the British excavations of 1904, and left the way clear for discussion of the results.

Dr. Arthur Evans, F.R.S., explained his preliminary scheme for the classification and approximate chronology of the periods of Minoan culture in Crete, from the close of the Neolithic to the early Iron age. To the period as a whole it is proposed definitely to attach the name *Minoan*, as indicating the probable duration of successive dynasties of priest-kings, the tradition of which has taken abiding form in the name of Minos. It is proposed to divide this Minoan era into three main periods, early, middle, and late, each with a first, second, and third subperiod. The use of the word *Mycenaean* should be confined to objects of the late and subsidiary outgrowth (*Late Minoan III.*), when the fine motives of the "last Palace Period" at Knossos (now *Late Minoan II.*) are already in the state of decadence observable at Tell-el-Amarna (about 1400 B.C.), and even in earlier objects associated with cartouches of Amenhotep III. and his Queen, in Egypt, Rhodes, Mycenæ, and elsewhere. The less decadent forerunners of this style, in the new-found cemetery at Knossos, are still later than the art of the "last Palace Period." The third *late Minoan* period may thus be roughly dated between 1500 B.C. and 1100 B.C.

*Late Minoan II.*, which precedes it, is best illustrated, in the latest palace at Knossos, by the fine "Palace style," with its strong architectonic elements, and marked correspondence, in its latest stage, with the art of the Kefts

and "Peoples of the Isles of the Sea" on Egyptian monuments of the sixteenth century B.C.; and the royal tomb at Knossos contains alabaster vessels of early eighteenth dynasty date. But the "Palace style" must itself represent a considerable period of development, and its earlier phases must go back at least a century earlier. *Late Minoan II.* may thus extend from about 1700 B.C. to 1500 B.C., corresponding with the Mycenaean shaft graves, and at Knossos with the later Class B of the Palace archives in linear script.

*Late Minoan I.*, an earlier stage of the later Palace, marked off by an extensive catastrophe, is clearly shown in the "Temple Repositories" as an age of ceramic transition with naturalistic art at its highest perfection, and Class A of the linear script. The elaborate lid with King Khyan's name, and a monument of thirteenth dynasty period, date this stratum between 1900 B.C. and 1700 B.C.

The *Middle Minoan* age is especially characterised by the polychrome style of vase-painting on a dark ground, and by the conventionalised pictographic script which precedes the linear. In *Middle Minoan III.* the polychrome is degenerate, and naturalism, in reliefs and on gems, is growing; and it is in *Middle Minoan II.* that the polychrome (formerly "Kamares") style reaches its acme. The beginning of this stage is approximately dated by Egyptian motives on the seal-stones, and by the sherds found by Prof. Petrie in the rubbish-heaps of Kahun, dating from the time of Usertesen II. of the twelfth dynasty (2300 B.C. acc. to Lepsius; Petrie and others say nearly 2700 B.C.). In any case the Cretan evidence excludes the recent theory which makes the twelfth dynasty border on the eighteenth. *Middle Minoan I.* is also represented among the Kahun sherds (which thus give a precise upper limit for *Middle Minoan II.*), and mounts back at least to the middle, and perhaps (on Petrie's chronology) to the beginning of the third millennium.

Beyond this lies the long *Early Minoan* cycle of nascent culture, with geometrical decoration and ornament, generally dark on a light ground, though the dark glaze slip itself goes back to the confines of the Neolithic. Raised decoration on the surface of the clay is also abundant, and the hand-polished, dark-faced Neolithic ware survives throughout. The painted decoration also betrays the influence of the earlier incised designs. A section opened below the pavement of the west court shows a distinct stratification of floor levels of this period, of which the earliest (sub-Neolithic) shows incipient light-ground technique, improved Neolithic fabrics, and the first spiral ornaments, carved or incised, the prototypes, probably Cycladic in origin, of the later painted spirals. Early Minoan seal-stones show adaptation of seventh dynasty motives, and vases of syenite, &c., betray intercourse with dynasties I. to IV., while imported black ware from the first dynasty layer at Abydos is indistinguishable from that of sub-Neolithic Knossos. Comparison of Neolithic with Minoan rates of accumulation of debris gives a probable antiquity for Knossos of 12,000 years in all.

Discussion was opened by Prof. Ridgeway, who agreed with the proposed chronology as far back as the beginning of the eighteenth dynasty, but was not satisfied in regard to the twelfth and beyond. The name "Mycenaean" was no longer appropriate in a generic sense, but the term "Minoan" was open to a similar objection when applied to a period so long and early. His chronological objections were supported in detail by Mr. J. Garstang. Lord Avebury, on the other hand, expressed himself prepared for even longer periods in prehistoric chronology, and Prof. Sayce agreed that the interval between dynasties XII. and XVIII., though archaeologically a blank in Egypt, may have been a long one. Dr. Kabbadias and Mr. Hogarth discussed the relations in which Minoan culture stands to Hellenic, the former laying stress on the sociological differences, the latter on the continuity in artistic essentials.

Dr. Evans, in reply, agreed as to the large element of survival from Minoan to Hellenic time, but laid stress on the evidence for the introduction of a fresh ethnic element in the interval. Mr. Garstang's criticisms did not affect the proof that the respective stages of Minoan and Egyptian

culture synchronised at the points indicated in his classification.

Other papers on Cretan archaeology followed.

Mr. R. M. Dawkins described the painted vases of the Bronze age from Palaikastro, in eastern Crete, with special reference to the styles of decoration, to which Dr. Evans's Knossian classification is applicable at all important points.

Mr. R. C. Bosanquet reported progress in the British School's excavations at Heleia (Palaikastro) and Praisos; a late Mycenaean palace has been excavated, and the main street further explored, with the adjacent houses; more middle Minoan ossuaries have been opened, and also a very early burial-place near Kastri, and a later cemetery with larnax-burials. A steatite libation-table yielded an inscription of seventeen Minoan characters. Within the Minoan town a shattered Hellenic sanctuary contained a slab inscribed in letters of Roman date with an archaic Doric hymn in honour of Young Zeus. This identifies the site with the temple of Zeus Diktaios, and consequently the plain of Palaikastro with the classical place Heleia. At Praisos the west face of the Altar Hill has yielded fragments of architecture and inscriptions from a sanctuary on the summit, among them a fresh document of the Eteocretan language in Hellenic characters of the third or fourth century B.C.

Sir Richard Jebb gave a rendering of the hymn to Zeus, and discussed its allusions to the Curetes and their cult, adding a suggestion (based on Plato, *Laws* 624 A) as to the "nine-year" legend of Minoan legislation; and Prof. R. S. Conway discussed the linguistic character of the Eteocretan language in the light of the new inscription from Praisos, which confirms previous results, and indicates an Indo-European type.

Mr. R. C. Bosanquet described a find of copper ingots at Chalcis, in Eubœa, nineteen in number, and of a characteristic Bronze age form already known from Crete, Cyprus, and Sardinia. The source of supply was probably in Othrys, while Chalcis was the chief emporium. The bronze axe-heads frequently found hoarded in the Ægean (e.g. recently in Othrys itself) have shaft-holes too small for use, and may be currency. The memory survived in the Cretan expression "axe" for a fraction of a talent.

Prof. Oscar Montelius gave a well illustrated description of the geometric period in Greece, which succeeds the Mycenaean (late Minoan) in Hellas and the Ægean, though apparently not in Asia Minor. He rejects the view that the geometric style is derived from countries north of Greece, holding that its characteristic motives appear earlier in Greece than in the north. He regards it as a modified continuation of the Mycenaean style, not due merely to the migration of the Dorians (as it is well marked in Attica, which they did not conquer), but mainly to the expulsion of the Tyrrhenian or Pelasgian foreigners, to whom he attributes the Mycenaean culture. He dates the geometric period between the twelfth and the close of the eighth century, and divides it into the three stages marked by the Dipylon, Phaleron, and pre-Corinthian types of vases.

