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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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REVIEWS AND OUR BOOKSHELF.

R. CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK.

NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

THURSDAY, NOVEMBER 5, 1903.

BLOOD AND IRON.

Plant Disease and its Relation to Animal Life. By E. F. Wright. Pp. vi + 160. (London: Swan Sonnenschein and Co., Ltd., 1903.) Price 3*s.* 6*d.*

THIS little book with so alluring a title is emphatically disappointing, and would appear to have been written by a compiler quite inadequately informed on the subject, especially in its botanical aspect.

The principal contention of the author seems to be that, because iron is necessary for the production of chlorophyll in the green plant, and is an indispensable ingredient in relation to the hæmoglobin of the blood in animals, these two bodies, chlorophyll and hæmoglobin, are the same. Thus on p. 1 we read, "Now what chlorophyll is to the plant, hæmoglobin is to the animal, the one being a red modification of the other," and, p. 69, "As hæmoglobin is allied to the proteids and a red modification of chlorophyll, it follows that the hæmoglobin of the animal varies as the chlorophyll or chlorophyll products vary in the plants eaten."

He then proceeds to argue that if an animal eats plants deficient in chlorophyll (*i.e.* chlorotic) it suffers the evils due to want of iron—*e.g.* (on p. 6) "animals eating chlorotic food must be deficient in sugar, fats and proteids," which would seem to indicate (since the author appears not to discriminate between chlorosis and etiolation) that people who are fond of cauliflowers, asparagus, endive, rhubarb, and the like, run risks hitherto unsuspected. For note this (p. 13), "if my contention is correct, the susceptibility to certain bacterial diseases is directly traceable to the use of chlorotic food." And on p. 15, "from which it follows that a chlorotic plant will contain less proteids than a plant containing the maximum quantity of iron." And, again, p. 28, "it is clear that there must be a large number of animals living entirely or partly on this chlorotic vegetable food, from which it follows that a large portion of animal life must be more or less anæmic through eating this chlorotic food."

We have already stated that the author draws no distinctions between different forms of chlorosis and etiolation, and puts the former down simply to a lack of iron. Now let us see what he regards as the measure of this deficiency, bearing in mind that modern plant physiology teaches us that the traces of iron found necessary to develop the peculiar form of chlorosis in question are so minute that it is often somewhat difficult to ensure the absence of that element in experimental cultures.

On p. 7 we read, "Yet there are many soils quite wanting in iron, and in the history of agriculture you never read of manuring with iron, excepting possibly in the case of some experimental plots, although some iron has been used of late years in the form of basic slag, which contains about 18 per cent. of iron," and, further on the same page, "Unfortunately, much vegetation is deficient in iron, and consequently chlorotic, and it would seem simpler instead of washing with sulphate of iron, as is now occasionally done, to have recourse to manuring the ground with iron," all of which goes to show that the author's notions as to the relations between iron and plants are, to say the least of it, crude. Does he seriously suppose that basic slag is used as manure on account of the iron it contains?

But lest there should be any risk of misunderstanding the author's meaning here, we may quote the following from this amusing book. After describing how one lamb of a flock, too weak to proceed, was rescued and brought up by the children of a blacksmith, the author continues (p. 34), "This lamb grew up by grazing on the grass growing round this [the blacksmith's] shop, and was shorn three times in three years," &c., and he explains the excellent condition of this lamb as follows:—"In the first place, it is quite certain there would be plenty of iron in the soil for some distance round a country blacksmith's shop, owing to rusty iron being carried about, to say nothing of the scales of iron and iron filings," &c.

To show what gourmands for iron the author's animals are, we quote from p. 93:—"And to show that

animals require iron, I have seen mules licking rusty iron, just as thousands of people have seen horses licking salt," to which valuable testimony he quotes an account of quails in Florida picking at the holes in the steel rails.

But to appreciate fully what a man of blood and iron we are concerned with, it is necessary to obtain some insight into his views of what his plants and animals do with these relatively enormous quantities of the metal.

We read on p. 5, "iron is the means of fixing the ammonia of the air in the soil to form nitrates. In any case I am sure there is a fixed law by which the ammonia of the air is fixed in the soil to form nitrates . . . ." Then, on p. 21, "it has been proved over and over again that iron is fatal to all fungi, consequently it is unreasonable to suggest that bacteria would attack a perfectly healthy animal, and destroy the blood containing a constituent which was a poison to them."

And, again, on pp. 98–99, "The distinct chemical difference between fungi and what we look upon as ordinary plants, is that the fungi contain no iron or nitrogen, while these constituents are essential to ordinary plant life. It is known that iron and nitrogen are fatal to fungi, therefore the more iron and nitrogen animal life takes up in its food the more likely it is to be immune to bacterial diseases."

It might not unreasonably be expected that we had here plumbed the depths, but the following shows that there are nether regions still, for on p. 42 we have the astounding statement, "It is fully recognised that iron and nitrogen in combination with the phosphates are the means by which the plant is enabled to take up the carbon of the air, . . ." and on p. 68, "it is admitted that the proteids are fatal to pathogenic bacteria." Even these are not the only contributions of the author to the study of bacteria, for he states (p. 98) "it is recognised that all classes of bacteria can only live on foods corresponding in chemical composition to themselves," which pronouncement would appear to require some explanation in view of the previous one regarding proteids, for instance, and the following, quoted from p. 33:—"it is admitted that pathogenic bacteria cannot live in the presence of proteids."

What the author's idea of a proteid may be we have been unable to make out, but there is no hesitation needed in regard to some of his notions regarding immunity, of which the following is a specimen (p. 60):—"Another important factor in immunity is electricity, which is so closely connected with the chemistry of the animal that it is reasonable to think that an animal of normal chemical combination will be in a position to produce much more electricity than an animal chemically deficient."

Immunity is a fascinating but a very difficult subject, but the author is not deterred by the latter in his submission to the former attribute.

On pp. 118–119 we read, "although Storer does speak of the better kinds of humus, yet it may be a chlorotic humus, or it may be a humus containing a maximum chlorophyll, or any variation between the two, which variation would be capable of constituting a great chemical difference." Indeed, we should think it would! But let us read on (p. 120), "if you have a field rich in all the essential mineral constituents, in an assimilable form, and a green crop be grown in this field and ploughed in, and then a cereal crop be grown, this cereal crop will be immune to rust, to say nothing of other parasitical diseases." Here it might be said that the author is merely claiming that high manuring renders a crop more immune, did not the context show that his ideas are by no means so simple, and if the continuation on p. 120 were overlooked, "while if in another field, very deficient in these assimilable mineral constituents, a green crop was grown of a chlorotic nature and ploughed in, then the cereal crop grown would not be immune owing to the imperfect chemical functions performed by what I may call a chlorotic humus."

And this, after all the careful work that has been done on the cereal rusts and other parasitic diseases!

On p. 131 the author declares that "parasitic fungi and bacteria can only flourish when the plant (or animal) on which they feed is deficient in chlorophyll or chlorophyll matter, or their products."

An interesting specimen of the author's quality appears in the following naïve passage on p. 148:—"Slugs, indeed, living as they do like the fungi mainly upon decaying vegetable matter, are not unlike creeping fungi, and I believe it can be shown that they are chemically of a similar composition." Again, p. 158:—"I have now pointed out that there are forms of insect life that are to all intents and purposes simply an extension of the fungi."

These suggestive quotations will, we are of opinion, convince the reader that the present volume cannot be said to be of any use to a serious student of science.

MINES AND MINERALS OF THE UNITED STATES.

Mineral Resources of the United States. Calendar Year 1901. Pp. 973 and index. (Washington: Government Printing Office, 1902.)

THIS is the eighteenth volume of the well-known series issued by the United States Geological Survey, and, like those which have gone before, it is full of valuable information concerning the mineral output not only of the country itself, but also of the world generally. The book consists of a number of articles written by various experts; thus the production of iron ore is dealt with by Mr. Birkinbine, and the American iron trade by Mr. Swank. Mr. G. F. Kunz contributes some interesting pages upon precious stones, whilst the coal trade is reviewed by Mr. E. W. Parker. The consequence is that a more useful contribution to knowledge is made by the United States Geological Survey than by the British Home Office in its annual mineral statistics.

The introductory remarks written by Dr. David T. Day tell us that the total value of the minerals produced in 1901 is reckoned at 1,086,529,521 dollars, or about 223 millions sterling; this is more than twice the value of the mineral output of the United Kingdom last year. It must be pointed out, however, that the

American figures are swollen by taking the value of the metals and not the value of the ores, but even if the comparison with this country were made upon strictly identical lines, we should still be a long way behind.

In 1901 the United States produced more coal, copper, gold, iron, lead, salt and silver than any other country in the world. The yield of coal was about one-third of the world's supply. This mineral is mined in twenty-eight different States, Pennsylvania being, of course, by far the most important. Twenty-four States are producing iron ore, Minnesota heading the list with 11 million tons of red hæmatite.

Montana yields about two-fifths of the copper of the United States, the Lake Superior district about one-quarter, and Arizona about one-fifth.

Colorado has outstripped California, and is now the leading gold-producing State.

Mr. Oliphant's chapter upon natural gas is sure to claim much attention, and is of special import for those who are interested in our new supply in Sussex. The advantages of this cheap and economical fuel are lauded to the skies by the author, who reckons that the quantity tapped and supplied in 1901 exceeded one cubic mile in volume; 21,848 miles of mains, 2 to 36 inches in diameter, are employed in distributing the gas to consumers.

We learn from Mr. Struthers that the United States are the largest producers of borates in the world. Most of the borax is obtained by treating the colemanite of California.

According to Mr. Joseph Hyde Pratt, who deals with abrasives, artificial corundum is now being employed in the manufacture of emery wheels. It appears that bauxite is converted into corundum by means of great heat and pressure in an electrical furnace. The mineral monazite is far more widely distributed than was imagined when its name was chosen in allusion to its supposed rare occurrence; it derives its commercial value from the small percentage of thoria which it contains. The quantity washed from gravels and sands in North and South Carolina in 1901 amounted to 334 tons.

In dealing with a great work like the volume under review, it may seem ungenerous to point out a small and trifling error, but probably Mr. Birkinbine will be glad to correct the statement that "no true manganese ore is won" in Great Britain. The Merionethshire ore cannot be fairly described as "manganiferous iron ore" when an analysis[1] shows 25 per cent. of manganese and only 4 per cent. of iron.

CLIMATOLOGY.

Handbook of Climatology. Part i. General Climatology. By Dr. Julius Hann. Translated by Robert de Courcy Ward. Pp. xv + 437. (London: Macmillan and Co., Ltd., 1903.) Price 12*s*. 6*d*. net.

THE translation into English of the first volume of Dr. Hann's "Climatologie" is a very welcome addition to the library of English-speaking meteorologists. The translation does not extend to the last two volumes of the original work, which deal with special climatology, as it has been found "impracticable" to translate them. This is greatly to be regretted, for the generalisations which constitute the science of climatology cannot be satisfactorily treated without reference to the statistical data and the means for verifying them. Moreover, a compendious review, in English, of the statistics of the various meteorological elements arranged according to geographical distribution is constantly wanted for many purposes, and either a translation of Dr. Hann's volumes, or a reproduction in an abridged form of Dr. Buchan's volume of the *Challenger* reports, is a necessity of which every student of meteorology must be aware. It is quite true that such a survey would be a work of reference, and would not serve as a text-book in a course of general climatology, and as that is Prof. Ward's purpose in preparing the translation, we must unfortunately wait for some other interest to prompt the translation of the two volumes of special climatology.

The translator himself explains the relation of the English version to Hann's first volume:—

"This translation, as it stands, essentially reproduces the original. Numerous references, especially such as will be most useful to English and American students, have been added, and changes have been made in the text in order to bring the discussion down to date. A natural temptation to expand the original has been yielded to in very few cases only. Practically all of the important publications which have been issued since the completion of the second German edition are referred to. Some new examples of different climatic phenomena have been added, chiefly from the United States. Most of the examples given, however, necessarily still relate to Europe, because the climatology of that continent has been studied more critically than that of any other region. A few cuts have been made where the discussion concerned matters of special interest to European students only."

Among recent works, references to which have been incorporated, Bartholomew's "Atlas" is conspicuous, but the remarkable Russian "Climatological Atlas," published in 1900, is not, although it furnishes a large number of illustrations of climatological principles.

A distinction is drawn by Hann between climatology and meteorology, but when one deals with general climatology it is rather hard to maintain the distinction. In dealing with the analysis of climates into solar, or mathematical climate, and physical climate, with such subdivisions as mountain climate, continental and marine climates, forest climate, and such supplements as mountains as climatic barriers, geological changes of climate and periodic variations of climate, all of which are treated in the book, it is obvious that neither author nor translator would be content with the mere analysis of figures representing these different sections. The mode of classification at once suggests the causes of climate, and the investigation of such causes is practically general meteorology.

It is scarcely necessary to refer to the admirable way in which Dr. Hann arranged his introductory volume to include a survey of all the general facts about climate and its local variations, and to produce a book

[1] Halse, "On the Occurrence of Manganese Ore in the Cambrian Rocks of Merionethshire." (*Proc.* N.E. Inst. M. and M. Eng., vol. xxxvi. 1887).

which always surprises those who take it up by the fulness of its information and by the interest which it stimulates. There is no specific indication in the present volume as to what parts are derived from the original and what parts are due to Prof. Ward's careful editing; in any case, the result of the collaboration is a most admirable book.

W. N. SHAW.

OUR BOOK SHELF.

The Steam Turbine. By Robert M. Neilson. Second Edition. Pp. xvii + 294. (London: Longmans, Green and Co.) Price 10*s.* 6*d.* net.

THE history of the steam turbine previous to the reign of Parsons, whose first patents were applied for in 1884, may be made out from chapters i. and ii. But descriptions of inventions in the language and with the illustrations usual in patent specifications are not quite what is expected from the author of such a book as this. There is an appendix giving the names and dates of all patents relating to steam turbines. The history and construction of the Parsons and the Laval turbines are given at some length, with the results of practical tests for power and consumption of steam, and the reader gets an opportunity of understanding the construction of modified forms which are now, under various names, coming into use. Students are anxious to examine good drawings and descriptions of the details of the Parsons turbine, and it would appear that these are difficult to obtain. The author of this book has given much information and many illustrations somewhat in the style made familiar to us in the engineering newspapers. Much more information is given about the Laval type of turbine. As to the theory of these turbines, the essentially important points seem to be ignored, and yet all the theory of any turbine known to anybody may be given very shortly indeed. There is a particularly interesting point in connection with the Laval turbine to which the author might have directed attention, namely, the exceedingly great speed reached by fluid at the end of an expanding mouthpiece. So far as we know, the reason for this has never been published, and yet any student of the papers of Osborne Reynolds ought to be able to give it readily.

The chapter on the propulsion of ships by turbines is interesting.

On the whole, the book is one that ought to be read by students; it is practically the only book on the subject, but we think that the author has not done so well with his materials as he might have done.

Whittaker's Electrical Engineer's Pocket Book. Edited by Kenelm Edgcumbe. Pp. viii + 456. (London: Whittaker and Co., 1903.) Price 3*s.* 6*d.*

THIS little book differs in several respects from the ordinary type of pocket book; it possesses the usual features—a limp cover, round corners, gilt edges, and a weight quite unsuited to the pocket—which serve to characterise the "pocket book," but in the arrangement of the matter it rather resembles a small encyclopædia. Each branch of electrical engineering is dealt with in a separate section or chapter, which may be read consecutively as if it were a brief treatise on the subject. The method has much to recommend it; the electrical engineer who comes across some problem in a branch with which he is not familiar can turn up the section dealing with that branch and read a summary of the whole subject; numerous references to recent papers will greatly help him in finding the particulars which he wants. There are, of course, also a number of tables of the constants more generally required. The treatment is not very even; thus whilst generating machinery—dynamos, alternators, and motors—receives full consideration in 100 pages or more, only four pages are given to electric lamps and lighting, and the information given therein is quite inadequate. The diagrams and illustrations are clearer than those usually to be found in books of this class.

M. S.

Astronomischer Jahresbericht. By Walter F. Wislicenus. Band iv. Pp. xxxii + 648. (Berlin: Georg Reimer, 1903.)

THIS, the fourth issue of this most valuable and useful volume, contains the references and a brief summary of contents of the astronomical literature published last year. The work is of the same high standard as in former years, and casts great credit on the labours of Herr Wislicenus and his joint compilers. This year-book is so well known to astronomers, and has been found so valuable by them, that it is hardly necessary to dwell either on the general arrangement of the subject or on the method of treatment. The main object of the compilers was to make as perfect a record as possible of all the published papers on this subject, yet to keep the book from becoming too bulky. This they have succeeded in doing, in spite of the fact that many of the abstracts of lengthy papers are very complete.

Now that the Royal Society has published the first annual issue of this branch of science (E. Astronomy) in the "International Catalogue of Scientific Literature," it seems possible that there will scarcely be room for both of these compilations, since the more perfect they become the more closely will they resemble each other. This question, however, the future will no doubt settle. There is, nevertheless, one main difference between them, in that the volume before us summarises the contents of each paper to which reference is made, while that of the "International Catalogue" is restricted to the bare references.

W. J. S. L.

Practical Management of Pure Yeast. By Alfred Jörgensen. Translated by R. Grey. Pp. viii + 60. (London: the *Brewing Trade Review*, 1903.)

THIS useful little work might have received with advantage a title better descriptive of its contents. It contains a condensed account of the biological methods which are employed in the author's well-known laboratory in the pure culture and analysis of alcohol-producing yeasts. According to the preface, the leading purpose of this treatise is to enlighten the so-called practical man in the methods of investigation employed by the zymotechnologist, so that in the future the practical man and the technologist may work together with better understanding at the many important and difficult problems which are encountered in the processes of the fermentation industries. No doubt the little book is well calculated to fulfil its object if only the practical man will read it, and we hope it will be in much demand for this purpose. But whatever may be the success of the book in this direction, it undoubtedly deserves the careful attention of all zymotechnologists, as it indicates the lines on which a well-known investigator of great experience is working with a view to the solution of many interesting and complicated problems in connection with the organisms of fermentation. The last words on the biological methods of analysis and the technical employment of pure cultures of yeast are still a very long way from being spoken, but as an advance towards this end we cordially recommend the work to the attention of all interested in the biological aspect of the fermentation industries.

