THURSDAY, JULY 20, 1905.

ARCTIC METEOROLOGICAL OBSERVATIONS.

The Norwegian North Polar Expedition, 1893–1896; Scientific Results. Edited by Fridtjof Nansen. Vol. vi. Published by the Fridtjof Nansen Fund for the Advancement of Science. Pp. xiv+659; 20 plates. (London: Longmans, Green and Co., 1905.) Price 36*s.* net.

IT is a misfortune that meteorological results demand so many figures for their discussion, and so much space for their exhibition. Vol. vi. of the Norwegian North Polar Expedition, dealing with the climatology of the area through which the *Fram* drifted in its memorable voyage, 1893–6, is a most interesting book, but its size and appearance might repel any but the most ardent meteorologist. The discussion of the observations has been undertaken by Prof. Mohn, of Christiania, and the arrangement is a model of clearness and efficiency. Prof. Mohn superintended the whole meteorological equipment, suggested the plan of work to be carried out during the voyage, and arranged with Captain Scott-Hansen the general management of the meteorological work. We imagine Prof. Mohn must be gratified with the success of his arrangements, and the intelligent interest which the officers of the expedition have shown in the work. Notwithstanding the severity of the climate, there is hardly a gap in the series of observations. At sea, the observations were taken at intervals of four hours, but for the greater part of the time the readings were made every two hours, with a regularity that compels admiration. The result is that we have, with very considerable accuracy, the climatological elements of a region in the circumpolar Arctic Ocean, where the surface of the earth during the whole time was of a unique homogeneous nature, consisting of a level of frozen water, remote from continents and islands, and with an uninterrupted free horizon.

The wind, particularly with regard to direction and velocity, is the first element discussed. To obtain a sufficiently long series of observations for investigation, Prof. Mohn divides the interval into three groups, a dark season when the sun was below the horizon, a sunny season during which the sun was above the horizon for practically twenty-four hours, and the equinoctial months, during which there was regular day and night. The discussion shows that during the *dark* season the wind shifts generally against the sun. Only during four hours in the twenty-four does the wind veer with the sun, while in the *sunny* period the wind veers with the sun, backing about six hours, divided into periods of two hours each at three different periods of the day. In the equinoctial months the backing and veering are equal, the wind shifting with the sun during the night and morning, and against the sun from 10 a.m. to 10 p.m. The diurnal period of the wind's direction is a phenomenon which still awaits an explanation, and the different direction of the shift of the wind in the dark and in the sunny season seems to be of some importance for the solution of the problem. With reference to the velocity of the wind, it is shown to be greater when the sky is overcast than when it is clear. In the former case, the average velocity is 5·09 metres per second (11·4 miles per hour), and in clear weather only 3·54 metres per second (8 miles per hour). The greatest velocity recorded appears to be 40 miles an hour in February, 1896.

The discussions of the variations of temperature are very interesting, but the results drawn from them regarding the periods of the meteorological elements must of necessity be less trustworthy than if there had been a longer series of observations at disposal. It may therefore be premature to draw conclusions as to the connection between the different observed phenomena, and between those phenomena and their probable causes. The desirability of a longer period, and the character of the errors that can be introduced by the comparison of but few values, are shown very readily if we attempt to derive the month of lowest temperature from the figures given. The readings are centigrade, and show the mean temperature for each month:—

	January	February	March	April
	°	°	°	°
1894	−35·72	−35·57	−37·08	−21·31
1895	−33·71	−37·18	−35·01	−28·89
1896	−37·33	−34·73	−18·89	−18·15
Mean	−35·59	−35·83	−30·33	−22 78

The great variation of temperature in March, 1896, making it nearly equal to that of April, demonstrates the uncertainty that must accompany any attempt to derive mean values from short periods. But the deductions drawn directly from the observations, and supported as they are in many instances by similar observations made in Arctic latitudes, are not liable to the same uncertainty. Among these results may be placed the following:—Throughout the dark winter months, when the sky is clear, the lowest temperature occurs in the *day*, the highest during the night. Generally, in the other months, we have the ordinary diurnal period. With the sky overcast, the diurnal period, with a minimum in the early morning hours and maximum after noon, is very well developed in all the months except January.

"The most striking feature," says Prof. Mohn, "seems to me to be the distinct diurnal period of the ordinary march in the winter and dark season, with the sky overcast and relatively higher temperatures. The inverted period with clear sky in the dark season seems to be due to the diurnal period of the wind's direction. The dark-season period with its stronger, south-easterly winds, is hardly to be accounted for by the radiation from the sun or sky."