#### Other Archaeological Papers.

Prof. Valdemar Schmidt, of Copenhagen, summarised the latest discoveries in prehistoric science in Denmark. The musical properties of the famous Bronze age trumpets in the Copenhagen Museum have been re-discovered, and are utilised annually. An earlier period has been established in the Danish Stone age than those of the "kitchen-middens" and the dolmens; for a peat bog in W. Zealand, near Mullerey Harbour, yields implements of early types which were dropped by the inhabitants of floating "raft-dwellings." Examination of the impressions of corn grains in prehistoric pottery has established the kinds of wheat and barley which were cultivated at different periods. Systematic archaeological survey has established the true distribution of tumuli and other monuments. The tumuli follow lines which avoid swamps, converge on fords, and otherwise betray themselves as roads, and offer valuable clues for the location of settlements along them.

Miss Nina Layard's further excavations on a Palæolithic site in Ipswich determined a Palæolithic floor sloping to the margin of a former lake, all now buried 8 feet to 12 feet



in brickearth. Forty implements and numerous chipped fragments have been found, and the position of certain well wrought oval implements, in and under compact clay at the lowest levels, identifies them as missiles hurled at water-fowl on the lake. Teeth of elephant, rhinoceros, ox, and deer occur in coarse gravel below the implement layer, and plant-roots in the clay below that.

Prof. E. B. Poulton exhibited records of Palæolithic man from a new locality on the north-east coast of the Isle of Wight, including every stage from flake to finished implement.

The sixth report of the committee on the lake village at Glastonbury announced fresh excavation in 1904, under the joint superintendence of Mr. A. Bulleid and Mr. H. St. G. Gray. Eight mounds, containing two or more floors, were examined, and plans and photographs secured. Objects of amber, glass, and tin, and an adze of iron were found, as well as bronze, stone, and bone objects, and pottery. In one mound, peas were found in some quantity. Arrangements are in progress for the publication of the results of the whole excavation.

Mr. F. R. Coles and Dr. T. H. Bryce described an interment of the early Iron age found at Moredun, near Edinburgh, in 1903. A cist covered with flagstones contained fragmentary human remains of normal local type, with a fibula of La Tène type, a ring-brooch, and a circular open pinhead, indicating a date not later than the second century A.D. This is the first completely attested interment of early Iron age in Scotland.

Dr. T. H. Bryce discussed a phase of transition between the chambered cairns and closed cists in the south-west corner of Scotland. The clue is given by a cairn at Glecknabae, in Bute, which contained two "atypical" chambers set radially in the cairn and containing burnt bones, and a closed cist with unburnt interment. One of the chambers also contained an unburnt fragment. The pottery, which included both typical "chamber" pottery and also fragments of the "beaker" class, indicated a triple occupation of the site, and a late date for the reduced atypical chamber.

The report of the Roman sites committee described work in progress at Silchester and Caerwent, and Mr. T. Ashby summarised the season's progress on the latter site. The south gate has been found to be parallel to the gate on the other side, and an inscription dedicated to Mars bears the date August 23, 152 A.D.

Prof. Flinders Petrie's excavations at Ehnasya have been already mentioned in connection with his series of Roman lamps. Ehnasya is the Roman Herakleopolis Magna and the Egyptian Henensuten, about 70 miles south of Cairo and 10 miles from the Nile. It was the home of the ninth and tenth dynasties, of which hardly anything is known. It is found to contain temples of the eighteenth and twelfth dynasties, and under the latter a stratum of older houses and burials with scarabs of Antef V. This king has recently been assigned to dynasty XVI. or XVII., but is thus brought earlier than dynasty XII. Later buildings of dynasty XXIII. yielded a fine votive statuette, in gold, of the local ram-headed deity, Hershefia, dedicated by a vassal of King Piankhi; and houses of Roman date gave important evidence as to the stages by which Christianity first displaced the native animal-cults, and then itself absorbed the Isis and Horus worship as the Madonna-cult.

Mr. J. Garstang described his excavations in the Royal tomb of Negadeh, in Upper Egypt, which completed the work begun some years back by the French, and recovered another fragment of the "Tablet of Mena," to whom the tomb has been commonly attributed.

Mr. R. N. Hall's recent excavations at Great Zimbabwe show the ruins to be three times larger than was supposed, and distinguish clearly between (a) the original constructions (e.g. the eastern half of the "Elliptical Temple"), which are still of uncertain age and associated with numerous phalli, and (b) sundry additions which are shown by Arab pottery to be not older than about 1300 A.D., and do not contain phallic objects. Much useful work has been done on behalf of the Chartered Company to preserve existing structures, and to clear the ruins of surface deposits and other obstacles to study.

#### BOTANY AT THE BRITISH ASSOCIATION.

THE meeting of the botanical section at Cambridge may probably be regarded as the most successful of the whole series of meetings which have been held since botany was constituted a separate section of the British Association. A large number of distinguished foreign botanists were present, and there was a fully representative gathering of British botanists to meet them. By the kindness of Prof. H. Marshall Ward, F.R.S., the meetings were held in the rooms of the new botany school, which proved to be admirably suited for the purpose. Prof. Ward and the botanical staff are to be congratulated upon the excellent arrangements made for the lectures, lantern demonstrations, exhibition of apparatus and specimens, &c., which contributed so much to make the meeting a success.

The president (Mr. Francis Darwin, F.R.S.) in his address, which has already appeared in NATURE (September 8), dealt with the perception of the force of gravity by plants, and especially with the statolith theory of geotropism.

The general work of the section included, in addition to the more technical papers, the usual semi-popular lecture, and a series of three addresses of a general character on important topics.

The subject of the semi-popular lecture, which was delivered by Dr. D. H. Scott, F.R.S., was a new aspect of the Carboniferous flora. It was shown that Brongniart's conception of the Carboniferous period as the reign of Cryptogams can no longer be maintained. Recent work has all tended to show that a large number—perhaps the majority—of the so-called ferns of that period were not true ferns at all, but seed-bearing plants approaching the Cycadophyta. While their affinity with ferns is evident, these plants had already acquired spermatophytic methods of reproduction—hence the name Pteridospermeæ is proposed for them. If we further take into account the seed-plants previously known—notably the Cordaitæ—and those Lycopods which produced organs analogous to seeds, we are led to the conclusion that quite half the vascular plants of the Carboniferous period had already assumed the seed-habit.

#### Ecology.

Prof. A. G. Tansley, in an address on the problems of ecology, defined ecology for his purpose as the study of those relations of plants to their environment dependent on geographical and topographical factors. It is very largely topographical aggregates, due to soil, water, and other conditions with which ecology has to do, and the study of these falls into two parts, descriptive and experimental. The problems to be solved may be indicated during the progress of an ordinary botanical survey, but it requires the establishment of experimental stations in regions characterised by definite and specialised floras in order that the detailed investigation of the functional relations of plants to their surroundings may be more completely carried out.

Dr. W. G. Smith, whose work in connection with the botanical surveys of the north of England is so well known, in referring to the ecological aspect of the British flora, pointed out that a general survey of the chief plant associations of Britain has so far revealed some broad principles of distribution in relation to soil and climate, and that when wider areas are investigated the chief plant associations may be more clearly defined as climatic, edaphic, or biological formations.

Mr. T. W. Woodhead gave an interesting account of his observations on the biology and distribution of woodland plants, and dealt with some of the principal factors, such as shade, soil, &c., which tend to modify the plant associations under trees.