A. J. B.

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.*]

Variation of Atmospheric Absorption.

I SHOULD be pleased to know how far some observations on the change in the average absorption of the terrestrial atmosphere in this country during the last two years have been confirmed by observations elsewhere. The following table gives the mean of the best of these, made at Washington in the autumn of 1901, the spring and autumn of 1902, and in the winter, spring, and summer of 1903.

Coefficients of Transmission for Zenith Sun.

	μ	μ	μ	μ	μ	μ	μ	μ
Wave-length... ...	0·50	0·60	0·70	0·80	0·90	1·00	1·20	1·60
Mean of observations, 1901–1902.	0·765	0·769	0·857	0·897	0·910	0·921	0·933	0·930
Mean of observations during 1903	0·627	0·692	0·753	0·797	0·825	0·847	0·874	0·909
Excess of transmissibility of 1901–1902 over that of 1903	20%	10%	13%	12%	10%	8·4%	6·5%	2·3%

The decrease in the transmissibility of the air this year as compared with the last is so marked that some local effect on climate and vegetable growth might seem to be probable. Whether the unusual coolness of the summer, reported both in America and abroad, is connected with it may be a subject for speculation. S. P. LANGLEY.

Smithsonian Institution, Washington, October 22.

Heating Effect of the Radium Emanation.

THE very important and fundamental experiments described by Profs. E. Rutherford and H. T. Barnes in NATURE of October 29 will have been read with the greatest interest. Owing to the importance of the subject, I should like to direct the authors' attention to some points in their comment and explanation which do not appear to me to be quite clear, and if I can draw from them some more detailed discussion this letter will have served its purpose.

The general conclusion arrived at by the authors is that "more than two-thirds of the heating effect is not due to the radium at all, but to the radio-active emanation which it produces from itself." If I understand the description of their experiments correctly, these seem to me, however, to point to the fact that it is the "excited activity" and not the emanation that is the cause of the heating. Apparently de-emanated radium gives out an amount of heat at a rate which falls in a few hours to a minimum and then slowly recovers. Now the emanation itself begins to form again at once, so that on the authors' hypothesis the heating effect should start with a minimum and then gradually increase. The activity of the radium measured by electric methods follows the course of the heating effect, and, as Messrs. Rutherford and Soddy have explained (*Phil. Mag.*, April, *not* May as quoted by the authors), this is due to the fact that the de-emanated radium has still the excited activity attached to it, and this activity decays in the course of a few hours. When the excited activity is gone there is nothing but radium left, and the further changes are due to the re-formation of the emanation and its subsequent change into excited activity. During the course of the first few hours there is, therefore, very little emanation, but there is excited activity which falls to a minimum and then slowly grows again. Does not the explanation which holds for the activity also hold for the heating effect, and would it not follow that the parallelism of heating effect lies with the amount of the excited activity present, and should be assigned to it rather than to the emanation?

Similarly, the emanation, according to the authors, does not give its full heating power at first, but the heating effect rises to a maximum in the course of the first few hours. If the emanation is the cause of the heat, why this slow rise? Here again the effect seems proportional to the amount of excited activity present, and not to the amount of the emanation. The connection of heating power with the emission of α rays also requires further elucidation, and the information given by the authors is not, I believe, sufficient to prove their case. It is only with great diffidence that I address these remarks to you, because Prof. Rutherford knows the whole subject at first hand, and his judgment is more likely to be correct than mine. Nevertheless, one likes to know whether others have felt the same difficulty, and whether the apparent disagreement is one of misunderstanding or has some more deep-seated cause. ARTHUR SCHUSTER.

The Owens College, Manchester, November 2.

Radium and Plants.

THE sensibility of protoplasm towards the radiations of radium is a matter of so much importance that a few preliminary experiments I have carried out on plants may be of interest.

The first experiment I made in this direction was with cress seedlings. About 100 seeds were uniformly distributed over the surface of some moist sand contained in a flower saucer, and a tube containing 5 mgrs. of pure radium bromide supported at a height of 1 cm. over the centre of the sand surface. During the experiment the saucer, covered with a glass shade, was kept in the dark. It was hoped that this arrangement would show whether the radiations are harmful or not to the sensitive cells of seedlings, and at the same time indicate if they are able to act as a stimulus to evoke positive or negative curvatures.

After the germination of the seeds, which took place within two days nearly simultaneously all over the sand, the growth of all the seedlings was nearly uniform. But close comparison showed that the seedlings immediately under the radium tube were to some small extent retarded in their development. The retardation was apparent in the seedlings situated within a radius of about 2 cm. from the radium bromide. Besides being smaller, these seedlings developed somewhat fewer and shorter root-hairs than those nearer the margin of the sand.

In the subsequent growth the presence of the radium evoked no curvatures in the little plants close by it, or in those more removed. Nor did it appear to exercise any noxious effects, other than the retardation just described, on the seedlings within the period of the experiment, viz. thirteen days. The plants grew up beside it and against the glass containing it, neither influenced by it nor hurt by it, so far as one could see.

This experiment was repeated on two other occasions (one experiment lasting three days after germination and the other lasting four days) with the same result, viz. no curvature was evoked, but the seedlings close under the radium bromide were slightly retarded in their growth.

In order to determine if motile organisms are sensitive to the radiations I enclosed the radium tube in a vessel of water containing large quantities of *Volvox globator*. Extraneous light was cut off from the experiment. After twenty hours many of the Volvox colonies had sunk to the bottom of the vessel, but they were evenly distributed over the bottom, and were neither aggregated under the tube nor dispersed away from it. Those that were still swimming in the water were also uniformly distributed through it, some actually in contact with the radium tube and some far away from it, but showing no sign of being attracted towards it, or of being repelled from it.

It is apparent from these few experiments that the radiations emitted by radium bromide are not able to produce marked effects in a short time on these vegetable cells and tissues. Even the phosphorescent light (which is quite perceptible to the eye under suitable conditions) emitted by the radium bromide is too feeble to be effective in calling out a phototactic response. HENRY H. DIXON.

Botanical Laboratory, Trinity College, Dublin.

Solar and Magnetic Disturbances.

THE Kew photographic curves showed appreciable magnetic disturbances of a normal type on the evening of October 30 and early morning of October 31, but the first distinct precursor of the magnetic storm was an exceptionally sudden movement at about 6h. 3m. a.m. on October 31, shown alike in the declination, horizontal force and vertical force curves. This movement was largest in the horizontal force, where there was a sudden increase of about 60 γ ($1\ \gamma \equiv 1 \times 10^{-5}$ C.G.S. unit). In the declination there was a simultaneous movement of about 7′ to the west, apparently preceded by a very tiny movement to the east, lasting too short a time to be distinctly shown. The first large movements commenced about 6.45 a.m., when there was a movement of the declination needle to the west through about 34′, and a diminution of 240 γ in the horizontal force. The storm was most violent between 10 a.m. and 7 p.m. on October 31, but there was a large amount of disturbance until 3 or 4 a.m. on November 1.

The traces from the Kew magnetographs—declination, horizontal force and vertical force alike—went off the sheet repeatedly, so that the full extent of the disturbance cannot be derived from them. A declination magnetograph, however, of lesser sensitiveness recorded apparently the complete movement, and showed a range of about 2° 12′. Between 1 and 7 p.m. there were at least twenty to and fro oscillations of the declination needle—each occurring in but a few minutes of time—the amplitude of which exceeded 20′. In addition to these there was a very large number of smaller oscillations. At times these followed one another so rapidly that they can hardly be seen apart on the photographic sheet. In the horizontal force there were also very numerous oscillations. The general tendency from 7 a.m. to 10.30 a.m. was towards a reduction of the force. From 10.30 a.m. to 1 p.m. the oscillations were about a value not far from the normal. At about 1 p.m. there commenced a rapid rise, which in twenty minutes amounted to about 690 γ, the curve going off the sheet. During the next two and a half hours the trace was often off the sheet. Between 3.50 and 5.10 p.m. the trace crossed the sheet from edge to edge, representing a change of about 750 γ, or somewhat more than one twenty-fifth of the value of the whole horizontal force. The vertical force disturbance was small at first, and did not become really large until nearly noon on October 31. From noon to 7 p.m. there were numerous large oscillations, the curve going off the sheet repeatedly on one side. At about 1.40 p.m. there was an oscillation where, in the course of five or six minutes, there was a decrease and increase of more than 350 γ. The trace remained off the sheet from about 3.30 to 5 p.m. Between 5.10 and 5.50 p.m. the force diminished about 450 γ.

The storm is much the most notable recorded at Kew since February 13–14, 1892. CHARLES CHREE.

National Physical Laboratory, Richmond, Surrey, November 3.

IN connection with the magnetic storm of Saturday last, October 31, it may be of interest to record that observations made between 10 and 11 a.m. on that day by Prof. Callendar and myself showed a violent distortion and reversal of the C line of hydrogen in the neighbourhood of the great sunspot group, which was then a little past the central meridian. A notable feature was the apparent detachment of a portion of the dark C line, the separated part presenting the appearance of a cloudy patch, displaced towards the violet by about three tenth-metres. The observations were unfortunately interrupted by clouds.

A reversal of the C line over the same spot had been observed on the two preceding days, but though on these occasions the bright line was more brilliant than on October 31 there was much less distortion of the dark line.

A. FOWLER.

Royal College of Science, South Kensington, November 3.

Dr. Shaw's Address at the British Association.

I HAVE received the following letter from Sir Arthur Mitchell, K.C.B., who has been for long closely identified with the Scottish Meteorological Society, both as a scientific worker and as an administrator, and who was one of the founders of the Ben Nevis Observatory, and I send it to you as it expresses what I am sure must have been the feeling of meteorologists on reading Dr. Shaw's otherwise admirable and inspiring address on methods of meteorological investigation.

34 Drummond Place,
Edinburgh,
October 15.

Dear Mr. Omond,—

Dr. Shaw's address to the subsection of astronomy and meteorology of the British Association in September last, by its appearance in NATURE of September 17 has quickly and effectively reached the whole scientific world, and it is misleading in important directions, quite unintentionally, I believe.

The absence of all reference to the meteorological work done by Buchan, Stevenson, Aitken, Buchanan, Murray, yourself and others will probably receive an interpretation which I hope is erroneous, for I cannot think that Dr. Shaw would designedly belittle the valuable work these men have done, which is recognised as being of a high character all over the world.

But it seems to me more remarkable that Dr. Shaw should have made no special reference to the work of the Ben Nevis Observatories. In that work a very great, costly and laborious effort has been made to advance meteorology and to add to knowledge, and this has been done mainly through private enterprise, under the guidance of the foremost scientific men of our time, including Kelvin, Tait, Buchan, Murray, Copeland, Aitken, Buchanan, Stevenson, and many others. The discussion of the outcome of this great experiment in connection with the physics of the atmosphere has only recently begun. It cannot be quickly finished, much time by many experts must be given to it, and it cannot fail to cost a large amount of money.

My special object in writing to you is to suggest that, as honorary secretary of the Ben Nevis directors, you should in some way supply what I regard as an incompleteness in Dr. Shaw's address by briefly stating how the work of the Ben Nevis Observatories now stands, and what prospects there are of its yielding further important additions to knowledge.

Very faithfully yours,
ARTHUR MITCHELL.

In accordance with Sir Arthur's suggestion I beg to make the following statement explanatory of the present position of the Ben Nevis Observatories, and to note briefly the work carried on at and in connection with these observatories.

When the observatory on Ben Nevis was opened twenty years ago very little was known about the condition of the atmosphere above a few hundred feet height over the British Islands. The first object aimed at was to determine the meteorological constants for that position, and the relations of the air there to that at sea-level in the neighbourhood. This latter part of the work has only been adequately carried out since the establishment of the Fort William Observatory in 1890. The observations down to the end of 1892 have been published in two volumes of the *Transactions* of the Royal Society of Edinburgh (Nos. 34 and 42). The first of these was printed at the expense of the Royal Society of Edinburgh, and the second at the joint cost of the Royal Societies of London and Edinburgh. Another volume is in the press, and will be issued shortly.

The constants referred to are:—(1) The average value at each hour of the day for each month of the year of barometric pressure, temperature of the air, humidity, rainfall, direction and force of wind, amount of cloud and sunshine on Ben Nevis. (2) The relation of each of these to the corresponding sea-level values at Fort William. Immediately arising from these average values is the question of the changes induced on them, especially on the second series, by different conditions of weather—that is, the determination of the vertical gradients of pressure, temperature, &c., under varying atmospheric conditions. This discussion has been partly carried out, and the more important results arrived at are summarised in papers appended to the two volumes of observations.

One of the most interesting practical aspects of the Ben Nevis records is their application to the reduction of barometric readings to sea-level, a subject which is at present engaging great attention in this country, in the United

States, and, indeed, wherever meteorology is studied. The other subjects treated in these papers include :—

(1) The changes in the hourly variation of the barometer in fine and in cloudy weather at Ben Nevis, Fort William, and several other stations.

(2) The general meteorological conditions on Ben Nevis in clear and in foggy weather.

(3) Atmospheric dust on Ben Nevis.

(4) The pumping effect on a barometer of strong winds.

(5) The difference in the direction of the wind at Ben Nevis from that at sea-level.

(6) The change of temperature with height in anticyclones.

(7) The diurnal ranges of the Ben Nevis and Fort William barometers when both are reduced to sea-level by the usual tables.

(8) The diurnal range of the variability of temperature from day to day at Ben Nevis and some other places.

(9) The meteorological conditions at Ben Nevis during the severe frost of January and February, 1895.

(10) The relation of wind direction to temperature and to rainfall at Ben Nevis.

The establishment of the Ben Nevis Observatories has provided meteorological data of a character unique in this country, and, indeed, in the world, owing to the position of Ben Nevis as a high-level station placed right in one of the storm-tracks of the Atlantic. But it has also led to investigations which could not otherwise have been carried out, for no increase in the amount or quality of low-level observations would have supplied the necessary data, and the high-level records got from kites or balloons are too fragmentary for the purpose.

The observatories were built with money subscribed by the public, and up to this time have been supported by subscriptions, aided by an annual payment of 100*l.* for the Ben Nevis Observatory and 250*l.* for the Fort William Observatory from the Parliamentary grant of 15,300*l.* given annually for meteorological purposes. What their future position may be depends on the recommendations of the Parliamentary Committee of Inquiry into the administration of this grant now sitting, but whether Parliament gives the money necessary to carry them on, or whether they are closed and abandoned, as they assuredly will be if not taken over by the State, the work done at and in connection with these observatories is a record of investigation which will be growingly studied by meteorologists.

Edinburgh, October 17. R. T. OMOND.

No one is more conscious of the shortcomings and omissions of the address than its author. One correction I should like to make here. The joint editors of the *Meteorologische Zeitschrift* are Dr. Hann and Dr. Hellmann; Dr. Pernter is associated with the journal as "Herausgeber."

I cannot fail to be aware that, with perfect propriety, I might have devoted a large part, or even the whole, of the address to the obligations of meteorology to private enterprise in this country. In that case it would have been a different, perhaps a better, address, but I will ask your readers to believe that any omissions of that kind which they detect and regret were not due to a desire to belittle anything except the address itself.

In one sentence I did explicitly refer to Edinburgh and Ben Nevis. I cannot altogether emulate the achievement of Mr. Puff, who managed to extract so much meaning from a shake of Lord Burleigh's head, but I should like to say that if Sir Arthur Mitchell had used an appropriate magnifying power, and had got it properly focused upon that sentence, he would have read the following opinion which the mention of Ben Nevis always suggests to my mind, "that if means were found for endowing a chair of meteorology in the University of Edinburgh, and one of the distinguished Scottish meteorologists, whose names require no announcement from the chair to make them known to the British Association and far beyond, were appointed thereto, a most important and productive step would be taken towards the solution of the many problems connected with the great Scottish work of the Ben Nevis Observatories, the twenty-first annual report of which Dr. Buchan will present to the Association." W. N. SHAW.

October 21.

Weather Changes and the Appearance of Scum on Ponds.

IF any of your readers could explain an interesting natural phenomenon constantly occurring here we should be very grateful. It is simply that, invariably before any decided change of weather, there comes up a scum on the surface of the pool or small lake which skirts our south and east lawns—part of the pleasure grounds surrounding the mansion. Sometimes it looks like soapy water, but at other times it is black, and makes the breasts of our swans as black as ink just above the water-line. Then the scum will suddenly disappear, and the swans' breasts become white again. Our geological formation is the junction of the Upper Greensand and the Lower Chalk. The bottom of our lake is chalk; it is fed by springs, and the stream formed by its overflow runs finally into the Thames. It is shallow, and is surrounded by large trees. There are at present eight swans on it, also many moorhens and wild duck, and quantities of fish, which attract herons; kingfishers live in the bank, which is very high on the far side. There is also an island with large trees and a dense undergrowth. PLATANUS ORIENTALIS.

Aston Rowant, Oxon.

WITH reference to the letter of "Platanus orientalis," it seems to me that a possible explanation of the appearance of dirty scum on the surface of the pond before any decided change of weather may be that a sudden change of barometric pressure may accelerate the flow of springs rising through the chalk of the floor of the pond. This would carry up to the surface of the water some of the fine mud which had rested on the chalk, or even lodged in crevices within it. When the flow of the springs diminished or ceased, the sediment would naturally subside once more. It would be interesting to keep an exact record of the appearance of the scum and of the variations of atmospheric temperature, pressure, and the rainfall by automatic recording instruments.

Without knowing the local conditions it would be impossible to speak definitely as to the sufficiency of this explanation.

Another that occurs to me is that, if the sediment at the bottom of the pond is of a flocculent character, its movements may be due to the same cause as those of the precipitate in a "storm-glass," whatever that cause may be; but in that case the appearance would probably be limited to dead calm weather.