The forms of cloud, the relative humidity, and the amount and character of precipitation are discussed at full length, but do not present results of unusual importance. With regard to the latter, however, it is not altogether uninteresting to notice that the number of days in a year on which rain is probable is 49, while snow may be expected on 157 days, and some form of moisture will be collected on 180 days.

Hail fell on only 5 days throughout the whole period. Rain can fall only from May to October, and July has the greatest number of rainy days, also it is the month which gives rise to the greatest amount of fog. Very considerable care was taken to determine the temperature of the Polar ice, but, naturally, much difficulty was experienced in recovering the thermometers from the bore-holes, in which they might be frozen fast, while during the summer, the viscous ice would close round them, requiring the thermometers to be dug out. Neither is it easy to remove the sources of error from the observations, especially from the effects of brine contained in the ice, which was apt to fill the bottom of the holes even during the coldest season, whilst during the summer all the holes were filled with briny or saline water, the salinity of which decreased inversely as the temperature. This brine percolated from a different level to that in which the thermometer was placed. In the winter time the temperature of the ice increased from the surface downward, and therefore the brine at the bottom of the hole was probably of too low a temperature. On the other hand, in the summer time, the ice near the surface was warmer than that lower down, and the brine would be less saline, and consequently lighter in the upper layers than in the deeper, so that in the summer time the temperature reading would again be too low. The result drawn from the observations is that the surface of the ice, in all months with the single exception of June, is warmer than the air. The difference is greatest in December, amounting to 16° F. The surface of the ice, being covered, except during a short time in summer, with snow, is protected from cooling by radiation upwards, and receives heat from the underlying warmer layers. This, no doubt, is the main factor in the explanation, though other causes are suggested by Prof. Mohn.

The book contains also an account of the meteorological observations made during the sledge expedition to Franz Josef Land in 1895–6. From this account we can quote only one remark, which illustrates the determination of the leader of the expedition to secure an unbroken series of observations.

"We had no lantern for the reading of the thermometer, and I tried in vain to construct one, which would not burn more oil than we could afford to use. But our eyes of course became gradually trained to see in the dark, and even in mid-winter, with no moonlight, there was so much light reflected from the snow that the column of the darkly coloured Metaxylol was dimly visible, and also the figures of the thermometer scale, but not the division marks."

Dr. Nansen therefore apologises for the absence of the decimal reading, which is missing about the time of new moon. The interest of the book is necessarily largely centred in the fact that the crew of the *Fram* laboured so diligently and so well to overcome the difficulties that were imposed upon them by the situation in which they were placed. To go up to the crow's nest to take additional readings of the instruments in dark, wintry weather seems to have been a source of positive enjoyment to those who took part in these observations.

EUROPEAN AND ASIATIC GEESE.

The Geese of Europe and Asia. By Sergius Alpheraky. Pp. viii+198; 24 plates. (London: Rowland Ward, Ltd., 1905.) Price 3*l.* 3*s.* net.

AT the present day most works on ornithology of a general character are of little permanent value because the broad outlines of the northern fauna have already been adequately dealt with. What we want, and what we so seldom see, are complete life-histories of separate groups of birds, adequately illustrated and described by ornithologists who are both well acquainted with them in the field and are capable of summarising their labours in an accurate scientific account. To do this a very large series of birds must be collected, examined and digested, and this means years of travelling and study with little monetary reward as the result. Nevertheless, the works of such men are of great and permanent value, although their costly nature must ever be a constant drawback to the producer. No good form of colour printing is cheap, and as this is a *sine qua non* in works of this kind, the results can only pass into the hands of a public "fit but few."

The latest of these monographs is that of "The Geese of Europe and Asia," by Mr. S. Alpheraky, and the Russian naturalist is to be congratulated in giving us the first detailed account of this interesting and, we may say literally, confusing group of birds. It is an admirable treatise, full of research in field and museum, and the work of one who has carefully studied the subject from all points of view. There are twenty-four coloured plates by Mr. F. W. Frohawk, which are unfortunately only moderately successful. Twenty-one of these represent the different kinds of geese described by the author, and for the most part the lithography is weak and hard, and evidently does not do justice to the artist's careful work; whilst the three plates representing the bills of four various kinds are excellent, and will be of the greatest use both to sportsmen and naturalists in the determination of species. The frontispiece to the work represents the assemblage of white-fronted and red-breasted geese on a sandspit, and is from the brush of Dr. Sushkin. The idea of movement exhibiting the various attitudes into which these birds throw themselves is very fairly represented, but the technical work of painting and the drawing of some of the wings, as well as the general composition, leave much to be desired. It seems a thousand pities that chromolithography is a dying art, and that no firm in Europe is capable of turning out first-class work except W. Greve, of Berlin. For all we know, these drawings by Dr. Sushkin and Mr. Frohawk may have been soft and truthful representations of nature, but here we only see hard and black lines such as nature never shows.