Prof. A. Engler (Berlin) read a paper on the plants of the northern temperate zone in their transition to the high mountains of tropical Africa, in which he pointed out that the differences seen in most of the highland forms of plants of tropical Africa, as compared with their relatives of the northern temperate zone, are always in harmony with the different climatic conditions. The modifications observed may be regarded as adaptations, but only in the sense that the adaptation is a passive one caused by the physical con-

ditions of the climate, not an active one corresponding to the views of the Lamarckians.

Mr. Francis J. Lewis presented a paper on the inter-Glacial and post-Glacial beds of the Cross Fell district, in which he pointed out that the plant remains are of considerable interest as throwing light upon the duration and climatic conditions of the several Glacial and inter-Glacial periods. The plant remains of the post-Glacial peat also show that considerable fluctuations have taken place in climate since the close of the Glacial period.

#### Morphology (including Palaeobotany).

Dr. D. H. Scott, F.R.S., described a new type of sphenophyllaceous cone from the Lower Coal-measures; the cone shows the anatomy and general organisation characteristic of the group, but is distinguished by its branched sporangiophores terminating in peltate, bisporangiate scales, and by the absence of any sterile appendages.

In conjunction with Mr. E. A. Newell Arber, Dr. Scott also presented a short account of two new Lagenostomas. In one of them, *L. Kidstoni*, the seeds are naked, but in the other, *L. Sinclari*, there are indications of an external envelope or cupule. The new seeds were apparently borne on the ultimate branches of a frond in which the lamina had been greatly reduced. There are indications that the fronds were of the Sphenopteris type.

Prof. C. Eg. Bertrand (Lille) contributed a paper by Prof. Cornaille and himself on "La structure de la trace foliaire des Filicinaées inversicatenates."

Miss Sibille O. Ford gave an account of the anatomy of *Psilotum triquetrum*, from which she concludes that the Psilotaceæ not only present an affinity with the fossil Sphenophyllales, but also have a strong resemblance, anatomically, to some of the fossil Lycopods, especially to the stem of *Lepidodendron mundum*, as well as to the axis of the cone of *Lepidostrobus Brownii*.

Mr. T. G. Hill, in a paper on the presence of parichnos in recent plants, pointed out that in the mature sporophyll of *Isoetes Hystrix* in the lateral expansions of its base are two longitudinal mucilage-containing cavities which arise by the mucilaginous degeneration of two strands of parenchyma. He suggests that this represents the parichnos occurring in *Lepidodendron*, *Sigillaria*, *Lepidocarpon*, &c.

Dr. Marie G. Stopes described her recent observations on some new points observed in the ovular anatomy and structure in the different genera of Cycads, with the conclusion that there are well marked indications of two integuments.

Mr. L. A. Boodle read a paper on the reduction of the gametophyte in *Todea Fraseri*. Owing to delay in the dehiscence of the sporangium under certain conditions, many of the spores germinate within it. The prothallus may consist of only two or three cells with an antheridium. This is of special interest when compared with the microspores of *Salvinia*, as illustrating how a reduction of the thallus of a fern approaching that shown by *Salvinia* may be brought about by the non-dehiscence of the sporangium.

Dr. William H. Lang, in a paper on the reduction of the marchantiaceous type in *Cyathodium*, concludes that it appears probable that *Cyathodium* has been derived by adaptation to damp and ill lighted situations from a well characterised marchantiaceous form of about the same grade of differentiation as *Targionia*.

Dr. J. P. Lottys (Leyden), in an interesting account of the virgin woods of Java, discussed the modifications produced in the vegetation by the two great forces moisture and light, and proposed the use of a new term, *biaiomorphose*, indicating that the form of each individual plant is not a form innate to that plant, but is the result of its specific structure and the sum of all external circumstances which have acted upon it.

Mr. E. A. Newell Arber presented a paper on a new feature in the morphology of the fern-like fossil *Glossopteris*.

Dr. Otto Stapf exhibited and described the fruits of *Melocanna*, *Melocalamus*, and *Ochlandra*.

Mrs. D. H. Scott gave demonstrations of kammatograph photographs showing the opening and closing of flower buds, the visits of insects to flowers, and other interesting records of the movements of plants.

Mr. Alfred P. Maudslay gave an account of some measurements he had made of the great swamp cypress at Santa Maria del Tule, Mexico. The area of a cross section of the

trunk of this tree, at a height of 6 feet from the ground, is 408 square feet.

Dr. K. C. Miyake (Tokio) read a paper on the centrosome of the Hepaticæ, from which it appears that it is very doubtful whether centrosomes occur at all in these plants.

Lord Avebury, F.R.S., in a note on the forms of the stems of plants, brought forward the view that the shapes of the stems of plants are dependent upon the arrangements of the leaves, and the consequent distribution of the strengthening tissues in the stem so as to secure the greatest strength with the least expenditure of materials.

A short discussion on the present state of our knowledge of the cell structure of the Cyanophyceæ was opened by Mr. Harold Wager, F.R.S., who pointed out that the central body of the cell must be regarded as a nucleus, but that it is of a simpler or more rudimentary type than the nucleus of the higher plants.

Prof. E. Zacharias (Hamburg), whilst admitting that the central body contains, under certain conditions, that essential constituent of the nucleus, nuclein or chromatin, could not accept the view that it is a nucleus, and especially objected to Kohl's conclusion that it is a true nucleus in which both chromosome and spindle formation can be observed.

Prof. R. Chodat (Geneva) considered that the central body of the Cyanophyceæ is merely a specialised region of the cytoplasm in which granules of reserve substance accumulate, and not of the nature of a nucleus at all.

Mr. E. R. Burdon gave an account of the pineapple gall of the spruce which are caused by the hibernating generation of certain Aphidæ belonging to the genus *Chermes*.

In the early stages the chlorophyll, tannin, resin, resin canals, and secretory cells of every description disappear within the gall area, which consists entirely of enormously swollen parenchymatous cells. Starch is found in great abundance round the periphery of the gall area, and it is suggested that it may be the ultimate product of the disintegration of the tannin.

The nuclei of the galled cells also become enlarged, and the chromatin network becomes aggregated into numerous wart-like nucleoli. The mitotic figures are of the usual somatic type, and no indication of heterotypical mitoses has yet been found.

Mr. R. T. Baker exhibited specimens illustrating (1) the comparative constancy of specific characters of *Eucalyptus*, (2) the relation between the leaf venation and the oil constituents.

Prof. R. Chodat exhibited some beautiful examples of pure cultures of algæ, and Prof. G. S. West some photomicrographs of fresh-water plankton.

#### Physiology.

Dr. F. F. Blackman gave an interesting address on the important investigations which have been carried on by Miss Matthæi and himself on the question of sunshine and carbon-dioxide assimilation. The address was illustrated by a series of experiments, and the numerous elaborate and ingenious pieces of apparatus which have been devised by the authors for the automatic recording of the complicated data required were exhibited and explained.

Prof. S. H. Vines, F.R.S., gave an account of his researches on the proteases of plants, the general occurrence of which he has demonstrated in all parts of plants. They are not of the nature of pepsin, but correspond rather to either the trypsin or the erepsin of the animal body. Trypsin and erepsin differ from each other in their capacity for peptonising the higher proteids. Thus trypsin can peptonise so complex a proteid as fibrin, whereas erepsin cannot, though it can peptonise casein. It has been found that in certain cases the juices or extracts of plants can peptonise fibrin, indicating the presence of a tryptic protease; but more commonly they do not possess this capacity.

Prof. L. Errera (Brussels), in a paper on the localisation of alkaloids in plants, pointed out that, although the physiology of alkaloids is far from settled, a critical study of their topography, as well as their behaviour in germination, growth, etiolation, maturation of seeds, &c., supports the view that they are waste-products, resulting from the catabolism of cytoplasm, and secondarily utilised for defence against animals. A few grams of an alkaloid constitute a protection not less efficient than the strongest spines.