It is possible that the scum may be organic, and it would be desirable to have it examined microscopically by a student of limno-plankton.

HUGH ROBERT MILL.

Cranial Casts.

IN the number of NATURE which arrived here to-day there is a report of the interesting presidential address delivered by Prof. Symington in Section H at the British Association's recent meeting. In this report there are several statements which are likely to prove misleading to those who are not familiar with the literature relating to brain-casts. The reader might imagine (see p. 540) that this was an entirely new branch of research suggested by Dr. Forsyth Major's work on the subfossil Lemuroids (1898) and only fully exploited by Prof. Schwalbe in 1902. This, of course, cannot be the meaning which Prof. Symington intended to convey, because he is quite familiar with the scores of cranial casts made in such profusion by Prof. Gervais in the years 1867–1871, and by a long line of anatomists and palæontologists both before and since that time, and with the valuable contributions to knowledge which have resulted from this fertile branch of study; in fact, Prof. Symington happened to visit the work-room in the Royal College of Surgeons in 1901 when I was examining and describing the considerable collection of such casts (representing more than one hundred genera) which have been brought together by the late Sir William Flower and the present conservator, Prof. C. Stewart. (And, with reference to Prof. Symington's remarks on curators, I may mention that no one more fully recognises the value of cranial casts than the present conservator of the Royal College of Surgeons' Museum.)

But more remarkable than this is the statement:—"This method has been applied with marked success to the determination of the characters of the brain in various fossil lemurs by Dr. Forsyth Major and Prof. R. Burckhardt" (p. 540). The "*marked success*" of Prof. Burckhardt consisted in flatly contradicting in almost every essential feature the *correct* account of the same specimen given by Dr. F. Major, as I have pointed out in a work (*Trans.* Linnean Soc., February, see especially p. 365) published seven months ago. Prof. Symington could not have chosen out of the scores of memoirs on cranial casts an example more likely to bring contempt on the method he so eloquently and so justly extols.

His statement that "so far as prehistoric man is concerned, we can never hope to have any direct evidence of the condition" of the brain is stultified by the fact (which I mentioned fifteen months ago in the *Journ. of Anat. and Phys.*, July, 1902) that I have in my possession a large series of actual prehistoric brains with the crania from which they were derived. Many of these are so excellently preserved that every detail of the convolutionary pattern can be recognised, and by transferring it to the surface of the cranial cast an accurate model showing exactly the size, shape, and arrangement of the sulci with perfect accuracy can be obtained. That I am not exaggerating the excellence of these prehistoric relics may be seen from the brain fragment (D. 691) in the galleries of the Royal College of Surgeons' Museum, especially when I add that I possess whole hemispheres in even a better state of preservation.

As to the method of interpreting human brain casts, if we follow Prof. Symington's advice and begin by identifying the Sylvian fissure as the groove produced by the orbito-sphenoid ("as is well known, the marked prominence at the base of the human skull separating the anterior from the middle fossa fits into the deep cleft between the frontal and temporal lobes of the brain") we shall fall into grave error in many cases. It sometimes happens (in more than 50 per cent. of my collection of "Greek" and "Turkish" hemispheres) that the orbito-sphenoid lies far in front of (and not *in*) the Sylvian fissure, mapping out a great "post-orbital limbus" (Spitzka) of the frontal lobe, which has slipped over into the middle cranial fossa. I have seen the Sylvian fissure lying as far as 1 cm. behind the orbito-sphenoid (in a Syrian brain), and a prominent crest derived from the alisphenoid projecting into it.

It is surprising to find Prof. Symington repeating that time-worn fallacy:—the inferior frontal convolution "is well known to be much more highly developed in man than in the anthropoid apes" (p. 541). For if we follow the lead of Profs. Marchand and Cunningham—and to anyone who really examines the facts of the case there is no other alternative—the inferior frontal sulcus is represented in the apes by the sulcus rectus, and the inferior frontal convolution is *relatively much bigger* in the apes than in man.

Every anthropologist will cordially re-echo Prof. Symington's wish that information concerning large series of non-European brains may soon be forthcoming. But that we know so little concerning these other types of the human brain is not wholly the fault of the people who have access to such material. The chief blame must rest on those anatomists who, with every advantage which museums, libraries, and trained assistants confer, have done so little to provide data relating to the European types of brain which are of any anthropological value. I know several anatomists in various parts of the world who have the material and are merely awaiting a "lead" as to which features of the brain are of anthropological importance and are worthy of being recorded.

I have recently met with the same difficulty. After having examined six hundred Egyptian, Soudanese, and a varied assortment of other non-European brains, I am unable to acquire from the writings of European anatomists just that information of the European types of brain which I need for purposes of comparison; moreover, I am unable to publish the anthropological results of my work in any satisfactory form until I have discussed such purely morphological questions as the real constitution of the fissure of Sylvius and have unravelled the intricacies of the parieto-occipital regions of the brain. When the "home" anatomists have done their part of the work, the rest will soon follow.

G. ELLIOT SMITH.

The School of Medicine, Cairo, October 7.

I HAVE to thank you for your courtesy in allowing me the opportunity of reading a letter which Prof. G. Elliot Smith has addressed to you, criticising various statements in my presidential address in Section H of the British Association at Southport. Prof. Smith has raised so many points that I have only time, at present, to reply to a few of them.

What a reader "might imagine" I will not attempt to picture, but I certainly had no intention of implying that only the three investigators I happened to mention had worked at the subject of cranial casts, or that "it was an entirely new branch of research."

I endeavoured to show that the examination of a skull was necessarily incomplete until the interior of its cranial cavity was exposed and cast, and that, although such methods were calculated to afford valuable information as to the relation between the external and internal surfaces of the cranial wall, and to give an important indication of the form of the brain it once contained, yet the curators of museums appeared to have an invincible objection to making the necessary section, and the practice of taking casts of the cranial cavity had been too much neglected by craniologists. I gave as an illustration of the usual custom of preserving skulls entire the Hunterian Museum in London, and this selection appears to have been a source of offence to Prof. Smith, although he does not disprove my statement. His remarks as to the number of casts of different genera in that museum are quite beside the mark. I was referring to the very large collection of human skulls, and, so far as I have been able to ascertain, no systematic attempt has been made to examine more than a small fraction of them in this way. I know that many curators object strongly to the skulls under their care being bisected, and believe that at any rate their appearance would be seriously affected by such an operation. I ventured to advocate a method which, in my opinion, has not been followed to any marked extent in the collection of human crania in the Hunterian Museum or elsewhere in this country, and trust I was at liberty to do this without it being regarded as a personal attack upon the conservator, for whom I have the very highest regard.

Prof. Smith objects to my statement that "we can never hope to have any direct evidence of the condition of the higher nerve centres of prehistoric man" on the ground that he has collected a large series of such brains from Egyptian cemeteries, and he refers to a paper he published in the *Journal of Anatomy and Physiology* last year. I had the pleasure of reading his paper when it appeared, and although his specimens were of great interest, it seemed to me that their state of preservation was not sufficiently good to be of much use for the accurate determination of the numerous details which it would be necessary to know, when comparing them with modern brains. The specimens had undergone marked diminution in size, and in places were considerably distorted. Further, from the actual photographs (Plate xiv.) which he gave it appeared to me that a considerable restoration would be needed when attempting to limit the boundaries of the cerebral fissures. I hope that the impression left upon my mind from the perusal of his paper may be an erroneous one, and that the additional evidence promised by Prof. Smith will dissipate my doubts.

I do not quite appreciate the cautiousness of those anatomists who are waiting for a "lead" before describing the specimens of non-European brains in their possession. The numerous memoirs that have been hitherto published on the cerebral convolutions are based almost entirely upon the study of European brains, and what we obviously require is a careful and an unbiased account of the cerebral fissures and convolutions of other races. If Prof. Smith and his friends wait until the favoured "home" anatomists agree as to the "types" of European brains, and until he has definitely settled for us all the morphological problems connected with the cerebral cortex, we shall, I fear, need a large store of patience.

In conclusion, I should like to assure Prof. Smith that if I did not refer specially to his work it was not because I do not appreciate its value, but on account of the limitations in time and space necessary in the circumstances of my address.

J. SYMINGTON.

October 19.

MAGNETIC STORMS, AURORÆ AND SOLAR PHENOMENA.

THE attention of the whole civilised world has this year been directed to the importance of finding a connection between terrestrial and solar variations, but the phenomena recorded last Saturday in the nature of a great magnetic storm and a brilliant aurora borealis have perhaps brought home to many the desirability of pursuing such investigations which may help us to be forewarned, and therefore forearmed.

The enormous development of the telegraph, telephone, cable, and other applications of electricity since the date of the last great magnetic storm has caused the disturbance to be more generally observed than was previously perhaps the case.

Practically the world's whole telegraph system was upset, and information from this country, France, the United States and other lands shows that for several hours communication was almost completely interrupted.

According to the *Daily Mail* the London telegraphic department characterised the storm as the most extraordinary ever experienced. Messages dispatched on Saturday from Russia, Spain, Switzerland, France, Germany, Belgium, and other countries, which would ordinarily have been received an hour or less after transmission, were still slowly coming through on Sunday morning. Mr. Gavey, the electrician-in-chief to the Post Office, in an interview with a *St. James's Gazette* representative, said the storm was the most severe that had been experienced for the last twelve years. The effects of it were first felt at St. Martin's-le-Grand at 6.45 a.m. on Saturday, and they continued until five in the afternoon. It was eight o'clock before the storm had completely disappeared.

The New York correspondent of the *Daily Telegraph* states that the magnetic disturbance was felt practically everywhere in the United States, affecting the great cable companies for a time, while the telegraph wires in all directions from Chicago felt the effect; the long distance telephones were similarly troubled. The disturbance lasted eight hours, and at its climax "there were 675 volts of electricity—enough to kill a man—in the wires, without any batteries being connected to them." During the magnetic storm which occurred in 1871 the Eastern Telegraph Company showed that there was an earth current of 170 volts on their Suez-Aden line.

The *Times* correspondent in Paris states that according to a Press communication from the French Under-Secretary of State for Posts and Telegraphs the magnetic phenomenon extended in all directions, but with somewhat less intensity towards the north-west; the telegraph office was from nine o'clock in the morning deprived of communication with the greater part of the French towns and the adjoining districts. It was subsequently also cut off from communication with America, Spain, Portugal, Italy, Algeria, Tunis, and places beyond those countries. At 4.40 p.m. communication was re-established; it was again interrupted at 5.30 p.m., but a little after sunset almost all communications were found to be restored.

It is interesting to note that the effect of a magnetic storm on a telegraphic system may be modified in two, if not more, ways, and this was done in the case of our own Post Office. One method, as stated by Mr. Gavey, is to join two wires, thus forming a loop, and in this way eliminate the earth from the circuit. The other means is to employ condensers; these, when connected up with the circuit, stop a continuous current such as is set up by magnetic disturbances.

In several regions the magnetic disturbance was accompanied by a display of the aurora. In New York on Saturday morning the northern sky was described as "a dazzling display of light and colour"; it was first seen in the city at two o'clock, but faded away at four. In Ireland and Scotland during Saturday evening the aurora was also observed.

A message from the Sydney correspondent of the *Times* states that a beautiful Aurora Australis was seen there on Saturday night, the streamers reaching nearly to the zenith.

Earthquakes also seem to have been recorded as well. On Friday and Saturday two undulating shocks were felt at Benevento and Avellino, in Italy, the first lasting two seconds, and the other a minute.

In Essex several distinct earthquake shocks were felt at Saffron Walden. At midnight on Saturday one shock is stated to have lasted five minutes. These were repeated at 5.50 and 9.30 on Sunday morning. At Debenham, four miles distant, shocks were felt on Monday sufficiently strong to cause small articles to fall to the ground.

Tuesday's *Daily Mail* publishes a telegram from Simla (dated November 2) in which it is stated that terrible earthquakes occurred at Turshiz, near Turbatihaideri, in Persia. Unfortunately, the time of occurrence was not mentioned, and up to the moment of writing (Tuesday evening) the news has not been corroborated.

In a communication to the writer from Stonyhurst Father Cortie writes:—"We had a magnificent magnetic storm on Saturday and Sunday, the biggest ever recorded here. The declination magnet swung through 2° 46′. The spot of light for the horizontal force travelled several times right off the pages on the drum."

From the above brief summary of the information to hand it will be gathered that we have experienced a storm of quite considerable magnitude, not perhaps the worst that has ever been recorded, but at any rate a "great" disturbance.

Two important questions now arise. What is the cause of these sudden magnetic phenomena? Can they be predicted?

The first of these questions is one which is answered differently by different investigators. Some think that there exists a common cause external to the sun, while others are agreed that the storms originate from the sun itself; there are also many who go more into detail and are inclined to favour the view that they are caused by sunspots.

In the last mentioned case then it is natural to conclude that when there is a large spot we should experience a magnetic storm, and when there are no spots storms should be absent. This, however, is not the case. The true explanation must account for the three possibilities of the appearance of these storms.

(1) A large spot *with accompanying* magnetic disturbance and auroræ.

(2) A larger spot *with no accompanying* magnetic disturbance and auroræ.

(3) No great apparent solar activity, but magnetic disturbance and auroræ.

Since sunspots cannot be held to satisfy these necessary conditions, are there other solar disturbances which can be utilised? Yes, there are the prominences which were first seen projecting beyond the dark limb of the moon during total solar eclipses. Up to the year 1868 these were the only opportunities when such solar appendages could be observed, but during that year a method was discovered by Sir Norman Lockyer and Dr. Janssen by which they could be seen on the sun's limb at any time without the necessity of waiting for these brief opportunities. It was not, however, until the year 1870 that regular observations of the limb of the sun showing these indications of solar activity were

commenced, but, thanks to the magnificent work of Respighi, Tacchini, Ricco, and Mascari, we have practically a continuous record of them up to the present time.

The question then arises, are these prominences in any way related to the occurrence of magnetic storms? Before answering this, a few preliminary remarks may be made.

In the first place the number of spots on the sun is nearly always insignificant compared to the number of prominences. Prominences are, therefore, of greater relative importance than spots.

While sunspots are restricted to practically a narrow zone ($\pm 5°$ to $\pm 35°$) on each side of the solar equator, prominences can and do occur all over the sun's disc. Again, the general trend of the spot circulation is from the higher to the lower latitude, while in the case of prominence the reverse happens. In some years we have a great number of prominences near the solar equator, while in other years they are observed also in great numbers near the solar poles. A glance at some curves recently published in this Journal (vol. lxviii. p. 257, July 16) will shown not only the general drift

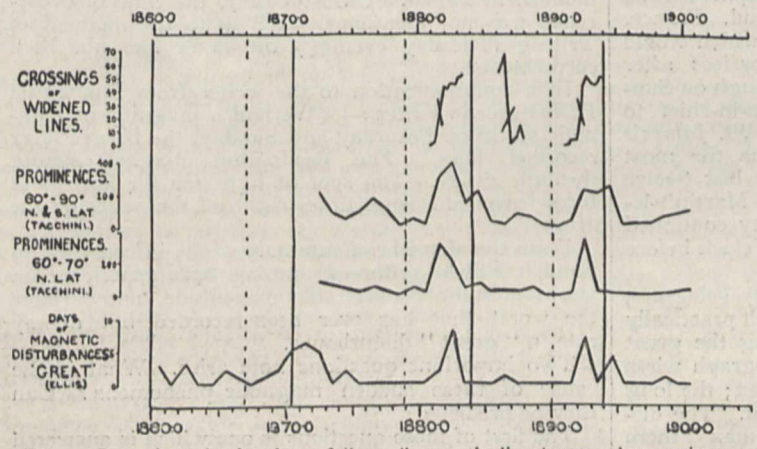

FIG. 1.—Comparison showing days of "great" magnetic disturbance, polar prominences and crossings of widened lines. (The continuous and broken vertical lines indicate the epochs of sun-spot maxima and minima respectively.)

of prominence activity, but the epochs when the prominences were present near the polar regions of the sun. The years in which they attain these high latitudes are not numerous; they are (first observations made in 1870) 1870, 1871, 1881, 1882, 1892, 1893, and 1894. Mr. William Ellis, who has made a special study of magnetic disturbances, has tabulated the number of days of "great" disturbances, that is, those recorded at Greenwich above a certain standard. These are utilised to form the following table:—

Date	Number of years	Number of days of "great" magnetic disturbances	Average per year
1870-1872 ...	3 ...	16 ...	5·33
1873-1880 ...	8 ...	2 ...	0·25
1881-1882 ...	3 ...	10 ...	3·33
1883-1891 ...	9 ...	1 ...	0·11
1892-1894 ...	3 ...	7 ...	2·33
1895-1900 ...	6 ...	2 ...	0·33

Another and perhaps more striking way of showing the coincidence of the epochs of the occurrence of days of magnetic disturbances and polar prominences is illustrated in the accompanying figure (*see* NATURE, February 19, vol. lxvii.).

The continuous and broken vertical lines indicate the epochs of maxima and minima sunspots, showing that the former tend to occur later than the peaks of the magnetic curves. In this diagram Respighi's observations of polar prominences made during the years 1870 and 1871 are not included, but their mean latitudes for each hemisphere during these years were $\pm 70°$.

It will thus be seen from the above that the occurrence of polar prominences is closely associated, at any rate in time, with great magnetic storms, and, therefore, with auroræ, which nearly always accompany them. Further, prominences fulfil the three conditions mentioned previously in this article, for they can occur when there are spots and also when there are none.

One argument used against the prominence theory is that the polar prominences are "quiet" prominences and therefore are not likely or are possibly not capable of producing such large terrestrial effects. The critic may, however, have forgotten to consider the possible and natural conclusion that the appearance of prominences in high latitudes may at least be simply an indication of greater action occurring nearer the equatorial regions with consequent greater extension of the disturbed region towards the polar zones.