Mr. Alpheraky is evidently a keen sportsman as well as a good naturalist, and he rightly holds a high view of the remarkable intelligence of this class of birds.

"Geese," he says, "afford one of the most difficult kinds of fowling. However cunning man may be, he

finds it extremely difficult to over-reach these wary birds, and in some places one may see them in hundreds of thousands for several weeks at a stretch without the possibility of securing a single specimen. This is especially the case in thickly populated regions, where the geese already know that danger may threaten them."

By this we know that the writer has toiled and suffered many disappointments. In certain British waters where for three seasons Brent geese were abundant we never obtained more than one good shot with the punt gun in a season. This was generally at the commencement, when the birds arrived in late October. After this date we could only "look" and "long." Other species are equally cunning.

The key to genera, species, and subspecies with which the author furnishes us is an excellent compilation, although he does not make clear the difference between species and subspecies. For instance, it appears that full specific rank is accorded to *Branta bernicla, Branta bernicla glaucogaster,* and *Branta bernicla nigricans,* the three varieties of the Brent goose which visit our shores. If those which are furnished with trinomial names are intended to be subspecies, and it is a very doubtful point if they deserve even this distinction, the author should say so in his table. Personally we do not think that there is any reason for separating these three well marked varieties. We have killed all three from one flock, and visitors to the northern breeding-places of these birds have also found all three, as well as intermediate forms, breeding together on the same ground. If such splitting were to come into general use, endless new subspecies must be created amongst the goldfinches, crows, skuas, &c., and many other birds we could mention the slight local peculiarities of which afford small points of distinction. Neither is the author consistent in this respect, for he refuses to recognise "two geographical races, much less two species," of grey geese living in eastern and western areas, and also the American and European forms of the white-fronted goose as distinct. With regard to the bean goose, Mr. Alpheraky recognises three distinct races, *A. segetum,* the common bean goose, *A. arvensis,* which possesses white feathers at the base of the bill, and the eastern bean goose, *A. serrirostris,* a bird described by Swinhoe, which is larger, distinguished by its more massive bill. Another species closely allied to the last named, namely, *A. mentalis,* but which was first described by Przewalski in 1876, seems to be of very doubtful rank, and may be only a large form of the Siberian bean goose.

In this excellent monograph the author gives us all we wish to know about the difference of sexes, gradual growth from nestling upwards, plumage variation, moulting, local names, chase, and colour of the soft parts, the latter, perhaps, the most important point of all in the determination of species. Many excellent outline figures of the bills are also given, so that the reader has no difficulty in recognising the differences of the various races even if he feels inclined, as he must sometimes do, to question the necessity of specific separation.

To the oologist, too, the table and descriptions to be found on pp. 185–190, furnished by Mr. G. F. Göbel, are of the most exact and comprehensive nature, and the book is one that every working naturalist or wild-fowler should possess in his library, for it is by far the best work that has as yet appeared on this interesting family of birds. J. G. M.

THE ELECTRIC FURNACE.

Le Four Électrique: son Origine, ses Transformations et ses Applications. By Adolphe Minet. 1er Fascicule. Pp. 76. (Paris: Librairie Scientifique, A. Hermann, 1905.) Price 5 francs.

THE application of electric heating to various metallurgical and other industries has of late been making very rapid progress. The time seems, therefore, to be well chosen for examining the various stages of development which the electric furnace has passed through.

M. Minet has taken great pains to collect together as much as possible of the available information, and has certainly succeeded in producing an interesting study. Chronologically, he divides his subject into three periods:—(1) laboratory furnaces (1808–1886); (2) industrial furnaces (1886–1890); (3) development of the industrial applications of the electric furnace from 1890 to the present day. The furnaces themselves are classified in nine groups, according to the function of the current and the method of its application. Any historical treatment of such a subject as this, which expects to be generally recognised as authoritative, demands very great care and judgment in its preparation. The present review certainly promises to be the most complete which the electric furnace has yet received.

It is, however, not so clear that the author has succeeded in accentuating just those developments which have been of the greatest influence to the general progress. There are no doubt difficulties in deciding between two such different claims as those of a brilliant invention and of a painstaking scientific investigation. The successful historian must, however, accurately estimate the value of each and decide on the relative merit according to the influence exerted by each upon subsequent development.