Prof. Errera also read a paper on the struggle for pre-eminence and inhibitory stimuli in plants, and Dr. J. P. Lotsy (Leyden) gave an account of his discovery of a new alkaloid in *Strychnos nux-vomica*.

Important papers were also read by Prof. R. Chodat (Geneva), on oxidising enzymes and katalases in plants; by Prof. G. Klebs (Halle), on the artificial formation of a new race; by Prof. F. Czapek (Prague), on the importance of the anti-ferment test in geotropically stimulated roots; by Prof. K. Fujii (Tokio), on the pollination of Gymnosperms; and by Dr. G. J. Peirce (California), on the dissemination and germination of *Arceuthobium occidentale*.

Mr. J. Parkin gave an experimental demonstration of a brilliant pigment appearing after injury in species of *Jacobinia*, the shoots of which when bruised and extracted with water yield a beautiful purplish liquid. Such a reducing agent as stannous chloride decolorises it. Micro-organisms can also readily bleach it when oxygen is excluded, but on allowing air to enter the original colour at once returns. The whole phenomenon bears some resemblance to the way in which indigo arises in plant-tissues.

Papers were also contributed by Dr. Otto V. Darbishire on the transpiration stream in small plants, and by Dr. George Barger on saponarine (soluble starch).

#### Fungi.

Prof. H. Marshall Ward, F.R.S., gave an address on recent researches in parasitic fungi. The investigations of De Bary and others were shortly described, and then Prof. Ward described his own experimental work on the determination of the external conditions necessary for the germination of the spores of fungi. He showed that a knowledge of the germinating capacity of the spores is necessary in order to arrive at definite conclusions as to the immunity of new varieties of cereals from disease. In opposition to Prof. Eriksson, he maintained that there is no evidence to show that fungus diseases are spread in any other way than by spores, and that his experimental and microscopic investigations do not in any way support Eriksson's mycoplasma theory.

Prof. Eriksson (Stockholm), in a paper on the vegetative life of some Uredineæ, dealt in considerable detail with this question, and sought to show that the evidence before us as to the infection of cereals by the disease could only be explained by the presence of mycoplasma in the seed.

Mr. V. H. Blackman and Miss Helen C. I. Fraser gave an account of the development of the æcidium of *Uromyces poae* and the life-history of *Puccinia malvacearum*, in which many new facts were brought forward, especially concerning the sexual fusion of nuclei in the æcidial cells.

Mr. E. S. Salmon described some further cultural experiments with biologic forms of the Erysiphaceæ which demonstrate the fact that the infection-powers of a "biologic form" are not altered by its residence for one generation on a strange host-plant, and give also some evidence in favour of the idea of the hereditary nature of the infection-powers of certain "biologic forms."

Mr. R. H. Biffen, in a paper on the inheritance of susceptibility to and immunity from the attacks of yellow rust, brought forward evidence to show that the liability to certain diseases is inherited, and from the results of crossing together races of wheat relatively immune from and highly susceptible to the attacks of *Puccinia glumarum*, it appears that susceptibility is dominant over immunity in the hybrid.

Miss C. M. Gibson gave an account of her infection experiments with various Uredineæ, which show that the germ tubes from the spores of any uredine may enter almost any plant, and that the attractive substance causing entry is not specialised in each species, but is something common to all plants.

Dr. A. H. Reginald Buller presented papers on the destruction of wooden paving blocks by the fungus *Lentinus lepideus*, Fr., and the reactions of the fruit-bodies of *Lentinus lepideus*, Fr., to external stimuli; and Mr. B. T. P. Barker on the structure of the ascocarp in the genus *Monascus*, and on some further observations on the ascocarp of *Ryparobius*.

Dr. A. F. Blakeslee (U.S.A.) briefly described his investigations on the sexuality of zygospore formation. According to their method of zygospore formation the Mucorineæ may be divided into homothallic and hetero-

thallic forms. In the first group zygospores are developed from branches of the same thallus. In the second group, comprising probably a majority of the species, the zygospores are developed from branches which belong to thalli diverse in character. The sexual strains in an individual species show a more or less marked difference in vegetative luxuriance. The author concludes that the mycelium of the homothallic species is bisexual, whilst that of the heterothallic species is unisexual.

In the agricultural subsection, which met under the presidency of Prof. W. Somerville, the following papers were read:—improvement of wheats and Mendel's laws, R. H. Biffen; hybridisation of cereals, Dr. J. H. Wilson; the clover mystery: a probable solution of it, R. H. Elliott; analysis of soil by the plant, and the probable error of agricultural field experiments, A. D. Hall; determination of available phosphates, T. S. Dymond and G. Clark; sulphates in their relation to growth of crops, T. S. Dymond and F. Hughes; the improvement of clay pastures by leguminous plants, Prof. T. H. Middleton; formation of ammonia, nitrites, and nitrates, Dr. E. J. Russell; chemical composition of mangels, and variation in mangels, T. B. Wood and R. A. Berry. Prof. W. D. Atwater (Middletown, Conn., U.S.A.), who was present at the meeting, also communicated a paper to the section.

#### EDUCATION AT THE BRITISH ASSOCIATION.

AFTER the president's address (published in NATURE of September 15), the first paper on the programme was on the present educational position of logic and psychology, by Miss E. E. C. Jones, in which attention was directed to the fact that, on the one hand, logical and psychological studies hold a position of growing importance in English thought and education, while, on the other hand, the quality and organisation of the instruction supplied leave much to be desired. Some logic and psychology are now required for teachers' training examinations; it is also desirable that all students of religious doctrine or of the great questions of philosophy should be equipped with logical method and psychological knowledge.

The section listened with interest to the lucid account of the advances made in the teaching of experimental science in the secondary schools of Ireland given by the Right Rev. Gerald Molloy. The result of three years' work is splendid, thanks to a cordial and remarkable cooperation of teachers, of schools, and of local authorities with the Intermediate Education Board and the Department of Agriculture and Technical Instruction. These latter bodies have adopted a common programme in science subjects, and are carrying out a common system of examination and inspection. All the secondary schools of the country, about 250 in number, are enjoying the benefits due to judicious introduction of practical work in the laboratory, and the administrators may justly be congratulated on the fact that there are more than 9000 pupils following the preliminary course, and 1500 pursuing a more specialised course after passing through the preliminary. The manner in which the first great difficulty, that of providing competent teachers, was overcome is interesting, but it is of more importance now to note that the organisers took the right road to efficiency by putting men first and bricks and mortar second. (Might not some of our local authorities and governing bodies in England receive a useful hint?) For the future "the Department propose to grant the 'Irish Teacher's Science Certificate' to all students who pass through a three years' course, prescribed for the purpose, in the Royal College of Science, Dublin. They will also recognise as qualified teachers students who have followed a similar course in any university or technical college, and who have obtained the corresponding degree or diploma."

The discussion was mainly congratulatory, but one criticism deserves, and will no doubt receive, careful consideration from the authorities. It was felt by many that among subjects relegated to the optional courses were some of such fundamental importance as to be an indispensable part of an all-round education. This, of course, is part of the wide and difficult problem which is getting more and more pressing, viz. what can be safely left out of the secondary school curriculum? It is safe to reply to Dr.

Molloy's question, as to the advisability of limiting the preliminary science course to those who do not take the classical, by affirming that all boys and girls should take a science course of some kind at some period of their school life. Sir Philip Magnus insisted that science is not an "extra," but a necessary part of the curriculum (not for the whole time of all pupils). Inspection should precede examination—it is unnecessary to examine junior pupils. Mr. George Fletcher, speaking as an inspector, stated that other subjects of the curriculum have not suffered by the introduction of science into Irish schools. Their unparallelled progress was made possible by the voluntary sacrifice of their holidays by the teachers. Prof. Armstrong regretted that the courses of demonstrations, which had been instituted by the London School Board and had proved so valuable a help to science teachers, had been discontinued.