That the polar regions of the sun are sometimes greatly disturbed is again emphasised by the presence of enormous streamers that are seen in those regions during some total solar eclipses. Further, these polar streamers are observed only at those times when the prominences approach high latitudes. Here again we have good cause to doubt the inability of these polar prominences as disturbing agents. Even if the prominences be not conceded to be the initial cause of magnetic storms, their gradual changes of position towards the solar poles may afford a valuable means of forecasting the epochs of magnetic disturbances.

From the facts before us let us consider the question of forecasting the years in which magnetic storms should occur. If the reader will glance at the figure accompanying this article and continue the curves on the assumption that the last sunspot minimum occurred in 1901·5 and the next maximum in 1905, he will most probably make a maximum fall between these two dates, but somewhat nearer the latter; in fact the maximum would have been placed in the middle of the year 1903. It will be noticed, however, that at the sunspot maximum of 1870 the disturbance curve reaches a maximum a year after 1870. A recent investigation has indicated that all sunspot cycles are not alike in intensity, and that the cycle commencing in 1901 may probably correspond to that which commenced in 1867. If, therefore, the coming sunspot maximum should attain the same dimensions as that reached in 1870, it seems quite possible that the magnetic disturbance curve for the present cycle should correspond to that portion commencing about 1867. If this be so, then not only should polar prominences be recorded from the years 1903 to 1906 or 1907, but during these years "great" magnetic disturbance will be liable to occur. As shown in the previous table, no less than 16 of Ellis's "great" magnetic storms occurred between 1870 and 1872; also two occurred in 1869 and one in 1868, so that if we consider the present year to correspond to 1868 there is much in store for us. It may be mentioned also that since the years 1899 and 1900 the prominences have exhibited the tendency to attain high latitudes, so that there seems every reason to suppose that magnetic storms and auroræ may be experienced during the course of the next three or four years, after which there will be a cessation for about ten or eleven years.

WILLIAM J. S. LOCKYER.

A NEW NATURAL HISTORY.[1]

IN our notice of the earlier portion we stated that it was then impossible to arrive at a definite conclusion as to the merits of this work, since the section in question was more or less introductory in its nature. Now that the author has got into the full swing of his subject, such a judgment is possible, and we have much pleasure in saying that our own verdict is in the main one of decided approbation. The author has had practically a new field before him, so far, at least, as English natural histories are concerned, in the mode of treatment of his subject, and the work ought to prove invaluable to all teachers of "nature-study." The illustrations—both coloured plates and text-figures—are in many cases excellent, some of them depicting the animals in attitudes or actions connected with the subject of the text. Examples of this type of illustration are afforded by the figure of a secretary-bird beating down a snake with its wings and beak, and that of a chamæleon darting its tongue at a fly.

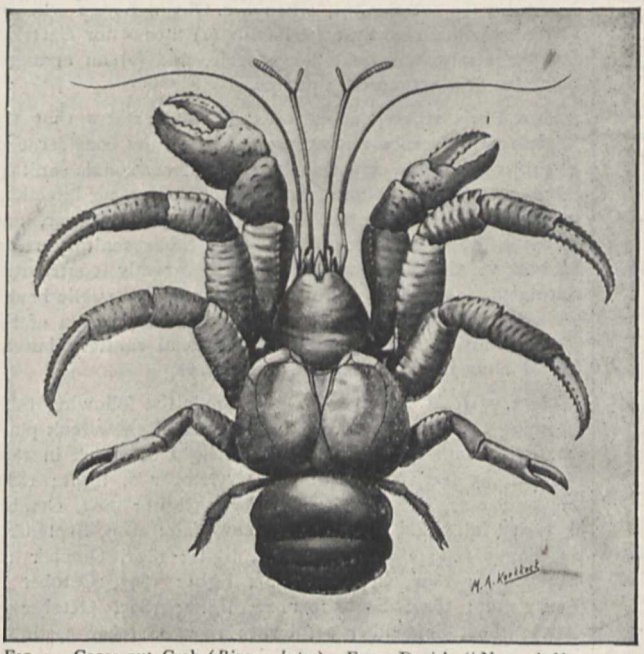

FIG. 1.—Cocoa-nut Crab (*Birgus latro*). From Davis's "Natural History of Animals."

In the first of the two half-volumes before us, the author commences by treating of the food of animals and the structural modifications of the animals themselves in correlation therewith, a subject which occupies the whole of one of the fasciculi and part of the other. This part of the subject is divided into three sections, according as to whether the diet is of an animal, vegetable, or mixed nature, each main group being taken in serial order in the several sections, commencing with mammals and finishing with zoophytes and sponges. Animal defences forms the title of the next main division of the subject. Here protective coloration and colour changes, mimicry, and the reason why so many animals are nocturnal, are discussed at length, and in the main satisfactorily, although all the latest observations on the former part of the subject are not mentioned. Passive defence, as exemplified by dermal armour, shells, the rolling-up habit, and the death-feigning instinct, and then active defence receive in turn their due share of attention, the second half-volume ending with an excellent dissertation on the various forms of animal respiration.

Unfortunately, the general excellence of the book is somewhat marred by certain blemishes. Confining our criticisms to a single group of animals, we have in the dental formula of the cat on p. 7 the number of pairs of incisors given as two instead of three. Nor can this error be attributed to the printer, for, although the total number of teeth in the animal is rightly given as thirty, the incisors are referred to in the text (as well as in the formula) as being eight, in place of twelve, in number. Moral, in proof-reading always add up your dental formula. Again, in the explanation of the figure of the dentition of the thylacine on p. 16, it would have avoided liability to error if the number of upper incisors had been alluded to as *four pairs* instead of *four*. Perhaps it is a venial error to perpetuate (p. 9) the old idea that the coloration of the tiger is designed solely to harmonise with an Indian grass-jungle, but it shows a decided want of acquaintance with modern zoological work to allude

FIG. 2.—Gila Monster, or Arizona Poisonous Lizard (*Heloderma suspectum*). From Davis's "Natural History of Animals."

[1] "The Natural History of Animals." Half vols. iii. and iv. By J. R. A. Davis. (London: Gresham Publishing Co., 1903.)

to the aard-wolf (p. 15) as a solely South African animal. More serious is the repetition of the error that blue foxes are the summer representatives of white foxes (p. 19), both being, as a matter of fact, in the winter coat. In our notice of the first two parts, we directed attention to a discrepancy between the lettering of some of the coloured plates and their descriptions; the same thing occurs in the plate of the polar bear facing p. 20, the animal being called *Ursus arctos* in the one place and *U. maritimus* in the other. Finally (p. 172), Euelephas is not the generic name for the Indian elephant, while there is no sort of justification for alluding to the polecat (p. 289) as *Putorius ermineus*, and the weasel (p. 290) as *Mustela vulgaris*, both animals belonging to the same genus, whether this be called by the one name or the other.

As samples of the better class of illustrations in this volume, we reproduce the figures of the cocoa-nut crab (Fig. 1) and of the "Gila monster," or Arizona poisonous lizard (Fig. 2). R. L.

NOTES.

THE American Academy of Arts and Sciences has, says *Science*, elected Dr. Joseph Larmor, F.R.S., as foreign honorary member in succession to the late Sir G. G. Stokes.

THE eighty-fifth session of the Institution of Civil Engineers was opened on Tuesday, when Sir William White, the new president, delivered an inaugural address of great importance, in which he discussed the main lines of recent advance in ship construction, the present conditions of British shipping and ship-construction, and warship building since 1860.

IT is announced by the *Electrician* that this year it is proposed to award the Nobel physics prize to Signor Marconi, the chemistry prize to Prof. Arrhenius, and the medicine prize to Prof. Finsen. Each prize is worth about 8000*l*.

THE United States National Academy of Sciences will hold its autumn meeting in Chicago, beginning on November 17.

WE regret to learn of the death on September 24 of Mr. J. A. Brown, aged seventy-two. He was an enthusiastic collector of flint implements, and author of a work entitled "Palæolithic Man in N.W. Middlesex" (1887).

A REUTER telegram from Stockholm states that Baron E. Nordenskjold has arranged to make a zoological and anthropological expedition to the frontiers of Peru and Bolivia. The expedition will start at the end of December or the beginning of January.

REFERRING to the suggested existence of radium in the sun, a correspondent points out that not a single line in the ultra-violet spectrum of radium described by Sir William Crookes (*Proceedings* Roy. Soc., vol. lxxii., No. 482) coincides exactly with a solar line. "The strongest radium line in Sir William's list is 3814·661, which is very near the solar line 3814.671 assigned to iron and carbon, but is not coincident with it."

THE *Terra Nova* and the *Morning*, the vessels which are to go to the relief of the Antarctic expedition on board the *Discovery*, have arrived at Hobart. The two vessels will leave together in the first week of December. The Swedish ship *Frithiof*, which is going to the relief of Dr. Nordenskjold's Antarctic Expedition, arrived at Buenos Ayres on October 30.

AT the end of last session it was decided to hold the meetings of the Physical Society alternately in the afternoons and evenings, and to change the place of meeting from the Chemical Society to the Royal College of Science, where the facilities for experimental demonstration are very complete. The first evening meeting will be held on Friday, November 13, at 8 p.m., when Sir Oliver Lodge will describe and illustrate by experiments (1) means for electrifying the atmosphere on a large scale, and (2) an arrangement for driving mercury pumps.

THE Paris correspondent of the *Times* states that the Sanitary Conference has at present under its consideration a project for the creation of an international sanitary bureau for the collection of information respecting infectious diseases, such as plague, cholera, and yellow fever, and also for the harmonious working of those sanitary regulations in the East which have so greatly contributed within the last five years to the preservation of public health as well as to the benefit of trade by the suppression of the old quarantine system. The international sanitary bureau would have its headquarters in Paris.

CAPTAIN J. M. JAMES, of Tokio, sends the following table showing the dates on which the first fall of snow took place on the summit of Fuji-Yama, the height of which in 1884 was 12,425 feet ±25 feet:—1884, October 6, light; 1885, September 27, light; 1886, October 7, light; 1887, October 2, heavy fall; 1888, October 1, heavy fall; 1889, September 25, heavy fall; 1890, October 4, light; 1891, October 12, heavy fall; 1892, September 25, light; 1893, October 7, heavy fall; 1894, September 22, light; 1895, October 3, light; 1896, September 21, light; 1897, October 5, light; 1898, September 26, heavy fall; 1899, September 16, heavy fall; 1900, September 25, heavy fall; 1901, September 25, heavy fall; 1902, September 19, heavy fall; 1903, September 27, heavy fall.

AT the recent meeting of the German Association at Cassel, Prof. Penck, of Vienna, was to have given an address on geological time, but illness prevented him from doing so, and his place was taken at the last moment by Prof. Conwentz, of Berlin. The writer of the article upon the meeting, in NATURE of October 15 (p. 586), was unaware that any change had been made, and the titles he gave of addresses for delivery on September 22 were those announced in the programme. Prof. Conwentz has now sent us a report of his address, which dealt with the preservation of remarkable natural objects, especially of rare living plants and animals. He pointed to the destruction of orchids in Thüringen, the extermination of rare thistles on the German coasts, the cleansing of brooks from aquatic vegetation, and the destruction of large trees, and argued that, both for scientific and æsthetic reasons, districts should be set aside where the natural features of the country should be preserved, while care should be taken not to destroy needlessly objects of interest to natural history.

IN a letter to NATURE of August 6, Messrs. Hutchins, of Cape Town, referred to the "Research on the Eucalypts Especially in Regard to their Essential Oils" by Messrs. R. T. Baker and H. G. Smith, reviewed in NATURE for April 2 (vol. lxvii. p. 524). The authors of this memoir have sent us a long letter of reply, in the course of which they say that the remarks upon their work are likely to lead to the idea that it has been confined to the chemistry of Eucalyptus oils almost entirely, and that new species have been named and a new classification for the Eucalypts formulated without sufficient warrant. They proceed to point out that their results are not those of the chemist

alone, but the joint efforts of a botanist and a chemist, and are supported by the field knowledge of botany of the botanical collector to the Sydney Technological Museum, and by numerous Australian authorities on the Eucalypts.

THE lecture on the "New Star in Gemini," delivered by Prof. H. H. Turner at the Royal Institution on June 5, has just been issued as an excerpt from the *Proceedings* of the Institution. Prof. Turner does not confine himself to his discovery of Nova Geminorum, but deals with the nature of new stars generally. He regards dark patches on the celestial sphere as not being actual voids in the stellar universe, but dark nebulæ which hide the light from stars beyond. A new star is due to the collision of a star with such a mass of invisible matter as this; for, adds Prof. Turner, "The friction of the encounter raises the temperature of the star enormously within a day or two, just as a meteor, on entering our tenuous upper atmosphere, is set ablaze in a second or two." This idea is, of course, fundamentally the same as that put forward several years ago in the meteoritic hypothesis as to the origin of new stars; and it is interesting to notice how the stone which the builders of astronomical theory rejected at that time has become the head of the corner since the phenomena of Nova Persei demonstrated the existence of masses of non-luminous matter in celestial spaces. But why did not Prof. Turner remember that Nova Persei only confirmed an explanation of the causes of the phenomena of new stars put forward long ago? He expresses anxiety lest England should fall behind in the progress of scientific discovery "for want of men and money, but especially men," and while we share his uneasiness of mind, his address gives rise to a wonder whether he knows what men have done, and are doing, for the advance of astronomy in this country.

THE Prussian Meteorological Institute (Berlin) has recently issued its report for the year 1902. This organisation deals especially with climatology, rainfall, and unusual atmospheric occurrences, while the Deutsche Seewarte (Hamburg) is chiefly occupied with marine meteorology and weather telegraphy. With the Berlin Institute is associated the meteorological and magnetical observatory at Potsdam, and the aëronautical observatory at Tegel. The latter establishment is carrying on a very valuable work in the investigation of the meteorological conditions of the upper air by means of kites and registering balloons, and has, since August, 1902, made daily ascents, the results of which are communicated by telephone to the Berlin office. On one occasion, in December last, a kite attained the unusual height of 5500 metres. These ascents are, in addition to the experiments with manned and unmanned balloons, undertaken in connection with the international monthly balloon ascents, to which we have had frequent occasion to refer. The magnitude of the useful work performed may be gauged from the fact that, including the observations from ordinary meteorological stations, rainfall statistics are received from 2574 places, and that no less than 37,273 reports were received from 1412 stations dealing especially with thunderstorms and unusual occurrences. The latter observations are published yearly in addition to the regular publications of the Institute, together with charts showing the place of origin, the tracks, and the velocity of the storms.

IN the *Annalen der Physik*, 10, Messrs. L. Holborn and F. Kurlbaum describe an optical pyrometer, first constructed in 1901, in which the temperature of an incandescent body is determined by photometric observations of the emitted radiations.

THE permanence of resistance standards of sheet manganese is discussed in the *Zeitschrift für Instrumentenkunde* by Mr. St. Lindeck, of Charlottenburg. Thirty-one resistances were experimented with from October, 1901, onwards; twenty-six of these were found to vary by not more than 0·05 per cent., and of the ten in which the variations exceeded 0·02 per cent., seven were large models which were subjected to currents of considerable intensity.

A NEW method of producing tension in liquids is described by Mr. J. T. Jackson in the *Scientific Proceedings* of the Royal Dublin Society (x., part i., 8). The method consists in the application to the particular question considered of the well-known principles governing the flow of liquid in a pipe of variable section. At a constriction the velocity increases and the pressure diminishes, and the author finds that under certain conditions the pressure can be made negative, thus confirming the well-known result according to which liquids may sustain a considerable tension without rupture.

DURING the past year several fragments of richly carved crosses have been found built into Lancaster Parish Church, which range from the earliest type of fine old Anglian work to late sculpture of the Danish period in the tenth and eleventh centuries. These most interesting relics have been described and figured by Mr. W. G. Collingwood in the current number of the *Reliquary and Illustrated Archaeologist*.

IN January, 1901, Mr. F. J. Horniman, M.P., gave his new museum and library, and the adjoining estate and the houses thereon, to the London County Council as places of public recreation and instruction; practically the only condition was that they were to be maintained in a proper state and dedicated to the public for ever. The London County Council has just issued its first annual report, which comprises a period of eighteen months. The report, which is illustrated, briefly states the history of the museum and of its transference, and gives a synopsis of the contents of the museum and of the scope of the library. The former arrangement of the museum has for the present been adhered to, and numerous descriptive labels have been prepared with the view of increasing the educational value of the museum. In the autumn term Dr. A. C. Haddon, F.R.S., the advisory curator, gave a course of lectures to teachers on the natural history of animals, which was illustrated by specimens in the museum and by lantern slides; owing to the large attendance it was necessary to give the lectures in a gallery; the average attendance at the lectures was 114. The total attendance at the museum for 1902 was 238,589, being an average of 658 on the opening days. The museum was visited by ninety-seven schools and institutions, with an average attendance of nineteen children. From these figures it will be seen that the educational advantages of the museum are appreciated, and there is every reason to believe that the next annual report will show that these are being increased. It may be added that the Horniman Museum and Library (at Forest Hill, S.E.) are open free to the public from 2 p.m. to 9 p.m. every day in the year except Christmas Day.

FROM the report of the Natural History Society of Northumberland, &c., we are glad to learn that the threatened split between that body and the Tyneside Naturalists' Field Club, to which allusion was recently made in our columns, has been avoided, and that for the future the two institutions are to amalgamate their forces.

IT is distinctly refreshing to find an American naturalist protesting against slavish adherence to the "fetish of

priority," as it is called by Dr. Gadow, in nomenclature, especially when there may be a doubt as to whether the names are really synonymous. In No. 76 (vol. xi.) of the zoological series of *Publications* of the Field Columbian Museum, Dr. D. G. Elliot directs attention to the use of the term Odocoileus for the American white-tailed deer and its relatives. That term was proposed by Rafinesque in 1832 for a fossil premolar of some kind of deer, which has been assumed to belong to the whitetail or some closely allied species. Even if this be really the case, Dr. Elliot doubts "whether a genus founded upon some fossil remains of an otherwise entirely unknown animal of a past age should be unhesitatingly adopted for a group of existing species that may be, in the majority of its characters, widely different from the extinct form." He further suggests the inadvisability of adopting palæontological names in any case for living forms, but adds that if such are used, the name Anoglochis, applied to European Tertiary deer, seems, as pointed out by Mr. Lydekker, to be available for the whitetail. It may be pointed out that, instead of giving a new name to the fossil deer-tooth, Rafinesque ought to have called it Cervus, and that by adopting Odocoileus we perpetuate an instance of ignorance and incapacity on the part of its proposer.