The classification of electric furnace processes is complicated, not only by the large number of separate cases which have to be considered, but more especially by the very different purposes for which the electric current is applied. In the first place it is necessary to distinguish between the purely electrothermal and the electrolytic functions of the current. The latter case embraces all such electrolytic methods as are carried out at a moderately high temperature. Here the electric current serves the double function of maintaining the necessary temperature and separating by electrolytic decomposition one or more of the constituents of the materials treated in the furnace.

During recent years the most extensive developments in electric furnace work have centred around the production and application of extremely high temperatures. The direct results of the scientific and

industrial discoveries along these lines have been very far-reaching. The success attending the investigation of various chemical reactions occurring at high temperatures has caused a marked revival in the interest taken in inorganic chemical research. This has been especially noticeable on the Continent, where, to a much greater extent than with us, the brilliant and rapid development of organic chemistry had led to a marked neglect of this older branch of the science.

The technical results are hardly less important. Several new and flourishing industries have been firmly established, some of them supplying hitherto unknown materials, which are proving themselves of great value in the arts. A still wider field of usefulness for the electric methods of heating seems now to be opening up. So far as the electrolytic and high temperature applications are concerned, there has been no direct competition with any existing technical processes. But now that the engineer and chemist have become familiar with the use of the electric furnace, there is a great tendency to extend its employment to work which requires temperatures already attainable by fuel heating if properly applied.

The possibility of generating the heat just where it is required, the ease of regulation of temperature, and the accompanying economy of heat losses, are the chief factors which tell in favour of electric heating under these conditions. The production of carbon bisulphide and the rapid development of the electrical manufacture of steel form excellent examples of what is being achieved technically in this direction; whilst even in the laboratory electrically heated tube and muffle furnaces are being largely employed in place of those heated by gas.

It is with the interesting details of such subjects as these that M. Minet is concerned. In view of the fact that this is but the first part of his complete work, it is impossible to do more than point out these main divisions of the subject. The author has drawn largely on the patent literature, and has copiously illustrated his descriptions with excellent diagrams and with the portraits of many of the leading investigators in this field of work. R. S. HUTTON.

OUR BOOK SHELF.

Elementary Microscopy. By F. Shillington Scales, F.R.M.S. Pp. xii + 179. (London: Baillière, Tindall and Cox, 1905.) Price 3*s.* net.

No instrument of research has such wide application in various branches of science and commerce as the microscope. It is, perhaps, scarcely too much to say that the principles underlying its construction and use are often disregarded by those who employ it, and sometimes totally ignored. Any treatise, therefore, on this subject, however unpretentious, is to be cordially welcomed, and the book now under notice is one that should meet a pressing need. It is written for beginners or for those who have used a microscope without troubling to understand it, and who consequently have never by any chance used it at its best.

The book commences with a description of various simple magnifiers and a descriptive diagram showing the essential parts of a microscope. These parts and the various accessories are in turn described more fully, as well as such appliances as are usually only found in the best instruments.

The most important points, such as substage condensers and fine adjustment construction, are treated somewhat fully. As to the choice of a microscope, reference is made to the fact that in medical schools and elementary science laboratories, where the cheaper form of instrument is usually provided, still no instruction is given as to its use, and that it is too often looked on as a mere magnifying glass. This is unquestionably true, and it is much to be deprecated that, in cases where the microscope performs such an important part in the work of instruction, no attention whatever is bestowed on its principles and use. The most interesting paragraphs in the book are, perhaps, those in which a comparison is made between the English and Continental stand. That the form of instrument now known as the English model is generally much superior in design and construction to the Continental stands is admitted and insisted on by the majority of those whose opinion is of value. At no period for many years past has the English microscope stand held such a high place, and it is greatly to be hoped that those who are in a position which gives them opportunities of recommending one form or another will recognise this. It is much to be regretted that, so far as objectives are concerned, the same cannot be said. Some English makers do undoubtedly produce lenses of good quality, but the average is not so high, and the finest objectives produced by Messrs. Zeiss are still unexcelled by those of any other makers. In the production of substage optical appliances, this country holds, as it has always done, a very high position, and it is difficult to understand why the same cannot be said of objectives. All the usual microscope accessories, as well as their method of use, are described as fully as the circumstances permit.

Chapters vi. and vii. are devoted to the practical optics of the microscope and its manipulation. This is the most important section of the book, and should be carefully studied. Perhaps more space might have been devoted to this, although it is quite easy to understand the difficulties that might arise in attempting anything like an exhaustive treatise on microscopic optics, debatable as the subject still is.