A paper which has attracted a widespread interest was that by Dr. J. de Körösy, director of municipal statistics at Budapest, entitled "Comparison of the Intellectual Power of the Two Sexes." The author had received reports since 1873 of 800,000 individual children. One method of testing applied was to take the percentage of children who had to repeat the year's work instead of passing on to the next standard. In the elementary schools the figures were all in favour of the girls, the two sexes being nearly level at first, but the advantage of the girls increasing with age. This result is more marked in the higher elementary or "citizen" schools (age ten to sixteen), but in this case the boys are drawn from a class less gifted than ordinary, while the opposite holds for girls.

Another test was the frequency of "very good" and "good" marks in the fourth standard. These best marks were obtained in arithmetic by 10.8 per cent. of boys and by 35.3 per cent. of girls. A truly surprising result! Several subsequent speakers admitted the superiority of girls at school and college, but contended that there it ended, but few women being eminent in learned professions, and the majority falling behind men when it came to the "struggle for existence." Dr. Beverley, of Norwich, differed from this view, arguing that women needed only equality of opportunity.

Mr. J. H. Leonard read a short paper on specialisation in science teaching in secondary schools. The contention was that the efficiency of science teaching in schools is itself threatened with a particular kind of specialism, *e.g.* objection was taken to the performance of titrations before sufficient progress has been made in elementary chemistry. The effect of according undue prominence to one study is that the school time is not fairly allotted—*e.g.* botany and physiography are often omitted—while the scholars are wearied instead of being interested. Unfortunately there was no time for discussion of Mr. Leonard's views.

Lieut.-Colonel McKinlay gave a description of his method of "realistic arithmetic." The "appeal to the eye" is thoroughly effective. The apparatus has been used in schools with favourable results.

#### School Certificates.

The main feature on the morning of August 19 was the discussion on school-leaving certificates. Prof. Armstrong led off by reading a "Report of the Committee on the Influence of Examinations." He explained that the question of examinations had entered upon a new phase by the issue, on July 12, by the Board of Education, Whitehall, of suggestions for a system of *school certificates* submitted by the consultative committee to the board. The committee was not in a position, therefore, to publish a report in the true sense of the word, but was presenting a compendium including the proposals of the consultative committee, notes on the Scotch leaving certificate, the London University scheme, and extracts from the Mosely Commission Report referring to the American accrediting system. Dr. Gray (Bradfield College) read a paper, communicated by Canon Bell, narrating the origin of the proposals of the consultative committee. Attention was directed to the vexatious multiplicity of examinations, no fewer than 64 in the United Kingdom and 140 in the Empire being accepted as qualifying for entrance into one or more professional courses.

Sir Arthur Rücker said the position was complicated by the fact that Oxford, Cambridge, and London Universities have already carried out something in the nature of school-

leaving examinations. The consultative committee had left the financial question out altogether. There had been no opportunity for the universities to consider the scheme of the consultative committee, but he, personally, was in favour of its general principles. Mr. Ernest Gray, M.P., regretted that the antiquated procedure of the British Association had left those attending this section in the dark as to the subjects to be brought forward until the meeting actually commenced. He thought that the scheme would revolutionise secondary schools, by enlarging the staff and increasing the length of school-life. The difficulties connected with fees must be met from other sources. The proposal was really a dual certificate, a junior and a senior; this principle was accepted by learned societies. A most valuable feature was the active share which the teachers are to take in the examination of their school; he thought that English teachers should be prepared to take the responsibility of recommending pupils, as is done in France. Schools should direct examinations, not *vice versa*. Local authorities will insist on some form of examination, and will probably wish to see local schools grouped round local universities.

The Rev. R. D. Swallow, on the other hand, regarded the idea of encouraging local authorities to hold to local universities as most detrimental. Secondary schools of the old-fashioned type would remain under the influence of the old universities, but a new type was springing up which the consultative committee had ignored, the higher elementary school with the words higher elementary painted out and secondary painted in. Dr. Mangold (Berlin) sympathised with systems of examination in which the teacher plays an essential part. Proved to be very satisfactory in Germany, the plan of taking into account the teacher's knowledge of the character and abilities of his pupils should act well in this country.

Principal Griffiths (Cardiff) referred to the experience of the Central Welsh Board. There was a tendency for a central board to become rigid, and he hoped that any such board would perform advisory and inspective rather than executive functions. We have to remove from local authorities their distrust of teachers. The curious worship of examination results by such authorities seemed to be a growing evil. Sir Oliver Lodge stated that Birmingham will put into action a scheme similar to that recommended by what was, on the whole, the admirable report of the consultative committee. Teachers should determine the relative order of pupils; the outside inspector should standardise and not pretend to read all the papers. He hoped universities would accept each other's certificates, and that no vested interests would stand in the way of reform.

Mr. Alderman Fordham (vice-chairman Cambs. County Council) thought that the alleged distrust of teachers did not, in reality, exist. It was recognised that the highest respect must be paid to teachers of every grade as the vital bases of every part of their work. He was in favour of the Swiss system of public examination for all children, and was dissatisfied with the existing mode of testing elementary schools. Miss Cooper wanted varieties of examination, equatable by their known equivalents. Mr. Oscar Browning thought that parents were insufficiently considered; a parent has a right to know whether his child has been taught to a reasonable standard. Mr. Mollison (Clare College) pointed out that America had a great advantage in freedom from examinations, and urged that the establishment of a fresh State board would be a disaster. Dr. Gray, as a member of the Mosely Commission, feared that the absence of a national desire for education made it necessary for us to have something more than the accrediting system. Dr. Roberts, Messrs. Flather, Fitzpatrick, and Cloudesley Brereton also spoke. The chairman, summing up, expressed his conviction that we had little need to fear State control, as we have inherited so long a struggle for freedom that we are hardly likely to be tyrannised over. The consultative committee had looked the finance difficulty in the face—and passed on.

#### National and Local Provision for the Training of Teachers.

The discussion on this urgent problem opened on Monday, August 22, with a paper contributed by the Right Hon. Henry Hobhouse, M.P., the object of which was "to

indicate the difficulties which beset local bodies in their endeavours to perform what is really a national task."

By the recent regulations training is insisted upon as a condition for registration, but the actual establishment of training colleges has been left, *more suo*, to private initiative. Under the Act of 1902, the burden of supplying the deficiency is thrown, not upon the State, but upon local authorities. In addition to the difficulty which the smaller bodies would experience in raising funds for new institutions with expensive buildings and equipment, there is the further one of getting proper cooperation between so many authorities, autonomous and often jealous of each other. The most serious drawback of all lies in the "localisation" of the individual teacher. Certain local authorities may prefer to secure teachers trained elsewhere by the offer of high salaries rather than train them themselves. As a counter-move, a local authority may bind each teacher it trains to serve for a reasonable number of years exclusively in its own schools, a system of indenture which, however sound financially, is educationally unsound, and which will seriously prejudice free circulation of educational energy, with special detriment to the weaker counties and boroughs. The present problem is how to encourage and impel our local authorities each to bear its fair share in the task of increasing the supply of competent teachers without forcing them all into one groove, and depriving them of all initiative and independence.

Mr. H. Macan sent a paper which arrived too late for an abstract to be made thereof, and was too lengthy to read in full. In the circumstances justice could not be done to this contribution. *Inter alia* he pointed out that a central hall costing 30*l.* per place was worthless compared with good teachers. As a large number of teachers at present leave the profession at an early age, he suggested that there should be two classes of teachers, one highly trained, the others less qualified short-service persons sufficiently equipped for the journeyman-work of teaching. (The writer of these notes does not know what "journeyman-work" means as applied to teaching.)