REFERENCE may be made to another change of nomenclature which, if adopted, is likely to cause the extreme of inconvenience with no resulting advantage. Almost from time immemorial the marmosets have been known as Hapale and the titi monkeys as Callithrix. In the October issue of the *Annals*, a well-known zoologist proposes to transfer the latter term to the marmosets (for which it appears to have been first employed) and to give a new name to the marmosets. In such instances, we venture to think, a "statute of limitations" should be insisted on. The replacement of well-established names is bad enough, but their transposition is unspeakable.

TWO parts of vol. x. of the *Decennial Publications* of the University of Chicago are to hand. In the one Mr. A. C. Eycleshymer treats of the early stages of the development of the bony pike (*Lepidosteus osseus*), as observed in living specimens and preserved material. After treating this exhaustively, the author compares the phases with those of the few other living representatives of the enamel-scaled fishes, concluding with general remarks on the character and significance of yolk-cleavage. The view that similarity in the first four stages of cleavage indicates kinship between the bony pike and teleost fishes is not accepted. The second of the two is devoted to the results of a study of the development of colour and colour-pattern in beetles and in insects generally, by Mr. W. L. Tower. It appears that insects show two distinct types of coloration, the one —dermal (or cuticula) and hypodermal—as ancient as the group itself, and consisting of colours arranged in segmentally disposed spots and stripes, correlated with the deeper vital organs; the other, of much later origin, produced by scales, or modified hairs. This secondary type tends to suppress and obscure the original one, and, being developed independently of the vital structures, permits of much greater variation and diversity; it is, in fact, a purely ornamental type. The essential difference between the two may be realised by contrasting the sombre browns and yellows of the ground-beetles of the genus Carabus with the brilliant pattern of butterflies of the Vanessa group. Cuticula colouring (as shown in the beautifully coloured plate of beetles) commences in the fore part of the body, where the muscles first harden, and gradually spreads backwards. It is clearly connected with the hardening of the cuticula, which tends to become brown, hence the prevalence of browns and yellows in so many beetles and cockroaches, metallic tints in the former being due, of course, to another cause.

DR. WACE CARLIER and Mr. Lovatt Evans have made some interesting observations upon the so-called hibernating gland of the hedgehog (*Journ. Anat. and Physiol.*, xviii., part i.). This is of an orange colour when fully developed, but becomes deeper in tint as the winter sleep progresses, until, towards its end, it is almost black. It at first averages 1–2 per cent. of the body weight, rises by the second month to 2·7 per cent., and then gradually falls 1 per cent. towards the close of hibernation. Careful analyses show that, to commence with, the gland contains 40 per cent. of fat, and that this is reduced to 18 per cent. at the end of hibernation, the proteids during the same period showing a reduction of only 1 per cent. At the beginning of hibernation (October) the animals are exceedingly fat, but by the end of March all the fat stored in the tissues has disappeared. For the first month the weight of the hibernating gland falls rapidly, much fat being removed, but from then until the end of March there is little change, when again the gland loses weight owing to removal of its contained fat, and by the end of May it is completely exhausted and reduced to a mere fibrous cord. It would seem that life during hibernation is maintained practically upon fat alone, and that the hibernating gland is a store of fat reserved for this purpose.

WE have received No. 9, vol. i., of the *Scientific Roll* conducted by Mr. Alexander Ramsay. It deals with the bacteria, which are arranged according to their size, no other information being given than the name of the organism and its "size" position. We have already expressed the opinion that this list is an example of misplaced energy, because there is no such thing as a fixed size for a bacterium, the size varying considerably with alterations in the nutrient soil and other conditions.

THE problem of tracing out the connection of flowering plants with lower types must always possess attraction for botanists. In a number of the *Decennial Publications* of Chicago, Prof. Coulter has expressed the general views held by botanists that a similar line of development is probably not to be expected for monocotyledons and dicotyledons, and that neither of these groups are directly connected with the gymnosperms. The positive suggestion is made that the origin of flowering plants is to be traced to that group of ferns which is represented at the present day by Marattia and Angiopteris.

A GRAPHIC account of some of the curiosities of flora and fauna of the Auckland Isles and Campbell Island is given by Mr. L. Cockayne in the *Lyttelton Times*, wherein he relates the general impressions obtained during a short cruise in southern waters. Contrasts between the flora of these islands and that of New Zealand were observed in the brighter, generally purple or bluish tinge of colour, as compared with white or yellow tones which predominate in similar flowers found in New Zealand; this brightness is not associated with insect visitors, for they are wanting. Again, in New Zealand herbaceous plants rarely die down in winter, whereas in the southern islands many do so, but not owing to the cold, for the forests keep their summer aspect. On Adam's Island Mr. Cockayne had an opportunity of studying the nests of the albatross placed in exposed situations, where the solitary chicken remains on the nest for a year, and on the desolate Bounty Islands were found the nests of the mollyhawk, and numbers of animals, crustaceans, spiders and beetles which make their home in the guano or on the bare rocks.

DR. C. H. LEES wishes to make the following corrections in his account of the British Association discussion on the nature of the emanations from radio-active substances which appeared in NATURE of October 22. In the last line but two of the third paragraph on p. 611, "not yet found to be non-radio-active" should read "not yet found to be radio-active," and in the fifth line from the bottom of the column, "high velocities of the emanations" should read "high velocities of the radiations."

A SECOND edition, revised to June 30, 1903, of the "Student's Handbook of the University and Colleges of Cambridge" has been published by the Cambridge University Press. In addition to a few minor alterations the following important additions have been made to the book, viz. a complete list of university professors, readers, and lecturers, a list of lectures on honours subjects given in the university, and a statement of the set subjects for special examinations. The new regulations for the mathematical papers in the previous examination are also given.

THE first volume of administrative reports and the official reports of the meetings of the International Council for the Study of the Sea deals with the work of the year ending July, 1903, and has now been published by MM. A. F. Høst et Fils, of Copenhagen. The character of the work of this international council was described in our issue for September 3. The volume now published contains the main results of the work arranged by the council for the year dealt with, printed in both English and German.

THE second part of the "Botany of the Færöes," which is based upon Danish investigations, has now been published in Copenhagen by Det nordiske Forlag (London: John Wheldon and Co.). It was expected that this part, together with that published in 1901, would complete the work, but it has been found that a third volume will be necessary. Part iii. will contain papers on the vegetation of land and sea, and will, Prof. Eug. Warming says in a prefatory note, most likely be ready in a year or two.

AT the beginning of next year the firm of Gebrüder Borntraeger, Berlin, will commence the publication of a comprehensive review of progress in physical chemistry under the title "*The Physico-Chemical Review*: a complete international review of the sciences of physical chemistry and the allied branches of chemistry and physics." The magazine will be edited by Dr. Max Rudolphi, Darmstadt, with the cooperation of distinguished chemists and physicists in many parts of the world. The new journal is not intended to be a medium for the publication of original work, but a review of such work described in abstracts furnished, so far as possible, by the authors of papers. It is proposed to include English and French as well as German abstracts. The whole domain of general and physical chemistry, as well as the allied sciences on both sides, so far as they bear on physical chemistry, will come under review. Such an international review will prove of importance and value to practical men as well as to those engaged in the pursuit of purely scientific research. The review will be issued twice a month. Specimen numbers will be sent post free upon application to the publishers, Gebrüder Borntraeger, Berlin SW 11, Dessauer Strasse 29.

THE volume of *Transactions and Proceedings* of the New Zealand Institute for 1902 has been received. This is the thirty-fifth volume published by the board of governors of the Institute, and it is edited by the director, Sir James Hector, F.R.S. Copies can be obtained in this country from Messrs. Kegan Paul, Trench, Trübner and Co. It is impossible to refer to the contents of the sixty papers forming the *Transactions* part of this bulky volume. These original articles are divided into five sections, viz. papers dealing with zoology, botany, geology, chemistry and physics, and miscellaneous subjects. The thirty-fourth annual report of the New Zealand Institute precedes the next main division of the volume, which includes the proceedings of the various incorporated societies, viz. the Wellington Philosophical Society, the Auckland Institute, the Philosophical Institute of Canterbury, the Otago Institute, the Hawke's Bay Philosophical Institute, the Southland Institute, and the Nelson Institute. An appendix contains a tabulated report of the earthquakes in New Zealand during 1902, and seismograph records from different observatories throughout the country for the same year. The volume concludes with fifty-four well executed plates illustrating various papers included in earlier pages.

THE vacation number of the *Berichte* contains two papers on fluorescence. In the first of these Richard Meyer criticises Dr. Hewitt's theory that fluorescence is dependent on oscillatory isomeric change, and urges that a "fluorophore" group must also be present in the molecule. The paper by H. von Tappeiner on the action of fluorescing substances on ferments and toxins is a continuation of a research in which it was shown that fluorescent substances, which have little action on micro-organisms in the dark, become very poisonous in sunlight; thus a culture of Paramecium exposed to sunlight was destroyed in six to ten minutes by a trace of acridine hydrochloride which produced no effect in 100 hours in the dark; of the fluorescent substances examined only æsculin was without action both in the dark and in sunlight. The hydrolysis of starch by diastase is not affected by exposure to sunlight or by the addition of eosin, but if the solution to which the eosin has been added be exposed to sunlight, the yield of maltose is reduced from 76 to 21 per cent.; this retardation, which is only produced by a limited number of fluorescent substances, can be detected when the proportion of eosin is only one part in 400,000, but disappears entirely if the incident light is filtered through a layer of the fluorescent substance. The action of invertin on cane-sugar is also checked by the addition of eosin when the solution is exposed to sunlight, and the effect of one part of eosin in a million can be easily detected. Papayotin appears to be even more sensitive than diastase or invertin. The only toxin investigated was ricin; unlike the enzymes, this was destroyed by all the fluorescent substances examined with the exception of æsculin, but was not injured by non-fluorescent dye-stuffs or by fluorescent substances if kept in the dark.

A PAPER by Knoevenagel on the nature of the double-bond appears in the vacation number of the *Berichte*. In order to account for the conversion of butadiene, $CH_2 : CH.CH : CH_2$, into dibromobutylene,

$$CH_2Br.CH : CH.CH_2Br,$$

he suggests that in compounds of this kind the carbon atoms are in a state of oscillatory motion, so that the molecule has, alternately with the formula given above, the structure represented by the formula

$$—CH_2.CH : CH.CH_2—.$$

Applying this theory to the benzene molecule, it is no longer necessary to assume a pendulum-like motion, as the carbon atoms may be regarded as revolving continuously, alternate atoms rotating to the left and to the right; the result of

this motion is that the three double bonds travel round the ring, whilst a labile form of the molecule with six free valencies is also indicated. In this way many of the peculiar properties of aromatic compounds may be accounted for.

THE additions to the Zoological Society's Gardens during the past week include a Sooty Mangabey (*Cercocebus fuliginosus*) from West Africa, presented by Mr. C. J. Spencer; a Levaillant's Cynictis (*Cynictis penicillata*) from South Africa, presented by Miss Bald; a Blue and Yellow Macaw (*Ara chloroptera*), a Red and Yellow Macaw (*Ara ararauna*) from South America, presented by General Sir Frederick Forestier Walker, K.C.B., G.C.M.G.; two Wharton's Fruit Pigeons (*Carpophaga whartoni*), a Christmas Island Dove (*Chalcophaps natalis*), five Christmas Island Crabs (*Birgus latro*) from Christmas Island, presented by Captain A. W. Cole; a Chameleon (*Chamaeleon vulgaris*) from North Africa, presented by Mrs. T. Wallis; seven Spiny-tailed Mastigures (*Uromastix acanthinurus*) from North Africa, three Brazilian Amphisbœnas (*Amphisboena brasiliana*) from Brazil, an Indian Eryx (*Eryx johni*) from India, two Sharp-nosed Snakes (*Lioheterodon madagascariensis*) from Madagascar, deposited; six Black Swans (*Cygnus atratus*) bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE FORMATION OF THE POLAR CAPS ON MARS.—An interesting paper, by Mr. Percival Lowell, which deals with the manner of formation of the Martian polar caps is published in No. 2 of the Lowell Observatory *Bulletins*. Mr. Lowell observed the old polar cap on July 3, and found it to be diminishing; on July 5 it was only 29″ of arc in diameter, equal to a diameter of 4°.1 on the planet's surface; and shortly afterwards he noticed that a new, large, white deposit had formed, north of Arethusa Lacus and touching the Pierius-Callirrhoe, in longitude 340°. This new white patch extended from the old polar cap to about latitude 55° N., and the Pierius, which it crossed, could be seen running through it, thereby showing that the appearance was due to a deposit and not to clouds, which would have obliterated all the features equally; it also indicates that some kind of vegetation, which had caused the deposit partially to melt, exists in the neighbourhood of the Pierius.

From July 7 to 17 the dark line of demarcation which usually surrounds the cap became less marked, until it was finally obliterated by the encroaching deposit of frost, only a superior whiteness, caused by the newly deposited frost lacking the sheen of the older, weathered and ice-welded snow, marking the presence of the older cap. It is only reasonable to suppose that this deposit actually was frost as we know it, for it is evident that a layer of frozen gas, such as solid carbon dioxide, would pass directly from the solid to the gaseous form under the pressure conditions obtaining on Mars, and would not exhibit the phenomenon of slowly melting such as was observed in the region about the Pierius.

The quick melting of the outer and the durability of the inner portion of the Martian snow-cap are both explained by these observations, which show that the whole cap consists of a perpetual kernel which periodically becomes surrounded by a shallow transitory husk, the formation of which was observed by Mr. Lowell.

The same observer also performed some experiments in connection with the visibility of the Martian canals, which showed that a wire having an angular width of 0″.69 at 1800 yards could be readily "glimpsed" with the naked eye, and from this he deduces that any canal having a width of half a mile on the planet's surface should be readily observable with a good telescope.

WOLF'S VARIABLE STAR 59, 1903, CYGNI.—A communication from Prof. Pickering to the *Astronomische Nachrichten* (No. 3911) states that the star recently announced by Wolf as being a probable nova appears on a large number of plates taken at Harvard between October 29, 1891, and the present time. On a plate exposed on July 30, 1895, the spectrum of this star is of the fourth type, and, from the series of plates, it is seen that the brightness varies by more than two magnitudes.

In the same periodical Prof. Wirtz records an observation made by him at Strassburg on October 15, when he found that the approximate magnitude of this object was 10·5, and that a comparison of its focus with that of several known stars on the Strassburg refractor showed no difference. The identity of this variable with the star B.D.+37°.3876 is confirmed by Prof. Wirtz.

PERIODICAL CHANGES IN THE COLOURS OF JUPITER'S BELTS.—In No. 3908 of the *Astronomische Nachrichten*, Mr. Stanley Williams directs attention to the periodical colour changes of Jupiter's equatorial belts announced in vol. lix. (p. 378) of the *Monthly Notices*.

The computed times of the maximum and minimum brightness of the respective belts are very uncertain, and Mr. Williams suggests that careful observations should be immediately commenced with the object of exactly determining the date when the red colour has entirely disappeared from the southern belt, and also the date of its corresponding reappearance, which will probably take place some time next year.

Mr. Williams's own observations indicate that the red colour has already almost entirely disappeared from this belt, some parts actually appearing blue, except in the neighbourhood immediately following the Great Red Spot, between longitudes 60 and 180, whilst the northern belt is of a bright, deep red colour.

THE MULTIPLE TAIL OF COMET 1903 *c*.—In discussing a number of beautiful photographs of Borelly's comet, which were obtained at Yerkes with a lantern lens having an aperture of 1·6 inches and a focal length of 6·3 inches, and are reproduced in the current number of the *Astrophysical Journal*, Prof. Barnard advances a novel explanation of the great changes of form which were observed in the tails of this and other comets.

From two photographs taken at Yerkes on July 24, the one immediately after the other, and one taken by M. Quénisset at Nanterre on the same date, it is seen that an enormous change in the form of the tail took place at about 2h. 30m. (G.M.T.), when a section of it broke away from the head and travelled in a retrograde direction at a rate, referred to the motion of the head, of about 29 miles per second. As the velocity of the comet itself was, at this period, about 22 miles per second *towards* the sun, it will be seen that the actual velocity of the section showed a repulsion of 7 miles per second *from* that body.

As an explanation of this phenomenon, Prof. Barnard suggests that either the outburst from the coma suddenly took place in a slightly different direction, or else the existing tail was forcibly detached by some unknown body (*e.g.* a swarm of meteorites), and simply floated away in its old path, under the sun's repulsion, until it was dissipated, or its light-emitting power died away; meanwhile, the new tail was formed by the material evolved by the coma, and for some reason the particles were evolved with a greater velocity than before, so that we get the phenomenon of the two tails nearly parallel for some distance, as shown on the Yerkes and other photographs.

THE SWISS ASSOCIATION OF NATURAL SCIENCES.

THE eighty-sixth meeting of the Société helvétique des Sciences naturelles was held at Locarno on September 2–5. Both as regards the number of visitors and the number and variety of the papers read, the gathering was highly successful. Several of the communications presented at the general meetings of the Association were especially well received.

M. A. Pioda (Locarno), the president for the year, after referring to the naturalists of the nineteenth century in his presidential address, went on to show that, in the same way as all other sciences have gradually been differentiated from

metaphysics, it was now the case with psychology. He spoke of the importance of this process as far as the increase of knowledge is concerned, and also as regards the improvement of each of the sciences and their relations one to another. He then traced the experimental and speculative character of psychology. Experimental psychology, the president urged, should confine itself solely to the scientific observation of facts. Certain facts, called psychical (Wallace, Crookes, Zöllner, Thury, &c.), are incapable of any explanation, at least by known physical forces, and it is the duty of science to examine these if psychology is really to assume an experimental character. The facts referred to belong, it may be, to psychophysics. When psychology has really become an experimental science such phenomena will be known not only by their external manifestations, but also by their hidden source, and the knowledge of them will become an organic whole.