Altogether, the book is to be commended as a genuine attempt to treat the subject in a simple straightforward manner, so that the reader for whom it is primarily intended may grasp its meaning without difficulty. J. E. B.

The Practical Photographer's Annual, 1905. Edited by Rev. F. C. Lambert. Pp. xxxvi + 160. (London: Hodder and Stoughton, 1905.) Price 1*s.* 6*d.* net.

THESE pages, as we are told in the preface, are intended to serve no other purpose than to aid the memory of the busy photographer, and if possible to anticipate his daily needs.

An examination of the book shows that the editor has very successfully accomplished his task, and at the same time has not made the volume of such a bulky nature as to render its size inconvenient. It is true that more references might have been inserted, but such an addition would perhaps be questionable.

The four sections into which the book is divided include a dictionary of practical hints, dodges, &c.; a collection of tables, weights, measures, everyday formulæ, &c.; a directory of the photographic societies of Great Britain and Ireland; and finally, a set of indices to the first twelve numbers of the present (library) series of the *Practical Photographer.* Each

of these sections is arranged so far as possible alphabetically, so that ready reference is greatly facilitated. We thus have a concise and practical dictionary which should be found of very general utility.

Murray's Handbook of Travel-Talk. Nineteenth edition. Pp. 688. (London: Edward Stanford, 1905.) Price 3*s.* 6*d.*

THAT this little pocket-book meets the requirements of travellers is shown by the fact that this is the nineteenth edition that has been issued. The success of such a companion depends mainly on the arrangement and scope of the material which it contains, and on these points it seems difficult to suggest any improvements. This edition is divided into fourteen distinct but comprehensive groups of subjects, each one containing exclusively those words and phrases which naturally belong to each section. Great pains seem to have been taken to bring the information up to date, motoring, for example, having quite a large part devoted to it. The Britisher is equally helped in either French, German, or Italian, and such a *vade mecum* as is here presented should be found of great service to everyone who crosses the Channel.

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.*]

The Pressure of Radiation on a Clear Glass Vane.

IN NATURE, June 29, a letter from Mr. G. F. Hull appeared under the above title. In it the writer claims to have verified experimentally that the pressure upon a transparent vane is equal to the difference in the density of energy in front of and behind the vane, and reference is made to a difference of views regarding the theory of the pressure in a non-absorbing medium.

In regard to the latter point, the same result is obtained for the particular case in question whether the beam of light is considered simply as a carrier of momentum or whether the pressure due to radiation is regarded as arising from a mechanical bodily force integrated throughout the material medium in which the radiation is being propagated. Consider the latter theory for steady radiation consisting of plane polarised waves of simple harmonic period $2\pi/\kappa c$ propagated along Ox (see Larmor, *Phil. Mag.*, vol. vii., p. 578, 1904).

We have

$$\frac{\epsilon}{c}\frac{\partial Y}{\partial t}=-\frac{\partial \gamma}{\partial x};\quad -\frac{1}{c}\frac{\partial \gamma}{\partial t}=\frac{\partial Y}{\partial x};$$

where ϵ is complex if the medium is absorbing.

The mechanical force per unit volume is directed along Ox and is given by

$$F=\frac{1}{c}\gamma\ .\ (\text{true current})=-\frac{\partial}{\partial x}\left[\frac{\gamma^2}{8\pi}+\frac{1}{8\pi\kappa^2c^2}\left(\frac{\partial Y}{\partial t}\right)^2\right].$$

If all the interfaces are perpendicular to Ox, then γ and Y are continuous throughout, whether the medium vary continuously or abruptly; consequently the mean value of the mechanical force upon any slice of the medium can be expressed as a pressure per unit area upon each surface equal in amount to the mean value of $(\gamma^2+Y^2)/8\pi$ at the surface. Thus for any vane suspended in free æther (or air) the resultant mechanical force is equivalent to a pressure per unit area equal to the difference in energy-density in front of and behind the vane.