Mr. Gray, M.P., said it was impossible to escape from the conclusion that the training of teachers should be a national charge. Secondary-school teachers needed better training in the art and craft of their profession, and the barrier between elementary and secondary should be removed. Mr. G. F. Daniell considered that the supply of men for secondary schools would be met if the kind of training required was made known, and proper pay, position, and conditions of work and tenure provided.

The Rev. W. T. A. Barber said that elementary teachers should have some practice in secondary schools during their training. The training college should be in connection with some university. To add a year's training in pedagogics to the costly years spent in graduating at a university would stop the supply of teachers for secondary schools unless the chances of the profession were improved. Dr. Ernest Cook, chairman of the Bristol Education Committee, complained that the ordinary training college provided secondary education, but very little instruction in the art of teaching.

Principal Griffiths referred to the position in Wales, where there is to be a congress of representatives of education committees, of the university, of teachers' associations, and of politicians to consider the position in the Principality. At present they needed to import 280 teachers from the neighbouring kingdom of England. He feared the effect of enlarging day training colleges, and wished to remove distinctions between "normal" and ordinary university students. Sir John Gorst said the difficulty of supplying teachers had increased since the 1902 Act was passed, and pressed for energetic measures to be taken both by Government and the local authorities. "Supply and demand" would not suffice except for the great public schools. The pupil-teacher system was rather a failure, and the training college system not a success. The burden laid on the young pupil teacher was greater than anyone could bear. The qualifications of teachers should be certified by the university, which should supply pedagogics, no new expensive buildings being required, and the attempt to distinguish between elementary, secondary, and technical education should be abandoned. Assistance for training should be given from both Government and local funds. He thought

the value of Ireland as a recruiting ground should receive attention.

Mr. J. L. Holland pointed out that we needed to know the actual number of teachers required, and stated the average life as a teacher to be, for a man, a little under 14.3 years, for a woman about 7 years. This means a fresh teacher per annum for every 2000 to 2500 of the population, and it should be noted that for every boy there are five girls going to be teachers. (The number of pupils in secondary schools in 1900 was:—boys a fraction over, girls a fraction under, five per thousand of the population.) The scholarship ladder is in danger of becoming a treadmill, leading from the school as a pupil to the same school as a teacher; through the bad influence of "localisation." Miss Walter said that the short professional life of teachers was due to low pay, and urged that more money be spent on salaries, in which case less would need to be spent on training.

M. Émile Havelaqué, Inspector-General of Public Instruction in France, made a particularly interesting speech, in the course of which he dwelt on the advantage that would accrue if a larger number of English students for the higher branches of the profession could be induced to take up residence at French schools and colleges, under a newly instituted scheme. The student would be able to study French educational methods; the teaching of the mother tongue, for instance, has received particular attention in France, while it is surprisingly neglected in England.

Dr. Mangold observed that in Germany the training of teachers was a national charge, the masters of method receiving a small addition to their salaries as teachers. He was astonished that it should be desired to remove the differentiation between elementary and secondary—such removal would be impossible in Germany at present.

#### Manual Training.

Sir Philip Magnus opened the discussion on methods of imparting manual instruction in its broadest sense in the various types of schools. Other speakers included Mr. George Fletcher, Mr. Millett, Mr. Oscar Browning, Mrs. Marvin, Prof. Armstrong, Miss Cooper, and Miss Taylor. There was agreement as to the value of manual training as a part of general education for all boys and girls, and it was also felt by the opener and others that the instruction should have the same aim for the two sexes. On the other hand, the subjects used for this purpose should be different, the manual teaching of girls being associated closely with the domestic arts.

#### Reports of Committees.

Mr. Hugh Richardson presented an interim report of the committee on the courses of practical, experimental, and observational studies most suitable for elementary schools. Useful work is being done, and it is satisfactory to note that a grant has been made for its continuance.

The report of the committee on the conditions of health essential to the carrying on of the work of instruction in schools emphasised the need of teachers themselves being trained to understand how the laws of health entered into every department of school life. Suggestions were made for the curriculum for such training. The report was followed by a discussion on hungry and exhausted children, led by Sir John Gorst, who boldly advocated that local authorities should be empowered to feed half-starved children and to punish those responsible for their neglect.

#### Afternoon Lectures.

On August 19 Mr. A. D. Hall lectured on the need of scientific method in elementary rural instruction, and on August 22 Prof. Armstrong gave a short address on the research method applied to experimental teaching.

The founders of the section should be well satisfied with the position which it has taken in so short a time. The gathering at Cambridge was remarkable for the bringing together of workers in every branch of the diverse paths of education. The debates were thoroughly well sustained, and with better arrangements for continuing the work of committees between the annual meetings, and some improvement of machinery for advertising the subjects to be discussed beforehand, there can be no doubt that Section L will exercise a useful national influence. G. F. D.

### THE OPENING OF THE MEDICAL SESSION.

THE beginning of October always sees the opening of the medical session, and introductory addresses have been delivered at many of the London and provincial schools. At others, however, the session opened without formality.

At University College Prof. Norman Collie, F.R.S., delivered the introductory address, taking for his subject the relation of chemistry to medicine. He said that it is now more than ever imperative that medical men should have a good grounding in chemistry, and he directed attention to the numerous instances in which chemistry has a bearing on medicine. The question of the action of ferments, of great importance to the medical man, must ultimately be answered by the chemist. The physiological action of toxins and antitoxins has for some time largely engaged the attention of medical science, but it will probably be the chemist, after he has determined their molecular structure, who will be able to explain how and why they are produced. In the process of the assimilation of food the changes that occur are purely chemical. The composition of the various secretions also can only be arrived at by an analysis in a chemical laboratory.

At King's College the session was opened with an address by Dr. Thomas Buzzard, F.R.S., on the future relation of King's College to its medical school and hospital. After a few words of welcome to new students, and impressing on his audience the value of the degrees of the University of London, he briefly sketched what will be the position of college and hospital when the latter has been removed to Camberwell. It is intended that the two should be distinct, the preliminary and intermediate studies being pursued at the college, the subsequent more purely medical studies at the hospital. At the same time the two will be autonomous, and there will be no obligation on a student who completes his preliminary studies at the college to pass on to King's College Hospital; he will be at liberty to go where he pleases. In order to carry out this separation, composition fees will be abolished, and no member of the hospital staff will be permitted to teach any preliminary or intermediate subject at the college.

Dr. A. E. Wright, in the opening address at St. Mary's Hospital, emphasised the importance of research and the need for the provision of adequate salaries for scientific workers.

Dr. F. J. Wethered, in his address on practice and theory in medical study at the Middlesex Hospital, also spoke of the need for the endowment of chairs in the University of London. He pointed out that medicine is not only a science, it is a practical art, and no amount of theoretical knowledge can replace study and observation in the wards and out-patient room.

At Charing Cross Hospital the opportunity of the opening of the session was taken for the delivery of the Huxley lecture. The lecturer this year was Sir William MacEwen, who prefaced his remarks with some allusion to the life-work of Huxley before passing on to his subject, "The Recent Advances in Science and their Bearing on Medicine and Surgery."

Prof. Alex. Macalister, F.R.S., was the lecturer at St. George's Hospital, and delivered an instructive address on "The Evolution of the Medical Curriculum."

At the London (Royal Free Hospital) School of Medicine for Women, and at the Royal Veterinary College, the sessions were opened by Miss Murdoch and by Prof. Brodie, F.R.S., respectively.