Mr. E. Fischer (Bern) read a paper on the biological species of parasitic fungi and of the origin of new forms in the vegetable kingdom. The nature and properties of biological species were studied particularly in the Uredinées, and more recently in *Claviceps purpurea*. Philogenetically, at present, a common origin is attributed to the biological forms of a *species*; consequently, it seems plausible that the original form (Stammform) inhabits all the hosts on which its descendants now live, and that some at least among its descendants may be specialised on one or other of the nourishing plants. Reciprocally, the passage of one parasite to new hosts has been observed directly. Among the causes of the origin of biological species, following Klebalen, is admitted in the first line the direct adaptation (Anpassung und Angewöhnung) of these nourishing plants. It was also said that the explanation given is not applicable at present to the origin of species morphologically different; the morphological characters of species are, at most, partially attributable to the direct action of the nourishing plants (Näherpflanzen), and for the most part they must be related to the characters of the organisation in the sense used by Nägeli.

M. H. Dufour (Lausanne) took for the subject of his paper to the conference ten years' observations of solar radiation in Switzerland, and its diminution in 1903. The Swiss plateau on the north of the Alps (Lausanne, Bern, Zürich, Bâle) has a number of hours of sunshine varying between 1900 at Lausanne and 1200 at Bâle, that is to say, 47–44 per cent. of the greatest insolation possible. The maximum occurs in August (64–57 per cent.), the minimum in December or January (27–29 per cent.); in March and May the insolation is relatively feeble. To the south of the Alps (Lugano, Locarno) 2300 hours of sunshine were recorded, 59 per cent. of the possible maximum; two minima occur in May and November, and two maxima in July and February, with 60 per cent. At Alpine observatories the character of the results changes. At Davos (1500 m.) the insolation is not so strong in winter as in summer, when 1800 hours of sunshine are recorded; two minima are observed—in January and May—and two maxima (February and September–October). At the summit of Säntis (2500 m.) the insolation of winter, 45 per cent., exceeds markedly that of summer, 40 per cent. The mean amount is 42 per cent; the minimum occurs in May and June, and the maximum in November. For the intensity of the solar radiation, measured by Bührer (Clarens-Montreux) and Dufour (Lausanne), the result has been obtained of 8·5 calories (kilogram-degrees) per minute and per square metre of normal black surface on the sun between 11 and 1 o'clock. The maximum occurs in April–May, the minimum in January. At an altitude of 400–500 m. it rarely exceeds 10 calories, at 2000 m. (Rochers de Naye) 13 calories. In 1903 the values of the actinometric measures are notably feebler than in previous years, probably because of an abnormal opacity of the atmosphere, which may be attributed to the diffusion in the air of dust arising from the violent volcanic eruptions of the Lesser Antilles, which would facilitate the condensation of aqueous vapour in the form of fog—very attenuated and invisible, but yet absorbent.

M. P. Weiss (Zürich) exhibited by means of a series of interesting experiments the new magnetic properties of pyrrhotine, that is to say, the directions in which crystals of this mineral are sensitive to the influence of magnets.

M. A. Lang (Zürich), in speaking of the biological significance of elegance in certain marine organisms, said that the scientific study of animal forms did not prevent an understanding of the æsthetic manifestations of nature which could be applied in decorative art, for instance. He showed that all those characters which give beauty and charm to the marine fauna—such as form and symmetry, phosphorescence, and transparency—enable these animal forms to respond to their environment, and thus to facilitate and assure their continued existence.

The number and importance of the communications which dealt with the canton of Ticino were very remarkable. M. C. Keller (Zürich), with his descent of the animal world of the Ticino cantons showed that the fauna principally studied by Stabile and Pavesi contains very different elements; the lacustrine is a *fauna relicta* (Pavesi), and the terrestrial contains arctico-alpine elements. But the most remarkable characteristics are those of the sylvatic fauna of central Europe, and also the great number of types of the Mediterranean subregion. He also made several interesting comparisons with the fauna of other Swiss regions, and showed several new researches for Ticino which have been found by him. At the same meeting M. F. Merz (Bellinzona) spoke on the forestry of the Ticino canton, and similar questions were referred to in various sections by MM. Freuler, Bettelini, Calloni, and Pometta.

The most largely attended sectional meetings were those concerned with physics and chemistry, and the most important papers read at these meetings were those of MM. Haller (Paris), Schär (Strassburg), de la Rive (Geneva), Nölting (Mülhouse), Forel (Morges), Bertoni (Livorno), Tomasina, Soret (Geneva), Schühmacher-Kopp (Lucerne), Riggenbach (Bâle), Hagenbach (Bonn), and others.

In the botanical section the most interesting communications were those of MM. Rikli (Zürich), C. Schröter (Zürich), A. Usteri, and Wilezeck (Lausanne); in the zoological section a magnificent monograph was presented by the honorary member, M. P. Pavesi (Pavia), on the fauna of the valley of Aosta, and papers were read by MM. Lang, Keller, Studer (Bern), Volz (Bern), and Pictet (Geneva); the section of geology and mineralogy mustered but a very small attendance, for the Swiss geologists were almost all at the international congress at Vienna.[1]

The excursions and the receptions, which took place in exceptionally fine weather, the cordial welcome and generous hospitality of the residents, all contributed to the splendid success of this year's gathering. R. NATOLI.

THE NATURE-STUDY EXHIBITION.

THROUGH the kindness of the Civil Service Commissioners and His Majesty's Office of Works a Nature-Study Exhibition was held at Burlington Gardens from October 30 to November 3. In the absence of Lord Avebury, chairman of the committee, Sir Henry Howarth presided, and Sir John Cockburn declared the exhibition open.

It may at once be said that the object of the undertaking was to put into effect, forthwith, the lessons learned from the exhibition held last year at the Royal Botanic Gardens. There, through the energy of Mr. J. C. Medd, for the first time were brought together all the various methods and matters which have been taken or mistaken for nature-study. It soon became obvious that much excellent science teaching on the one hand was masquerading under the title, and on the other that desultory collecting without rhyme or reason was a second claimant for it.

At the suggestion of Mr. Wilfred Mark Webb, honorary secretary of the Middlesex Field Club and Nature-Study Society, delegates from it and from the Selborne Society met, to appoint a committee to organise an exhibition on definite lines. The area from which exhibits were invited was also restricted to a dozen or so counties within easy reach of London. Evidence of work was asked for which dealt with such observational teaching as should form part of the education of all. This, while serving as an excellent preparation for science, is scientific only as regards method and accuracy of treatment.

[1] The communications to the various meetings of which mention is made will appear in the *Actes* and the *Comptes rendus* of the Association, most of them *in extenso*. Thanks are due to MM. Pioda, Fischer, Keller and Dufour for information very readily given.

The exhibition has been exceedingly successful from an educational point of view, and the exhibits showed that the schools which contributed had entered into the spirit which guided the committee in the preparation of its prospectus and in the desire to demonstrate what nature-study really is.

The judges were Miss Hodgson, formerly of the House of Education, Ambleside; Mr. Jonas Bradley, famous for his outdoor school at Haworth, Prof. Haddon, Prof. Minchin, and Dr. Chalmers Mitchell. The awards were made in strict accord with the objects of the committee, and were given so as to mark the work of the schools which are on the right lines. Certificates of merit, the highest official award of the committee, fell to the lot of the Froebel Institute, Streatham High School, Dulwich High School, Queenswood School, Orlestone Board School, and the Training College for the Deaf, Fitzroy Square.

Not the least important part of the proceedings were the conferences, at which practical teachers not only described their methods, but also in some cases showed how they came to adopt them. Speakers were carefully chosen from among those who exhibited last year and whose work was well known to the executive committee, of which several members helped to organise the previous effort.

On the morning of Saturday Mr. Hedger Wallace, chairman of the executive, presided over a meeting at which Mr. Badley, of Bedales School, Mr. Harry Lowerison, of the Ruskin School Home, Miss Sillham, of the Froebel Institute, and Miss Ethel Webb, of Streatham High School, spoke. In the afternoon the chair was taken by Mr. Jesse Collings, who had something to say about the Bill which he has before Parliament to promote nature-study in elementary schools, more particularly with the view of improving our agricultural education. There is every hope, moreover, that his measure will be passed without opposition. During the afternoon Miss Alderton, of Stretton, Mr. Thomas, of Orlestone, and Mr. Dodgeon, of Burnley, described their work. In the evening Mr. Richard Kearton, who has done so much to change the taking of birds' eggs for the collection to the taking of them by the camera, showed the pick of his well-known studies of wild-life, and others that had not been seen on a screen before. Afterwards, as on the previous evening, Mr. Martin Duncan proved the great possibilities of the Urban Duncan microbioscope for recording natural history observations in the ordinary way and under the microscope.

On Monday Mr. Oliver G. Pike gave an illustrated lecture on birds in their homes, and later the Middlesex Field Club held a meeting. Mr. Hedger Wallace pointed out the great necessity for a field club which should deal with Middlesex, record the fast disappearing animals and plants, and organise a local museum. Mr. Henry Stevens showed a number of remarkable slides of animals and plants under control, and Mr. Wilfred Webb demonstrated, also by the aid of the lantern (kindly lent by the Royal Geographical Society), how much nature-study could be done in London, proceeding afterwards to touch on the work of schools throughout the country.

On Tuesday evening Mr. R. B. Lodge lectured on some suburban birds and beasts, while under the auspices of the Selborne Society Prof. Boulger and Mr. E. A. Martin spoke on subjects in character with the objects of the exhibition. Financially, also, the exhibition has been a success.

BOTANY AT THE BRITISH ASSOCIATION.

THE meetings of the botanical section at Southport showed no falling off in interest. The arrangements made by the local authorities were admirable, and there was a good attendance of British and foreign botanists.

In his presidential address, Mr. A. C. Seward, F.R.S., gave an able and comprehensive summary of the present state of our knowledge concerning the composition and distribution of the floras of the past, from the earliest records in the Devonian and Lower Carboniferous up to the dawn of the Cretaceous period.

The report of the joint committee of Sections K and L on the teaching of botany in schools was read and discussed. A summary of the recommendations will be found in the report of the education section. In an interesting discussion which followed the reading of the report in Section K, several botanists expressed their approval of the report, and it was suggested that it would be a good plan if the methods recommended could be tried by teachers and the results communicated to the committee.

The morning of September 11 was given up to a series of papers and a discussion on the subject of heredity. Mr. W. Bateson, F.R.S., in an introductory address on recent discoveries in heredity, gave an excellent account of Mendel's researches, and pointed out that we have now reached a stage at which, by the employment of these methods, the solution of problems in heredity becomes possible under certain conditions. He described many of his own experiments, and exhibited specimens of the results which he had obtained in the hybridisation of various species of plants and animals, all of which give strong support to Mendel's laws.

Miss Edith R. Saunders followed by an extremely lucid account of her recent work on cross-breeding in plants, and showed the results of some of her more striking experiments (*vide* Reports to the Royal Society, 1902).

Mr. C. C. Hurst read a paper on recent experiments in the hybridisation of orchids, in which he showed by means of some beautiful coloured drawings that, so far as the intermediate hybrids are concerned, the results are apparently consistent with Mendelian principles. Dominant hybrids are infertile, and in the case of false hybrids further research is necessary before any definite conclusions can be arrived at.

The morning of September 14 was devoted to a discussion on the origin of the Monocotyledons, introduced by Miss Ethel Sargant, whose work on this subject is well known (*vide* "Annals of Botany," 1903). Miss Sargant maintains that a careful study of the anatomy of seedlings in various families of Monocotyledons and Dicotyledons leads to the conclusion that the common stock from which they both spring was not only angiospermous in character, but that it was more like a Monocotyledon than a Dicotyledon.

Miss E. N. Thomas, who followed with a paper on the structure of the embryo sac and the phenomena of fertilisation, pointed out that the results obtained support Miss Sargant's view in so far as they indicate the existence of a great gulf between Angiosperms and all other groups of plants, whilst there is little, if any, distinction in these respects between Dicotyledons and Monocotyledons.

In the subsequent discussion Miss Sargant's views were freely criticised, but all the speakers agreed that this valuable contribution to a very difficult question opened up a very interesting field of investigation.

Prof. H. Marshall Ward, F.R.S., gave an account, illustrated by plans and lantern slides, of the new botanical laboratories at Cambridge. This large block of buildings provides ample accommodation for study in all departments of botany, and special facilities are afforded for original investigation. The university is to be congratulated upon so important a development of its botanical school. Prof. Lignier presented a paper on the flower of the Gnetaceæ, in which some interesting new facts were brought forward, and Dr. Lotsy gave an account of his work on parthenogenesis in *Gnetum ula*.

The semi-popular lecture was given on the afternoon of September 14 by Prof. J. B. Farmer, F.R.S., on stimulus and mechanism in organisation. In a very able address the lecturer discussed the various forms of stimuli and the nature of the processes involved, and endeavoured to trace a connection between the growth and structural differentiation of an organism and the response to definite stimuli acting on special kinds of mechanism.

On September 12 an excursion, under the leadership of Mr. Lomax, was made to the Clough Foot Colliery, and on Tuesday afternoon the vegetation of the sandhills was investigated under the leadership of Dr. Otto v. Darbishire and Mr. Henry Ball. In a paper which he had previously communicated to the section as a preliminary to this excursion, Dr. Darbishire pointed out that the sand dunes are encroaching on the grass land, and that, although they can be fixed by sand-loving plants, it is only temporarily, and psamma is commonly planted for this purpose. The plant societies in the various regions of the dunes are well marked, and include a number of extremely interesting

plants, one of which, *Pyrola rotundifolia*, var. *maritima*, is found in certain parts in great profusion.

Of the numerous other papers communicated to the section, reference can only be made to some of the more important.

Fungi.—Mr. B. T. P. Barker (Cambridge) gave an account of the ascocarp in Ryparobius. The ascogonium appears to be uninucleate at first, and immediately after contact with the antheridial branch contains two nuclei, either situated closely together or apparently fusing. Later most of the cells of the system of hyphæ, developed from the ascogonium, are uninucleate, but some contain two nuclei, which probably fuse and become the single nucleus of a young ascus. Associated closely with this single nucleus is a structure of variable shape which has almost as strong an affinity for stains as the chromatin of the nucleus itself. It appears to be of the nature of a vacuole and to be intimately concerned with the nutrition of the nucleus, which at this time is of a remarkably large size. The results obtained point to a close relationship between the genera Ryparobius and Thelebolus.

Mr. E. S. Salmon communicated the results of culture experiments with biologic forms of the Erysiphaceæ, which prove that under certain conditions a "biologic form" which in nature is restricted to the species of a certain genus of host-plants becomes capable of infecting species belonging to another genus, and species of plants which are immune in nature are able to be infected. The author considers that it is possible that in this change of infection-powers of biologic forms of parasitic fungi in consequence of injury to the host-plant an explanation may be found of the sudden appearance of disease on plants hitherto immune.

Prof. H. Marshall Ward, F.R.S., in a paper on Eriksson's mycoplasm hypothesis, showed by means of a series of microphotographs and drawings that this so-called mycoplasm consists of haustoria only, and that there are no grounds for believing that Eriksson's views are well founded.

Prof. T. Johnson communicated a short note on a willow canker which has been the cause of considerable damage in an osier holt in the west of Ireland.

Physiology.—Prof. Letts and Mr. J. S. Totton contributed a valuable paper on the occurrence of *Ulva latissima* and *Enteromorpha compressa* in sewage effluents, and on variations in the composition of the tissues of these and allied seaweeds. The view expressed by one of the authors in conjunction with another chemist, that the growth of *Ulva latissima* in quantity in a given locality is a sign of sewage pollution, has received remarkable confirmation by the occurrence of this seaweed and of *Enteromorpha compressa* in the Belfast sewage beds. The spores probably found their way into the sewage by leakage of sea water into the system. The percentage of nitrogen was found to be higher, especially in Enteromorpha, in the sewage specimens than in those taken from the sea or brackish water.

Mr. R. H. Yapp gave an account of his observations on fruit-dispersal in *Adenostemma viscosum*. This plant is a composite which is widely distributed in the warmer regions of the globe. The distribution of the fruit is brought about by a pappus which consists of stalked glands, composed of numerous capitate hairs, which secrete a copious viscid fluid. The movements of the pappus setæ are effected by a group of motor cells which forms a pulvinus at the base of the stalk of each gland.

Mr. Harold Wager described some experiments on the staminal hairs of *Tradescantia virginica*, from which it appears that the protoplasmic movement can continue for some days after the hairs are removed from the plant, even if they are completely embedded in vaseline. The author also described a method by which the nucleus of the cells can be stained by means of the coloured cap contained in the vacuole.

Mr. J. Parkin gave an account of his work on the localisation of anthocyan in foliage leaves. In young leaves, and in the autumn coloured leaves, the anthocyan is usually confined to the mesophyll; in mature leaves mainly to the epidermis, except when the colouring matter is only produced under exceptional conditions, when it is usually found in the mesophyll. The author concludes that the presence of anthocyan in the mesophyll seems to weaken somewhat the view that its function is to protect the chlorophyll by absorbing the destructive solar rays.

Anatomy and Cytology.—Miss Ethel Sargant and Miss Agnes Robertson read a paper on some anatomical features of the scutellum of Zea Mais. They find that the epithelium of the scutellum in contact with the endosperm becomes folded into a number of gland-like structures in which traces of some kind of secretion are commonly found.

Mr. Arthur W. Hill (Cambridge), in a paper on the histology of the sieve tubes of Angiosperms, showed that the sieve plates of the mature sieve tubes are traversed by relatively thick slime strings, each being enclosed in a callus rod. In the radial and tangential walls the slime strings, which are grouped into oval or rounded pitted areas, are much smaller than those in the sieve plates, and some three to six strings are enclosed in a callus rod. Connecting threads also occur between the sieve tubes and companion cells. Between the sieve tubes and cambiform cells, and between the latter and the companion cells, the small groups of threads are found in small and deep pits.