The apparent confusion arises from the usual statement that the mean value of γ^2+Y^2 can only vary along Ox in the case of an absorbing medium, but this is true only for progressive waves. For a transparent medium of refractive index n conveying progressive and regressive waves the mean value of $(\gamma^2+n^2Y^2)/8\pi$, or the mean value of the energy density, is constant; but the mean value of $(\gamma^2+Y^2)/8\pi$ varies harmonically along the direction of propagation. For a plate extending from $x=0$ to $x=h$, and subjected to a normally incident beam of mean energy-density I, it can easily be verified that the mean value of $(\gamma^2+Y^2)/8\pi$ within the plate is equal to

$$I\{(n^2+1)^2-(n^2-1)^2\cos 2n\kappa(h-x)\}/\{(n^2+1)^2\sin^2 n\kappa h+4n^2\cos^2 n\kappa h\};$$

consequently the resultant pressure is equal to

$$2I(n^2-1)^2\sin^2 n\kappa h/\{(n^2+1)^2\sin^2 n\kappa h+4n^2\cos^2 n\kappa h\},$$

or equal to $2J_0I$, where J_0 is the normal reflecting power of the plate for the radiation used.

T. H. HAVELOCK.

St. John's College, Cambridge, July 14.

An Omitted Safeguard.

IN two schemes set out in a recent issue of NATURE, one dealing with the requirements of Oxford and one with the organisation of applied science in London, there appears a noteworthy omission.

If the weather is proverbially the first topic of conversation of Englishmen, it is surely because of the influence it has on the well-being of the community.

Yet in both the schedules referred to no provision is made for research in meteorology. It is singular how tardy is the recognition of so important a factor in the national welfare. It is to meteorology that we constantly appeal for help. By its daily survey of rainfall it safeguards our water supply (now a very anxious problem, being outpaced by the ever-increasing demands of population, sanitation, railways, or manufacturing machinery). We turn to it for the comparison of localities and to study the effects of climate or fog upon health and disease, or to ascertain the relations of temperature, sunshine, or rainfall to the prosperity of the crops and fruit gardens. We look to the readings of the barometer to protect the safety of those working underground. Meteorology takes cognisance of the force of the wind for the protection of structures, or of storms likely to imperil the mariner on his voyage, and by the extension of, and the improved modes of, forecasting the weather is becoming each year of greater service to all.

Without encroaching further upon the limits of your space, sufficient has perhaps been said to show *primâ facie* grounds (while so much is proposed to be devoted to physics, geology, or botany) for the consideration of a possible chair in meteorology, or for in some other way repairing an omission of so serious a kind in the schemes lately propounded. The large amount devoted annually to meteorology in the United States shows the appreciation of its utility to all classes of the community by so practical a people as the Americans, and that the outlay is amply recouped by the value of the services rendered by it.

RICHARD BENTLEY.

The Hydrometer as a Seismometer.

IN NATURE of June 29 Mr. Bennett discusses the motion of a floating hydrometer when vertical motion is imparted to the (rigid) vessel containing the (incompressible) fluid in which the hydrometer floats. The solution offered is that the whole system moves precisely as a rigid body would move, and this solution clearly satisfies the very simple equations of motion in the problem considered. But is such motion stable? In general it is not, and I believe that Faraday studied experimentally the "crispations" of a free surface of liquid when small vertical oscillations were imparted to the containing vessel.

This hardly affects Mr. Bennett's conclusion that a floating hydrometer is an unsatisfactory form of seismometer, but perhaps it may explain the positive results which some observers have obtained; elastic yielding of vessel or hydrometer, although conceivably an adequate explanation, is not the only one open to us.

Cambridge. C. V. BURTON.

NOTES ON STONEHENGE.[1]

VIII.—ON THE DARTMOOR AVENUES (*Continued*).

MY inquiries began at Merrivale because there is a circle associated with the avenues a little to the south of the west end of the longest; and again nearly, or quite, south of this there is a fine menhir, possibly used to give a north-south line. There is another menhir given on the Ordnance map, azimuth N. 70° 30′ E., which, with hills 3° high, points out roughly the place of sunrise from the circle in May (April 29). Although this stone has been squared and initialed, I think I am justified in claiming it as an ancient monument. There is still another, azimuth N. 83° E., giving a line from the circle almost parallel to the avenue. I hope some local achæologist will examine it, for if ancient it will tell us whether the N. avenue or the circle was built first, a point of which it is difficult to overrate the importance, as it will show the strict relationship between the astronomy of the avenues and that of the circle, and we can now, I think, deal with the astronomical use of circles after the results obtained at Stonehenge, Stenness and the Hurlers as an accepted fact. With the above approximate values the date comes out 1750 B.C., the declination of the Pleiades being N. 6° 35′.

I now pass on from Merrivale as an example of those avenues the direction of which lies somewhere in the E.-W. direction. Others which I have not seen, given by Rowe, are at Assacombe, Drizzlecombe and Trowlesworthy; to these Mr. Worth adds Harter or Har Tor (or Black Tor).