### THE EDUCATION OF A CHEMIST.<sup>1</sup>

THE education of a chemist (and the word "chemist," of course, includes the qualification "technical chemist") must be conceived in the sense that it consists in an effort to produce an attitude of mind, rather than to instil definite knowledge. Of course the latter must not be neglected; the definite knowledge may be likened to the bricks which the architect has at his disposal in erecting a beautiful building; he knows their shapes, their capacity

for resisting stresses, and, in short, what can be done with them. But the conception of the design is the result of many attempts to create; just as the poet has to utilise words, or the architect bricks, so the chemist has to know the materials with which he is dealing. The training of a bricklayer, however, will never make a man an architect; nor will the dry research of a grammarian train a poet. In short, it is the inventive faculty which must be cultivated.

Now how can this be brought about? The answer is perfectly simple: by offering examples. Every teacher in the laboratory, from senior professor to junior assistant, must be engaged in research, and, most important of all, they must not be reticent, but willing to converse freely on their problems. It is that which creates a "chemical atmosphere."

The qualities tested by such examinations as have been customary for the past forty years in England are the last which one would wish to have in a student of science—readiness of memory, to the exclusion of deliberate judgment; the faculty of spreading knowledge thin, and making a veneer of scientific facts instead of the power to correlate them and increase their value; and the skill to gauge the capacity of and hoodwink the examiner, instead of the power to incite enthusiasm in others. They are ideal qualities for a successful barrister, because they pay in his profession; but their reward has been the bane of science. A sound judgment, though it may be a slow one; persistence in struggling against obstacles; the knowledge where to get information when required, and to use it when found; and the inventive faculty—these are the qualities required, and they can be gauged only after long-continued observation. Moreover, the pernicious system of competitive scholarships and fellowships, instead of eleemosynary support given to the necessitous and deserving youth, has also contributed much to the debasement of the scientific spirit; for it has early implanted in the young mind the idea that to outrun his fellows, and to work solely for a money reward, are the ends to be aimed at, instead of the joy of the exercise of a divine gift, and the using that gift for the benefit of man.

The ideal plan of education for technical chemists would be some system analogous to the apprenticeship of engineers, after they have been educated in the science; that is, after the correct habit of mind has been largely formed. But it is difficult to see how this can be brought about. The obstacles in the way appear to me to be insurmountable. The chemical manufacturer is not willing to throw open his works to students, nor would he do so even if very considerable premiums were paid. Indeed, in England, it is not uncommon for the "chemist," so-called, to be refused admission to the works, and to be confined to the laboratory. In the larger German works, where many chemists are employed, it is possible for a young man to gain the requisite experience. I have been informed by the managing director of a chemical works in Germany where seventy chemists are employed that nature has divided the young men into three large classes, the members of which are fairly easily distinguished and do not greatly overlap. There is first the routine chemist, the young man who declines responsibility, but who is hardworking and trustworthy; he finds his place as an analyst, testing raw materials and analysing the products at various stages, including the finished products. Second, there is the young man to whom the management of some department may be entrusted; one with a firm will, plenty of energy, and the quality of governing men. And third, there is the research chemist, who delights in new problems, whether suggested by others or conceived by himself. All three classes are utilised; and after serving as analysts for some time, the young men naturally range themselves in one or other department, where their natural tendencies find scope. But even in Germany the number of works which employ seventy chemists is not great, and with a small number it is more difficult to effect the division of labour so satisfactorily.

In conclusion, let me make one more remark. It is that the scientific curiosity of to-day often becomes the trade necessity of to-morrow. A scientific friend of mine once directed my attention to the fact that most of the changes which have been introduced in industry have had their origin in the universities. Why? Because the investigator is un-

<sup>1</sup> From an address delivered before the Society of Chemical Industry, at New York, September 8, by the president, Sir William Ramsay, K.C.B., F.R.S.

fettered. If a man sets himself to improve an existing process, he very likely may succeed, but he will not effect a revolution in manufacture. The purely scientific investigator who is free to follow indications of no apparent commercial import has not infrequently made discoveries of a radical nature, which have entirely changed some particular industry. I do not recommend the one to the exclusion of the other; both are best; and both are best attained by an intimate association between the universities and the chemical works. The investigator often learns much by the study of industrial processes. The chemical manufacturer who is keenly alive to his own interests will not fail to keep himself in touch with every discovery, however little it appears to be connected with his own industry.

#### THE GRAIN IN PHOTOGRAPHIC FILMS.

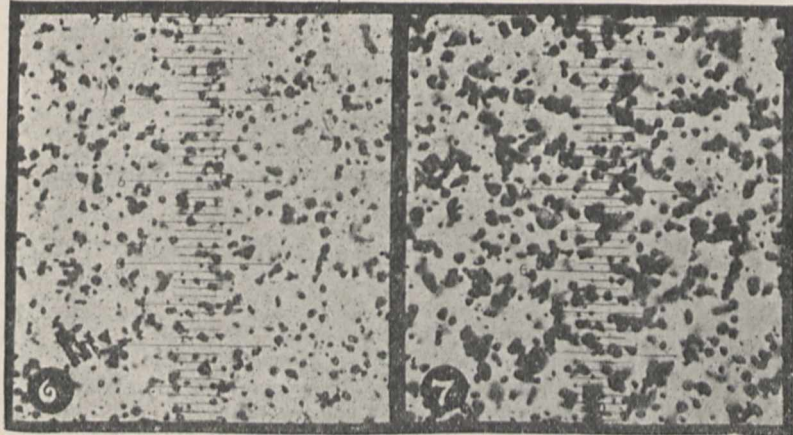
IN the September number of the *Astrophysical Journal* Mr. R. J. Wallace gives an account of his investigation of the circumstances that control the size of the silver particles in a developed gelatino-bromide plate. Of four rapid plates of American make, the "Seed 27, Gilt Edge" was found to give the best results. It was the most uniform in speed from time to time, and gave the least amount of "chemical fog," the smallest particles of silver, and the most regular distribution of them. While the particles were found to be, generally speaking, spherical in ordinary plates, isochromatic plates of several makes showed the peculiarity of having almost exclusively elongated (the author calls them "spicular") grains at the surface of the film, while in passing downwards through the film they gradually gave place to rounded particles, until close to the supporting glass these latter were the only ones found. Intensification increases the size of the particles; this is the common experience of those interested in these matters,

formation of "group-particles" because they dissolved off the film after development and examined a new film made from the product.

#### THE DUCHESS OF SUTHERLAND'S SCHOOL AT GOLSPIE.

AS announced in our columns last year (September 24, 1903), the formal foundation of the Duchess of Sutherland's Technical School at Golspie was inaugurated on September 8, 1903, by Lord Balfour of Burleigh, at that time Secretary for Scotland. The building is, we are informed, now completed, the total cost of erection, and equipment having exceeded 16,000*l.*, exclusive of the site and grounds given by the Duke of Sutherland. The school is a handsome structure in white freestone, and three storeys in height. It contains altogether fifty-six rooms, including fourteen class-rooms, workshops, laboratories, museum, &c. The dormitories are 50 feet by 21 feet, with bathrooms and lavatories attached. The school when full can receive sixty pupils. The curriculum covers a period of three years, and the subjects comprised are such as are most likely to meet local industrial requirements, the whole course being framed on a sound scientific basis. In drafting the original scheme the duchess had the cooperation of Prof. R. Meldola, Prof. Magnus Maclean, Lord Balfour of Burleigh, the Right Hon. R. B. Haldane, and Mr. Struthers, of the Scotch Education Department. A formal deed has been executed by the duchess ensuring the perpetuity of the school, and appointing for its management a local board of governors, the duchess herself being chairman and the duke a member of this board. An advisory committee has also been appointed consisting of leading educationists and representatives of Highland societies, as well as Her Grace's original advisers.