Mr. J. Lloyd Williams (Bangor) read a paper on the alternation of generations in the Dictyotaceæ and the cytology of the asexual generation, in which he pointed out that the nuclei of the tetraspore plants have about thirty-two chromosomes, and that in the formation of the tetraspores these become reduced to sixteen. The sexual plants also have the reduced number. The evidence, therefore, shows that the tetraspore produces a sexual plant, whilst the oospore produces the tetraspore generation.

Mr. L. A. Boodle (London) communicated a short paper on the structure of leaves of bracken from different habitats. In a very exposed and sunny situation the leaves are hard and short, while in a well sheltered and shaded locality they are much larger and soft. Long sori and short sori are typical of the first and second situation respectively. The internal structure of the pinnules varies with the habitat in a corresponding manner; the presence of a continuous, or nearly continuous, hypoderm and the large amount of the palisade tissue formed distinguish the leaf of the exposed from that of the sheltered plant.

Ecology, Distribution, &c.—In addition to Dr. Darbishire's paper on the sandhills of Southport, several other papers of some interest were read in this section. Miss M. C. Stopes gave an account of the colonisation of a dried river-bed. The stream became dried up in April, 1901, and during the years 1901–1903 observations were made upon the plants found growing on the dried up mud. In 1903 these included eleven frequent semi-aquatics, of which four are locally dominant, and thirty-two frequent land plants, of which eight are locally dominant.

Mr. T. W. Woodhead (Huddersfield) described his methods of mapping the distribution of plants, and the anatomical variations produced in the leaves of certain plants grown under varying conditions in different plant societies. He showed clearly by means of photographs what striking variations may be produced in the undergrowth of a wood owing to the nature of the trees immediately above it.

Dr. F. F. Blackman (Cambridge) gave an excellent summary of modern views on the phylogeny of the Algæ, illustrated by diagrams.

Mr. A. W. Hill (Cambridge) gave an account of his recent expedition to Upper Peru, and Mr. W. Wilson communicated a list of some of the plants growing on the serpentine rocks of the north-east of Scotland.

Fossil Plants.—There were only two papers of any importance in this section. Mr. E. A. Newell Arber (Cambridge) communicated some interesting observations on homœomorphy among fossil plants. Among recent plants species of different descent may possess many closely identical characters as the result of adaptation to particular conditions of the environment. There is some reason to believe that similar cases may be found among fossil plants, and the author finds some ten genera and species in which this phenomenon occurs.

Mr. Seward communicated a paper by Dr. D. H. Scott, F.R.S., and Prof. F. W. Oliver on the seed of Lyginodendron, which was illustrated by some beautiful lantern slides.

Economic Botany.—Mr. E. T. Scammell read a paper on the forest resources of Australia available for British commerce. The forest areas of Australia comprise 107,037,000 acres of marketable timber, or nearly half the areas of the forest lands of Europe, excluding Russia. The timbers are

of many varieties, and some of them are of high commercial value. The chief of these are the eucalypts, of which there are more than 150 species. Besides the eucalypts there are many kinds of casuarinas (the Australian oak), some conifers (the Moreton Bay pine, the cypress pine, the brown pine, or colonial deal, and others), many acacias (the Australian wattle), Banksias, and numerous other varieties. The range of Australian wood at present available for British commerce is limited. Western Australia and Tasmania are the only States that have seriously dealt with the question of exporting timber or of using their forest resources as a valuable commercial asset.

Mr. W. Powell described a process for seasoning and preserving timber which appears to be at once simple and effective. The timber is treated with a dilute solution of sugar, in which it is boiled until the air in the interstices has been got rid of. The timber is then cooled and dried at a fairly high temperature. Timber treated in this way is much improved, the soft woods especially, both in hardness and toughness.

EDUCATION AT THE BRITISH ASSOCIATION.

THE educational science section has become the debating ground where educational principles can be discussed without reference to minor administrative details and class distinctions. Increased efficiency is the leading idea, and it is promoted by the expression of authoritative opinion from a platform of the British Association. Attention is there directed to matters requiring consideration by authorities responsible for educational work, and the directions in which progress can be most usefully made are afterwards indicated in reports presented by committees. The work of the section is thus both critical and constructive, and its sphere of influence increases in extent every year.

After the president's address on the morning of September 10, a discussion on school curricula was carried on throughout that day and the next. The material for discussion consisted of eight papers received from leading representatives of various branches of educational work in response to an invitation issued by the committee of the section. The papers were printed in full in the September number of the *School World*, and the authors are Prof. J. Adams, Prof. H. E. Armstrong, F.R.S., Miss S. A. Burstall, Mr. G. F. Daniell, Mr. W. C. Fletcher, Mr. T. E. Page, Mr. J. L. Paton, and Prof. Michael E. Sadler. The three main divisions of the subject were:—(1) General principles upon which a school curriculum should be constructed; (2) the education of girls; (3) commercial education. To concentrate attention upon specific points, several propositions were formulated, and the authors of the papers were asked to speak to them instead of reading the papers. The propositions which were laid before the meeting during the discussion, and received general assent, were as follows:—

(1) It is desirable that specialisation should be deferred to as late a period as possible in the school career, and that the early curriculum should be so arranged as to lay a good foundation in English subjects, with, say, drawing and elementary science.

(2) It is to be regretted that the influence of public school entrance and scholarship examinations encourages the premature devotion of too much time to classics; it would be desirable that the study of Latin should not be taken before, say, twelve years of age, and that the language teaching up to that time should be confined to the mother tongue and one modern language.

(3) That a large measure of practical instruction should be included in the school course, and that both literary and practical instruction should be given throughout and made interdependent.

(4) It is desirable that in organising the curriculum there should be some differentiation, especially in science, between courses of study for boys and those for girls, more particularly between twelve and sixteen years of age.

(5) That for all girls literary instruction is of the highest importance; at some period of their school life practical instruction in the domestic arts should be provided, based on and correlated with elementary science teaching.

(6) With the view of obviating over-pressure, injury to health and superficiality, girls who intend to proceed to college, or enter a literary profession, should in general remain at school until eighteen years of age.

(7) It is desirable that county and borough councils and other authorities offering scholarships for girls to enable them to proceed to college should not expect them to take up their scholarships before they reach the age of eighteen.

It is impossible to describe in a few words the many important opinions expressed in the papers and during the discussion, but there was general agreement that the development of intelligence and self-reliance is of prime importance. The discipline of scientific studies was generally recognised, and also the necessity of making courses of instruction more practical than hitherto; that is to say, pupils should be active rather than passive in their attitude towards knowledge.

This is the touchstone which will test the quality of all educational work, whether in the humanities or in science, but as science deals with things more than words, it has special claims for recognition in the school curriculum. Mr. Balfour a short time ago, in referring to the relative advantages of classics and science as school subjects, expressed himself as doubtful whether scientific studies could supersede with advantage the traditional course of classics in schools. In connection with his remarks, it is of interest to refer to the following statement made by Mr. A. C. Benson in the *School World* for October in continuation of the discussion on curriculum:—"I have taught classics at Eton for nearly twenty years to boys of every degree of capacity. I have found that as a basis for teaching able boys they are excellent. But the effect of the present crowded curriculum, with classics as the basis, upon boys of ordinary or limited capacity is so absolutely negative, from the educational point of view, that I should hold that it would justify almost any experiment being tried."

Here we have an acknowledgment by a teacher of exceptional experience and ability of the failure of classical instruction so far as the average boy is concerned. This in itself is sufficient to justify the plea of the reformer for a readjustment of school studies on a broader basis than that at present adopted. In the discussion on curriculum, Mr. T. E. Page, a representative of literary culture, asked what branch of natural knowledge men of science wished to be taught in schools, and urged that there was a diversity of opinion upon this matter. The answer is, of course, that the subject is not so important as the method. It matters little whether botany, physics, chemistry, or any other science subject is used as the basis of instruction provided that they are studied practically under encouraging conditions and in the spirit of scientific inquiry. What men of science urge is that scientific studies are capable of forming habits of mind—resourcefulness, perspicacity, enterprise and initiative—in a way which the traditional courses and methods have not accomplished in the past.

A general view of the work done by the late Dr. Gladstone in connection with the teaching of science in elementary schools is contained in the final report of the committee on that subject. The committee was first appointed in 1878, with Mr. Mundella as chairman and Dr. Gladstone as secretary, and since 1883 has been annually reappointed to continue inquiries on the subject then instituted. The chief work of the committee has been to watch and record the proportion of children examined in science subjects in elementary schools. There has, of course, been a decided increase in numbers, but when the character of the work which has been done is considered, the committee now reports that the progress made is undoubtedly unsatisfactory. It is beyond question that science has in no way taken its proper place in our system of elementary education. Here and there work of the very greatest value has been done, but such cases are all too rare.

The report concludes with the remark that, in view of the national importance of developing the scientific spirit in elementary schools, it is not too much to say that it is now the duty of the Association to intervene with constructive proposals which will promote such an object. Judging from the great success which has attended the labours of the committee on the teaching of chemistry in schools and the recent discussion on the teaching of mathematics, there can be little doubt that a general inquiry might now be undertaken with great advantage, and that proposals might be made which would be of the greatest value

in guiding educational authorities generally. A special committee has therefore been appointed to report upon the courses of experimental, observational and practical studies most suitable for elementary schools, and generally as to the steps which it is desirable to take to secure proper attention to and encouragement of such studies. All who have paid attention to the subject will probably agree that some organised effort should now be made to extend the teaching of scientific method.

The dangers of ill-considered schemes of science study were referred to by Prof. H. E. Armstrong in presenting the report of the committee on the teaching of science in elementary schools, and were emphasised by Prof. Marshall Ward in the subsequent discussion. The committee points out that education authorities, realising the value of nature-study as a means of training and a matter of interest, will force instruction in this subject in schools in which the teachers are quite unable to handle it effectively by reason of their want of scientific training and knowledge. It cannot be too strongly impressed upon the lay mind that unless nature-study is taken up as a subject by which the spirit of scientific inquiry is created and fostered, men of science have no sympathy with its introduction into schools.

The report on the teaching of botany in schools should do something to direct the nature-study movement along scientific lines. There is a tendency to consider that the demands of the advocates of nature-study in schools are met by supplying reading-books in which a variety of facts in natural history are described, and are accepted by the pupils on the *ipse dixit* of the author or the teacher who dispenses them. If that is to be the result of the movement, it would be just as well to read fairy tales or fiction, so far as the development of mental faculties is concerned. To be of any value as a training in scientific method, nature-study must not only create interest, but must also demand active work for a definite purpose from the pupils. The difficulties in the way of doing this under the present conditions of teaching in schools are very great, but unless this fundamental principle of scientific instruction is acted upon, nature-study will prove a snare and a delusion.

On the importance of studying plants alive and experimentally, the botany report expresses decided opinion. It is pointed out that scientific curiosity is better occupied in discovering how plants get their food, respond to stimuli, adapt their structures to new circumstances, contend with their rivals or enemies, and propagate their race than in learning Latin names for the shapes of their leaves or classifving species. Individual practical work is, in fact, the only way to gain useful scientific experience, for knowledge accumulated by a mere act of memory is feebly grasped and soon forgotten. Throughout all stages of instruction, observation and experiment in the laboratory and out of doors must be the method of study. Among the conditions of profitable object-lessons for children, the committee notes the following:—(1) Every pupil should have an object to himself, or at least be able to examine the object as long and as closely as he pleases. A drawing is not to be allowed to rank as an object. (2) Living and growing plants should be frequently observed. (3) The living plant should not only be studied in flower, but whenever the change of season brings on a new phase of growth. Fruits, buds, and seedlings are as important as flowers. (4) Experiment can hardly come in too early, and there is nothing else quite so stimulating. Even young children can appreciate the interest of a simple experiment, and they may be allowed to take part in it before they are able to conduct it themselves.

Where botany can be seriously studied, plant-physiology is recommended as the basis of work, on the ground of its great practical importance and of its special value as discipline when studied systematically. The seedlings of common garden plants are recommended as providing the best material for early lessons.

A course of lessons on seedlings can be so arranged as to lead the beginner to consider attentively the nutrition of a green plant, the adaptation of the plant to external circumstances, and the development of new parts. The course should bring in drawing to scale, the graphical representation of experimental results, the care of garden beds, the care of water cultures, and many other practical arts. It ought also to encourage the habit of close observation, the habit of methodically comparing structures which in different plants answer the same purpose, the love of experiment, and the unwillingness (so characteristic of the scientific mind) to accept any conclusion except as the result of an independent and careful judgment.

How school gardens can be made of value in connection with the teaching of botany is described in one section of the committee's report by Miss L. J. Clarke, whose work at the James Allen's Girls' School, Dulwich, has shown that botany can be made a practicable as well as practical school subject. Other sections of the report are devoted to school excursions, collecting—which is condemned when carried on for selfish ends and without any scientific purpose—initiative of the teacher, and the simplicity of appliances required for teaching purposes.

An interim report was presented by the committee on the influence of examinations on school curricula and of schools on university requirements. The report was drawn up by the chairman, Prof. H. E. Armstrong, and consisted of expressions of opinion received from heads of schools, university tutors, &c., upon subjects to which their attention was invited. While pointing out the many evils which attend examinations, the majority of the persons who favoured the committee with replies took the view that in some form they are necessary. It is generally recognised that there has been a marked tendency to develop and improve examinations of late years. Among other results of the inquiry the following are noteworthy:—The effect of specific examinations, both as affecting general training and as encouraging undue specialisation, either on the humanistic or on the scientific side, was considered to be bad in most cases. Opinion was practically unanimous as to the need of unifying examinations with the object in view, among others, that certain examinations may serve a common purpose, *e.g.* as qualifying examinations for entrance upon a course of professional study.

The need of preventing examinations from becoming stereotyped and behind the times, and thus discouraging the development of new or improved methods, was another subject submitted for opinions, and the replies expressed the general desire that examiners should confer with teachers in some organised way.

With regard to the possibility of arranging outside examinations so as to test what has really been taught in the school, leaving the teachers a freer hand than in the past and arranging for their cooperation on the examining board, in the setting of the questions, and in considering the answers, there appeared to be a strange disinclination to insist that the teacher should be trusted.

The extent to which certain subjects are to be regarded as necessary and others as optional evoked diverse expressions of opinion, and the general conclusion seemed to be that entrance examinations at Oxford and Cambridge do not tend to promote a good all-round education.

The report of the committee on the conditions of health essential to the carrying on of the work of instruction in schools consists almost entirely of two reports of subcommittees on (1) the essentials of school buildings; (2) eyesight in school children. The report of the subcommittee on the former subject forms a condensed *résumé* of scientific principles of school construction of a very practical character. It may be regarded as a contribution toward the realisation of the proposal that a short practical treatise should be drawn up by the committee. Its conclusions are of a general character, and are applicable to all classes of school buildings. The subcommittee on eyesight in school children has dealt with and reported on (*a*) the causes of defective eyesight in school children, and (*b*) the conditions requisite for preserving eyesight from injury in school life. Besides dealing with general principles involved, it makes some practical recommendations of much importance. One of these is that it should be required that school books should be "passed" in respect to their typographic standard and quality by some recognised hygienic authority before being adopted in schools. The necessity for a very considerable eye-working distance in all the exercises and instruction imposed upon young children is a condition which lies at the root of school hygiene.

There was a useful discussion on the teaching of geography at a joint meeting with the geographical section, but as a short account of this has already appeared in the report of the proceedings of that section, no further reference need be made to it here. R. A. G.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. T. H. Havelock, Smith's prizeman and Isaac Newton student in astronomy and astronomical physics, 1902, was on November 2 elected to a fellowship at St. John's College.

Mr. J. M. Dodds, Peterhouse, has been appointed chairman of the examiners for the mathematical tripos.

The university contribution from the incomes of the colleges has been fixed for the year at 12½ per cent. This will yield the sum of 28,076*l.* to the common university fund.

The council of the Senate has proposed that a syndicate be appointed to consider whether it is expedient to make any changes in the present system of studies, teaching, and examinations of the university. It has been urged, it is said by His Grace the Chancellor, that some changes are desirable, especially as regards modifications of the requirements concerning the classical languages, and enlargement of the range of modern subjects. The reorganisation of secondary education throughout the country, and recent developments in other universities, have made the inquiry more than ever desirable.

IN small schools with limited accommodation, where instruction is given in both chemistry and physics, it is almost impossible to have separate laboratories for practical instruction in these subjects. Messrs. F. E. Becker and Co., of Hatton Wall, London, are manufacturing a combined bench for chemical and physical experimental work which succeeds in overcoming this difficulty. When the benches are required for a chemistry class there are shelves for bottles of reagents on much the same plan as in ordinary chemical laboratories, but when the benches are to be used for practical physics, the shelves and reagents can be safely lowered bodily until they are below the surface of the bench. The lowering is effected by weights, heavier than the shelves and their contents, attached to sash cords running over pulleys. This plan is a decided improvement upon the attempt to make the reagent shelves of such a pattern that they may be lifted when the benches are required by students of physics.

A COURSE of eight lectures on the fossil reptiles of South Africa was commenced by Prof. H. G. Seeley, F.R.S., at King's College, Strand, on Tuesday, and will be delivered on alternate Tuesdays until February 23, 1904. The lectures are addressed to advanced students of the University of London and others interested in zoology and palæontology, and to persons specially interested in the South African colonies. There is no fee for the course; cards of admission may be obtained on application to the academic registrar of the university. Other courses of special lectures in advanced zoology have been arranged, including the following, to be delivered next year:—Prof. E. A. Minchin, "Sporozoa"; Dr. P. Chalmers Mitchell, "The Structure and Classification of Birds"; Dr. C. W. Andrews, "The Fossil Vertebrates of Egypt and their Relations with those of other Regions"; Prof. H. G. Seeley, F.R.S., "The Forms of the Skull in the Extinct Reptilia" and "The Limbs and Arches which Support them in some Extinct Vertebrata."