The avenues which lie nearly N. and S. are more numerous. Rowe gives the following:—Fernworthy, Challacombe, Trowlesworthy, Stalldon Moor, Batterdon, Hook Lake, and Tristis Rock. Of these I have visited the first two, as well as one on Shovel Down not named by Rowe, and the next two I have studied on the 6-inch Ordnance map.

Fernworthy (lat. 50° 38′).—Here are two avenues, one with azimuth N. 15° 45′ E., hills 1° 15′. There is a sighting stone at the N. end. We appear to be dealing with Arcturus 1610 B.C. This is about the date of the erection of the N. avenue at Merrivale.

The second avenue has its sighting stone built into a wall at the south end. Looking south along the avenue, the conditions are azimuth S. 8° 42′ W., hills 3° 30′.

Both these avenues are aligned on points within, but *not* at the centre of, the circle.

Challacombe (lat. 50° 36′).—This is a case of a triple avenue, probably the remains of eight rows, in a depression between two hills, Challacombe Down and Warrington. There is no circle. The azimuth is 23° 37′ N.W. or S.E., according to direction. The northern end has been destroyed by an old stream work; there is no blocking stone to the south on either of the remaining avenues, but one large menhir terminates one row of stones. The others may have been removed. So it is probable that the alignment was to the north. If so, we are dealing with the setting of Arcturus, warning the summer solstice sunrise in 1860 B.C. To the S. the hills are 4° 48′, to the N. 4° 50′.

To this result some importance must be attached, first, because it brings us into presence of the cult of the solstitial year, secondly, because it shows us that the system most in vogue in Brittany was introduced in relation to that year. In Brittany, as I have before shown, the complicated alignments, there are 11 parallel rows at Le Ménac (p. 99) (there *were* 8 parallel rows at Challacombe), were set up to watch the May and August sunrises, and the solstitial alignments came afterwards. The Brittany May alignments, therefore, were probably used long before 1860 B.C., the date we have found for Challacombe, where not the sun rise, but the setting star which gave warning of it was observed.

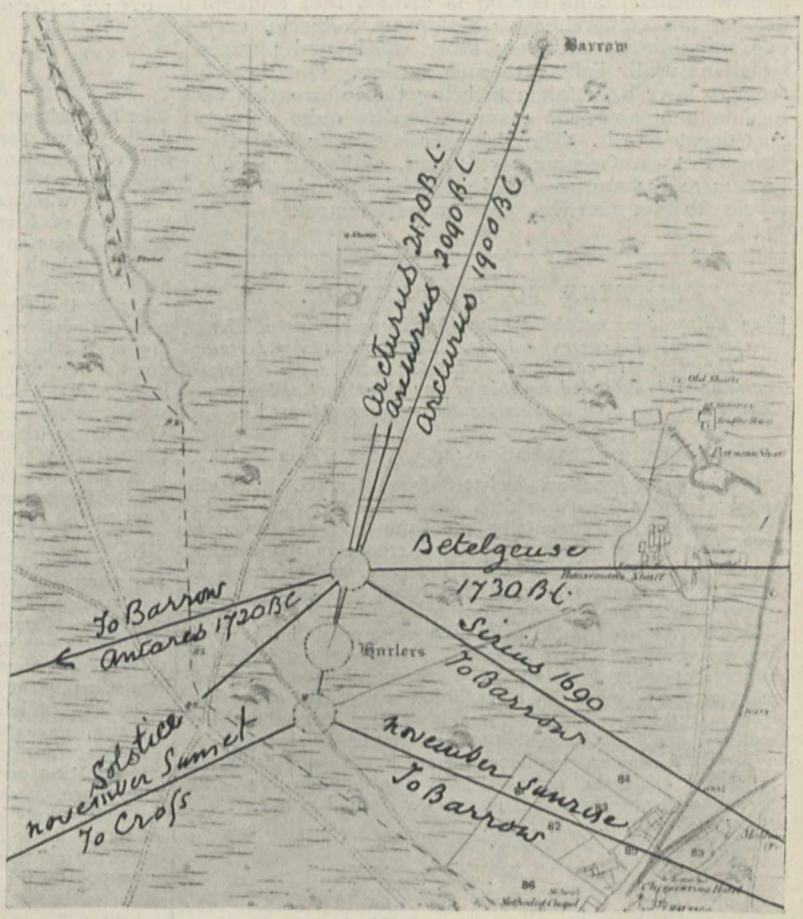


FIG. 20.—The sight-lines at the Hurlers, showing high northern azimuths among others. From the Ordnance map.