The building and equipment fund has been raised entirely by private voluntary subscriptions, the Duke of Sutherland having contributed 800*l.* Other munificent supporters of the scheme are Mr. Andrew Carnegie and Lord Strathcona, the Dukes of Portland and Westminster, Mr. James Coats, of Paisley, and Mrs. Carnegie. The cordial support which this new educational departure has received in Scotland will be recognised when it is stated that out of the sixty places in the school forty are provided for by bursaries guaranteed by various benefactors interested in the counties of Sutherland, Caithness, Ross and Cromarty, and one (by Mr. Dewar) for a student from Inverness-shire. Another indication of the local practical interest in the scheme is that at the opening of the school for regular work on October 3 the claims of more than sixty applicants for admission had been considered by the board of governors. Out of these, twenty-five bursars have been admitted as the first batch, and further admissions of bursars will



Before Intensification ( $1 \cdot 3$  to  $4 \cdot 0 \mu$ ).

After Intensification ( $2 \cdot 8$  to  $10 \cdot 4 \mu$ ).

FIG. 1.—Photomicrographs of Silver "Grain."

but the author's demonstration is of special interest, as he performed the intensification with a brush, using the mercury and ammonia method, without shifting the plate, so that he was able to photograph the identical particles before and after the operation. The same grains can easily be traced in the two photographs reproduced. The magnification is 430 diameters. The author also shows the difference between rapid and slow development. In the first case he considers that the silver particles most nearly approach the size of the original particles of silver salt from which they are produced, while by prolonged development they become enlarged by reason of the formation of "group-particles" as well as by accretion. For the finest grain the author deprecates slow development. In a postscript reference is made to the deduction of Messrs. Lumière and Seyewetz from their recent experiments to the effect that neither the temperature, concentration, nor duration of development practically affects the size of the grain. The author considers that these investigators have neglected the

be sanctioned for next year and for 1906.

It is proposed to work the school as a higher grade school under the Scotch Board of Education, and, in addition to the scientific and technical subjects, the ordinary literary and humanitarian subjects will be carried on from the elementary school stage, the standard of qualification required for admission as a bursar being that he should have completed his thirteenth year and have received the "merit certificate" or its equivalent. It is of interest to learn that the elementary schools from which the technical school will be supplied with pupils are cooperating most sympathetically in carrying out the scheme. One of the difficulties, as we learn from Prof. Meldola, which has beset the school in Essex founded by Lady Warwick, sister of the Duchess of Sutherland, has hitherto been the want of cooperation on the part of the local elementary schoolmasters.

The head-master of the new school is Mr. E. W. Read, of Cambridge, formerly agricultural instructor at the North-eastern County School, Barnard Castle, Durham.

### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE degree of Doctor of Science has been conferred upon Sir William Ramsay by Columbia University.

DR. F. CAVERS, lecturer in biology and botany at the Plymouth Technical Schools, has been appointed to the vacant professorship in biology at the Hartley University College, Southampton.

It is reported in *Science* that Prof. E. Wichert, of Göttingen, has been appointed to a chair of physics at Königsberg; Prof. Eduard Brückner, of Bern, has been elected professor of geography at Halle.

PROF. HUGH L. CALLENDAR, F.R.S., will deliver an address to-day at the Victoria and Albert Museum on the occasion of the distribution of prizes, medals, &c., to students of the Royal College of Science.

WE learn from *Science* that by the will of the late Dr. Henry Tuck, Harvard University will receive one fourth of the estate should his children not survive. The estate is valued at 1,000,000*l.* The effort to raise necessary funds towards the 30,000*l.* required for the new Eastman building of Rochester University, to be used for biology and physics, has been successful. Of the desired amount, the sum of 24,000*l.* is in hand, including 3000*l.* contributed by Mr. Hiram W. Sibley. Mr. Eastman, of Rochester, has given 12,000*l.* to the fund.

FOR the purpose of furthering the cause of education in the Transvaal, Mr. Alfred Beit has presented to the Government the Frankenwald estate, situated 12½ miles north-east of Johannesburg. The area of the estate is 1000 acres. The Government has purchased an adjoining piece of ground of 1000 acres, and Mr. Beit has spent an additional sum of 10,000*l.* himself on acquiring more ground. The total area available will thus be 2600 acres, a large portion of which is planted as orchards, vineyards, and nurseries, and part with timber trees, making the site admirably adapted for an agricultural college.

THE Board of Education has issued the following list of successful candidates for royal exhibitions, national scholarships, and free studentships (science):—*Royal Exhibitions*: Albert Eagle, Henley-on-Thames; Sidney H. E. May, Portsmouth; William B. Wood, Sheerness-on-Sea; Edmund W. Spalding, Cambridge; Joseph Lloyd, Pembroke Dock; Albert E. Monkcom, Portsmouth; John S. G. Thomas, Morriston, Swansea. *National Scholarships for Mechanics*: Sidney R. Dight, Plymouth; Harold H. Perring, Devonport; Stewart S. Spears, Sheerness-on-Sea; Edwin M. Vigers, Plymouth; Thomas A. Colvill, Chatham. *Free Studentships for Mechanics*: Arthur G. London, Southsea; Bert H. Penn, London. *National Scholarships for Physics*: John F. Mitchell, Cathcart, N.B.; Tom Harris, London; Harry Moore, Bradford; Hubert Watson, Darwen; Frank P. Fuller, London. *Free Studentships for Physics*: David C. Jones, Bala, N. Wales; Lucy Alcock, London. *National Scholarships for Chemistry*: John Keegan, Burnley; Harold Talbot, Farnley, Leeds; Charles Salter, Leeds; Alexander M. Hird, South Woodford, Essex; Herbert W. King, South Tottenham; Frank D. Miles, Carlisle. *Free Studentships for Chemistry*: Harold Mountain, London; Alan C. Webber, Brighton. *National Scholarships for Biology*: Frederick J. F. Shaw, London; Frederick J. Bridgman, London; Arthur B. Lister, Burnley. *National Scholarships for Geology*: Thomas Reed, Burnley; Herbert G. Smith, Burnley; Henry J. Jeffery, London.

### SOCIETIES AND ACADEMIES.

#### PARIS.

**Academy of Sciences**, September 26.—M. Mascart in the chair.—On a cause of variability of the errors of division in certain graduated circles: G. Bigourdan. It is usual to cut the actual graduations on a circle of silver let in to a support of another metal, such as brass or cast iron. The errors of graduation in astronomical instruments are usually

determined once and assumed to remain constant, but it is now shown that owing to the differences between the coefficients of expansion of the metal and its support considerable errors may arise. Cast iron should not be used as the supporting metal, brass or bronze being preferable, but it would be better to drop the use of silver, which tarnishes rapidly in towns, and make the whole circle of one metal, a nickel-steel for preference.—The Perseids in 1904: Lucien Libert. Observations were carried out at Havre from August 11 to 20 under good conditions; 339 meteors were counted, and 93 trajectories determined.—On the energy dissipated in iron by hysteresis at high frequencies: Ch. Eug. Guye and A. Schidlof. It has been shown in a preceding note that the loss of energy in iron due to hysteresis may be represented as a quadratic function of the frequency, provided that the wires are of small diameter. It has now been found that if the wires are made still thinner, 0.0038 cm., the equation becomes sensibly linear. In other words, the energy consumed per cycle, for the limits of frequency used in the experiments, is independent of the speed with which the magnetisation cycle is carried out.—The constitution and properties of the tungsten steels: Léon Guillet. Tungsten steels fall into two groups—perlitic steels, which possess analogous properties with those of carbon steels, but which take a greater breaking load the higher the proportion of tungsten, and double carbide steels, the properties of which are nearly independent of the percentage of tungsten, and the fragility of which is independent of the amount of carbon.—Carbinol salts and cyclohexanerosanilines: phenomena of decoloration: Jules Schmidlin.

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