THE Chester Society of Natural Science, Literature and Art, which now numbers more than a thousand members, held its thirty-second annual conversazione on October 22, when the Kingsley memorial prizes for nature-study offered for competition by the Chester Society were presented by the Duchess of Westminster. These prizes, of the value of a guinea each, are offered to boys and girls residing in Cheshire and North Wales, and this year the subjects selected for the competition were:—the life-history and habits of the common house sparrow; the collection of dried and mounted specimens of British grasses; the physical geography and natural features of the district in which the competitor resides; and a descriptive list of insects which are injurious to plants in the district in which the competitor resides. So far as practicable, the list of insects was to be accompanied by actual specimens of the insects tabulated. This plan, which the Chester Society of Natural Science has found successful in developing an interest in nature-study in the schools of Cheshire and North Wales, might with advantage be adopted by field clubs and natural history societies in other parts of the country.

AT Liverpool on October 31 Lord Londonderry opened a new wing erected in connection with Edge Hill Training College at a cost of 11,800*l.* Lord Londonderry, in the course of his address, said the universities were undertaking new and remarkable phases of work. Liverpool, Manchester, and Birmingham, which twenty years ago could not stand alone, were now eager for independence, and were anxious to discharge in their own way the duties of higher education. To be successful we must have an education system second to none. We had a considerable amount of leeway to make up, because we had not at the present time the advantages which were enjoyed by other countries in regard to this question. He wished it were possible that they could at once take the steps necessary to compete successfully and in friendly rivalry with other countries, but he trusted the day was not far distant when that might be done. It was the work of colleges which might induce the country at some future date to devote a sum of money annually to assist picked men and women engaged in research studies thoroughly to complete their education. He must not, however, be understood to be making any pledge that he had any such prospect in view.

THE classes at the Northern Polytechnic have for the last few years been greatly crowded, especially in physics, chemistry, and some of the trade subjects. To provide the necessary accommodation a large new wing has been constructed, to which the physics department has been transferred. This is now provided, amongst others, with three large laboratories, two of them 50 feet by 30 feet, and a lecture room that will seat about 100. On the top floor, in addition to the accommodation for chemistry already existing, are now added a large elementary laboratory, a laboratory specially fitted for honours students and research work, as well as a balance, a lecture room, and a fire-proof room. The new wing also contains a drawing office 50 feet by 30 feet, and four trade shops, for plasterers, masons, bricklayers, and painters respectively. The cost of this wing, with its equipment, has amounted to about 16,000*l.* The chemical laboratories, drawing office, and several trade shops are lighted by "inverted arcs," that is, by the light reflected from the ceiling only, upon which the arc lamps are caused to shine. The result is a light so diffused as to be almost shadowless, and therefore an exceedingly pleasant light for mechanical drawing and such things as masonry, in which there may be a lot of undercut work, which an ordinary light would make difficult. This wing was formally opened on Wednesday, October 28, by Lord Londonderry. Sir Arthur Rücker, Mr. Sydney Webb, and Sir Joseph Savory were among the speakers.

THE second article by a special *Times* correspondent on the work of the Mosely Educational Commission, published in the issue for October 28, contains several useful and suggestive expressions of opinion as to certain of the causes for the greater educational enthusiasm in the United States as compared with that in this country. The article states that "in England every penny spent on education is too often grudged; in America there is no public expenditure that seems to meet with more universal approval." Perhaps, the article continues, it is this belief in education for its own sake that has saved America from the whole system of examinations, scholarships, and prizes, under which English education groans. In our elementary schools the examination fiend has been partly exorcised, with the result that at this moment elementary education in England is in a healthier and freer condition than that of the secondary schools and universities. There, where education ought above all to be free to develop itself in the best methods and from the highest motives, the case is notoriously the reverse. From the time he enters a preparatory school until he leaves the university, an English boy imbibes the idea that the principal object of study is to pass examinations. Teachers must repress individuality of treatment, and with one eye on the nearest impending examination must think less of educating their pupils than of cramming them. Secondary schoolmasters dare not travel outside the require-

ments of university scholarship examinations, while preparatory schoolmasters must adapt their teaching to the competition for entrance scholarships at the secondary schools. Our whole system of higher education has got into a vicious groove of incessant competition. If the Commission succeeds in its mission, which is to stir up Englishmen to greater educational endeavour, it will have performed a great national service.

LECTURING on "The Work and Aims of the London University" on Monday evening at the London Institution, Sir Arthur Rücker remarked that a modern university had to concern itself with teaching, with research, and with technology. The London University was bound by its statutes to organise, improve, and extend higher education within a radius of thirty miles of the university buildings, but it started on this great task very sparsely equipped with funds. The Government gave a dignified centre in the Imperial Institute buildings and 8000*l.* a year, which was calculated to supply the actual needs of the university for the central staff and for carrying on the examinations, leaving the sum of 1500*l.* yearly with which to improve, organise, and extend higher education in London and thirty miles around. However, the London County Council put aside an annual grant of 10,000*l.* for the university, and that had enabled it to start from the first as a teaching university. It was essential, in carrying on the work, that the efforts of the university should at particular times be concentrated on particular objects, and at present three schemes had been proposed. The first of these was the incorporation of University College, which has offered to place its whole property at the disposal of the university and under its control. In order to carry out this scheme 200,000*l.* was needed to make the college ready for incorporation. The Drapers' Company had given 30,000*l.* for this object, and altogether about 100,000*l.* had been raised. But the scheme was delayed for the want of another like amount. The second scheme was connected with the great medical schools of London. They were at present hampered by the necessity of providing education in subjects such as physics and chemistry, which could be equally well taught at a distance from a hospital, and they were anxious that the university should undertake the whole of that work. This proposal would coordinate teaching in London, and a beginning could be made if 100,000*l.* were provided. The third scheme was that of a new college of technology proposed by Lord Rosebery. Large sums had been promised by private donors for this purpose, and the County Council had promised 20,000*l.* a year as an endowment if certain reasonable conditions were fulfilled. It was understood that about 100,000*l.* more was needed to carry out this plan also. Upon the carrying out of these schemes depended, among other things, whether the university was to be in reality a great teaching body or not.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, October 23.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—The bending of magnetometer deflection-bars, by Dr. C. **Chree**. A theoretical paper contributed to the Society by the present author in May, 1901, proved, amongst other results, that the bending of the deflection-bar of an ordinary magnetometer, under the combined weight of the bar and its load, must increase the distance between the deflecting and deflected magnets, during a determination of horizontal force, to an extent which is not negligible. This conclusion has been borne out by direct observations made at the National Physical Laboratory on a number of magnetometer-bars, including specimens from the leading makers. The mean results thus obtained are recorded in the present paper. In many magnetometers the increase in distance due to the bending is roughly proportional to the distance itself. In the case of bars by the Cambridge Instrument Company, the bending increased the distance by almost exactly 1 part in 10,000 at all distances. It is hoped that the method employed will prove useful to magnetic observers who have not ready access to a physical laboratory.—On the magnetism of basalt and the magnetic behaviour of basaltic bars when heated in air, by Dr. G. E. **Allan**. Bars cut from basalt obtained from Rowley Regis and from Linz, Germany, were tested by means of a magnetometric method to determine their magnetic properties at temperatures from 15° to 800° C. Hysteresis curves are given, and the temperature-permeability curves show that whilst the English basalt has, in general, a maximum permeability near 500° C., followed by a minimum about 550° C., the temperature of maximum permeability in the case of the German basalt lay in the neighbourhood of 50° C., there being a subsequent gradual loss of strength with rise of temperature. Sections of heated and unheated rocks are given, showing evidence of chemical change in some of the rock constituents, and a table of values of susceptibility of the specimens is appended.

Royal Microscopical Society, October 21.—Dr. Hy. Woodward, F.R.S., president, in the chair.—Mr. J. W. **Gordon** exhibited some photomicrographs of *Pleurosigma angulatum*, taken with a 1/14th inch oil immersion objective, the magnified image being received on an oscillation screen; the image so obtained was further magnified 150 times by a second microscope placed above the first, the arrangement being similar to that exhibited and described by Mr. Gordon when he read his paper on the Helmholtz theory of the microscope. The photograph was then enlarged by the usual process. The source of illumination was a pin-hole lighted by a Welsbach burner, but Mr. Gordon thought it would be better to use a lime-light for the purpose, as the threads of the mantle produced a somewhat striped effect, which rather impaired the appearance of the photograph.—Mr. C. D. **Soar** exhibited on the screen by means of the epidiascope a large number of drawings of British water mites, one or more species of each genus being included in the series. He gave a brief explanation of the special characters of each species shown.—A paper by Mr. F. W. **Millett**, being part xv. of his report on the Foraminifera of the Malay Archipelago, was taken as read.

Challenger Society, October 28.—Sir John Murray, F.R.S., in the chair.—Dr. R. N. **Wolfenden** read a paper on the distribution of the Copepoda as illustrated by his cruises from Valentia to the Færöe Banks and in the "cold area" of the Færöe Channel. Two species proved to be purely epiplanktonic, both in the warm and cold areas, twelve were eurythermic and eurybathic, ranging from the surface to 700 fathoms in both areas. Forty-seven out of sixty-four in the warm Atlantic, and twenty-three out of forty-seven species in the cold area, were mesoplanktonic, and not met with in the adult condition at less than 200 fathoms, although some few were epiplanktonic when young. No less than thirteen species were captured at 1000 fathoms. There is evidence that certain forms are confined to the bottom, and form part of a true hypoplankton (in the sense in which that word was originally introduced); mesoplanktonic forms are found among these latter.—Dr. E. J. **Allen** contributed notes on the changes observed in the water temperatures and plankton southwest of the Eddystone.—Mr. L. A. **Borradaile** exhibited and made remarks on symbiotic crabs from the Maldive Islands.—Mr. **Bidder** showed and explained a new meter for bottom currents.

PARIS.

Academy of Sciences, October 27.—M. Albert Gaudry in the chair.—On the scintillating phosphorescence presented by certain substances under the action of the radium rays, by M. Henri **Becquerel**. By working with the radium emanation in a strong magnetic field it was clearly proved that it is the α rays which cause the scintillation, this result being in agreement with the suggestion of Sir W. Crookes: the phosphorescence excited by the β rays, when it is appreciable, masks the effect of the α rays. The double sulphate of uranium and potassium is rendered phosphorescent by the β rays, the platinocyanide of barium by both α and β rays, whilst hexagonal blende and diamond are especially affected by the α rays, the phenomenon being very brilliant with the diamond. The facts observed are all in accordance with the hypothesis that the scintillation is due to cleavages irregularly provoked on the crystalline

screen by the prolonged action of the α rays.—Observation of the eclipse of the sun of September 20, made at the island of Réunion, by MM. Edmond **Bordage** and A. **Garsault.**—Observations of Mars made with the large telescope of the Observatory of Meudon, by M. G. **Millochau.** The appearance of the markings on the planet when viewed through the large instrument differs in some respects from the previous observations made with smaller telescopes. Four drawings accompany the paper, showing the appearance on different dates.—On the groups of transformations of linear equations of finite differences, by M. Alf. **Guldberg.**—On the practical solution of equations, by M. **Rabut.**—The experimental determination of the momentary pressure resulting from shock, by M. **Ringelmann.** The results obtained can be expressed by the formula $C=kPv$, in which C is the momentary pressure, P the weight of the falling body, v its velocity, and k an experimental coefficient, 13·55.—On a capillarimeter, by MM. E. **Tassilly** and A. **Chamberland.** The instrument consists of a biconcave cylindrical lens, on the plane edges of which two plane parallel plates are clamped, the difference in the heights of the meniscus on either side being measured.—The change of electrical resistance of selenium under the influence of certain substances, by M. A.-B. **Griffiths.**—On the fusibility of mixtures of sulphur and bismuth, by M. H. **Pélabon.** The fusibility curve is represented by three straight lines, with two points of inflection, one at 435° C. and the other at 685° C., the latter corresponding to the sulphide BiS.—The action of boric acid upon iodides; its use in the separation of iodine from iodides in the presence of bromides and chlorides, by MM. H. **Baubigny** and P. **Rivals.** Iodine can be separated from a mixture of haloid salts by distilling with boric acid and manganese peroxide in a current of air.—On the composition of the prehistoric bronzes of Charente, by M. **Chesneau.**—The calculation of the heat of combustion of organic acids, their anhydrides and esters, by M. P. **Lemoult.** By assuming certain thermal values for the (CO.OH), (C=C), (CO.O.CO), and (CO.O.C) groups, a general formula is given for the heat of combustion of the above named substances. On 450 cases examined, in 12 per cent. the approximation is within 1 per cent., in 20 per cent. between 1 and 0·5 per cent., and in 68 per cent. within 0·5 per cent. of the experimental values.—Researches on isoglucosamine, by M. L. **Maquenne.** Isoglucosamine is reduced by sodium amalgam to two stereoisomeric bases, one being *d*-glucamine, the other *d*-mannamine. Isoglucosamine thus furnishes a new means of passing from the mannite to the sorbite series.—The action of chlorine on barium acetate, by M. Albert **Colson.** A chloroacetate is formed of the composition $[BaCl.(C_2H_3O_2)+H.(C_2H_3O_2)]$.—Solid azo-colouring matters derived from α-amino-anthraquinone, by M. Charles **Lauth.**—Study of some ancient samples of bread. An examination of bread from Pompeii, Aosta, Egyptian tombs, and the lake dwellings of Neuchatel, by M. L. **Lindet.**—The tectonic structure of the island of Eubea, by M. **Deprat.**—Study of the muscular contractions and of the reflexes in *Stichopus regalis*, by M. Victor **Henri.**—On the stimulation of nerves and muscles by discharges from condensers, by M. J. **Cluzet.**—The seat of epileptiform convulsions, by M. Nino **Samaja.**—A new dental and surgical drill, by MM. J. **Bercut** and A. **Donat.**—On the curve of output of a subterranean spring, by M. Edmond **Maillet.**

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 5.

CHEMICAL SOCIETY, at 8.—Conductivity of Substances Dissolved in Certain Liquefied Gases. Preliminary Notice: B. D. Steele and D. McIntosh.—The Reduction of Hydrazoic Acid: W. T. Cooke.—The Behaviour of Metallic Oxides towards Fused Boric Anhydride: C. H. Burgess and A. Holt, Jun.—Some Reactions of Vanadium Tetrachloride: B. D. Steele.—Studies on Comparative Cryoscopy. Part I.: The Fatty Acids and their Derivatives in Phenol Solution: P. W. Robertson.—The Vapour Pressures of Sulphuric Acid Solutions. Preliminary Note: B. C. Burt.—The Viscosity of Liquid Mixtures. Preliminary Note: A. E. Dunstan and W. H. C. Jemmett.—Additive Compounds of *s*-Trinitrobenzene and Alkylated Arylamines: H. Hibbert and J. J. Sudborough.—A Contribution to the Study of the Reactions of Hydrogen Peroxide: J. McLachlan.—The Constitution of Certain Silicates: C. Simmonds.—Constitution of Ethyl Cyanacetate. Condensation of Ethyl Cyanacetate with its Enolic Form: P. Remfry and J. F. Thorpe.—Interaction between Chloric and Hydriodic Acids: J. McCrae.—3:5:5-Dichloro-1:1:2-Trimethyldihydrobenzene. A Correction: A. W. Crossley.—The Estimation of Hydroxylamine: H. O. Jones and F. W. Carpenter.—A Study of the Isomerism and Optical Activity of Quinquevalent Nitrogen Compounds: H. O. Jones.—The Action of Water and Dilute Caustic Soda Solutions on Crystalline and Amorphous Arsenic: W. T. Cooke.—The Union of Carbon Monoxide and Oxygen, and the Drying of Gases by Cooling: A. F. Girvan.

ROENTGEN SOCIETY, at 8.30.—President's Address.

LINNEAN SOCIETY, at 8.—On the Structure of the Leaves of the Bracken, *Pteris aquilina*, in relation to environment: L. A. Boodle.—On the Life-history of a New Monophlebus from India, with a Note on that of a Vedalia predaceous upon it; with Remarks on the Monophlebinæ of the Indian Region: E. P. Stebbing.

FRIDAY, NOVEMBER 6.

GEOLOGISTS' ASSOCIATION, at 8.—Conversazione at University College.

TUESDAY, NOVEMBER 10.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—North Polar Exploration, 1898–1902: Commander R. E. Peary, U.S.N.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Tensile Tests of Mild Steel, and the Relation of Elongation to the Size of the Test-bar: Prof. W. C. Unwin, F.R.S.

ANTHROPOLOGICAL INSTITUTE, at 8.15.—Exhibition of Pictures Painted by Colour-blind Persons: Dr. F. W. Edridge-Green.—The Survival of Primitive Implements in the Færöes and Iceland: N. Annandale.—Anthropological Notes on Kikuyu and Kamba: H. R. Tate.

THURSDAY, NOVEMBER 12.

MATHEMATICAL SOCIETY, at 5.30.—Annual General Meeting.—On Sequences of Sets of Intervals containing a Given Set of Points: W. H. Young.—On Spherical Curves: H. Hilton.—On the Weddle Quartic Surface: Dr. H. F. Baker.—A Formal Generalisation of Maclaurin's Theorem: Rev. F. H. Jackson.—Diffraction: W. H. Jackson.—A General Theorem concerning Absolutely Convergent Series: G. H. Hardy.—Note on Borgnet's Method of Dividing an Angle in an Arbitrary Ratio: Prof. J. D. Everett.—On an Expression of the Electromagnetic Field by Means of Two Scalar Potential Functions: E. T. Whittaker.—The Propagation of Wave-motion in an Isotropic Elastic Solid Medium: Prof. A. E. H. Love.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Inaugural Address by the President, Mr. Robert Kaye Gray.

FRIDAY, NOVEMBER 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 8.—(1) Means for Electrifying the Atmosphere on a Large Scale: (2) an Arrangement for driving Mercury Pumps: Sir Oliver J. Lodge.

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