It is worth while to point out that at Challacombe, as elsewhere, the priest-astronomers so located their monuments that the nearly circumpolar stars which were so useful to them should rise over an horizon of some angular height. In this way the direction-lines would be useful for a longer period of time, for near the north point the change of azimuth with change in the declination of the star observed is very rapid.

Shovel Down, near Batworthy (lat. 50° 39′ 20″).—

[1] Continued from p. 248.

A group of five rows of stones, four double, one single, with two sets of azimuths.

One set gives us 22°, 25°, and 28°. They seem to be associated. I will call them A, B, and C. A is directed to the circle on Godleigh Common. Its ends are free. B is a single line of stones to the E. of the triple circle, about which more presently. It is not marked on the Ordnance map; its ends are also free. C has its south end blocked, I think in later times, by a kistvaen. The astronomical direction may be, therefore, either N.W. or S.E. We find, however, a probable use in the N.W. quadrant, as at Challacombe, Arcturus setting at daybreak as a warner of the summer solstice.

FIG. 21.—The sight-lines at Trowlesworthy, showing high northern azimuths among others. From the Ordnance map.

The height of hills is 46′; we have then :—

Az.	N. Dec.	Star	Date
	° ′ ″		
22 ...	36 19 14 ...	Arcturus ...	1210 B.C.
25 ...	35 23 20 ...	,, ...	1040 ,,
28 ...	34 19 30 ...	,, ...	850 ,,

Adjacent to A, B, C, is another avenue, which I will call D. Unlike the others, its northern end points 2° E. of N. Its southern end is blocked by a remarkable triple circle, the end of the avenue close to it being defined by two tall terminal stones. We are justified, then, in thinking that its orientation was towards the north; the height of the horizon I measured as 45′. It may have been an attempt to mark the N. point of the horizon.

The triple circle to which I have referred is not an ordinary circle. I believe it to be a later added, much embellished, cairn. According to Ormerod, the diameters are 26, 20, and 3 feet, and there are three stones at the centre.

All the above avenues are on the slope of the hill to the north. On the south slope we find the longest of all, as shown on the Ordnance map survey of 1885. There is a "long stone" in its centre, and at the southern end was formerly a cromlech, the "three boys." Part of this avenue, and two of the three "boys," have been taken to build a wall. The long stone remains, because it is a boundary stone!

The azimuth is 2° 30′ W. of north or E. of south. Looking N. from the long stone, the height of the horizon is 2° 30′. I think this avenue was an attempt to mark the S. point.

Trowlesworthy (lat. 50° 27′ 30″).—The remains here are most interesting. This is the only monument on Dartmoor in which I have so far traced any attempt to locate the sun's place at rising either for the May or solstitial year. But I will deal with the N.-S. avenue first, as it is this feature which associates it with Fernworthy and Challacombe, and in order that a comparison may be made I append a map showing the sight-lines at the Hurlers (Fig. 20).

As at Merrivale, the avenue has a decided "kink" or change of direction. The facts as gathered from the 6-inch map are as follows :—

	Az.	Hills	Dec.	Star	Date
		° ′	° ′ ″		
S. part o. Avenue	N. 7 E.	2 52	41 29 10	Arcturus	2130 B.C.
N. ,, ,,	N. 12 E.	2 52	41 6 20	,,	2080 B.C.

FIG. 22.—The remains of the eight rows of the Challacombe Avenue looking North of East, terminal menhir to the extreme right.

This date is very nearly that of the use of the S. circle at the Hurlers, and it is early for Dartmoor; but it is quite possible that local observations on an associated avenue a little to the west of the circle which terminates the N.-S. avenue will justify it. This is not far from parallel to that at Merrivale, but its northern azimuth is greater, so that if it turns out to have been aligned on the Pleiades its date will be some time before that of Merrivale, that is, before 1680 B.C. I can say nothing more about it until I have visited it.

The new features to which I have referred are two

tumuli which in all probability represent more recent additions to the original scheme of observation, as we have found at Stenness; and show that Trowlesworthy was for long one of the chief centres of worship on Dartmoor. Their azimuths are S. 64° E. and S. 49° W., dealing, therefore, with the May year sunrises in November and February and the solstitial sunset in December. It is probable that, as at the Hurlers, tumuli were used instead of stones not earlier than 1900 B.C.

Stalldon Moor (lat. 50° 27′ 45″) I have already incidentally referred to. The azimuth of the stone row as it leaves the circle, *not* from its centre as I read the 6-inch map, is N. 3° E.; as the azimuth gradually increases for a time, we may be dealing with Arcturus, but local observation is necessary.

The differences between the Cornish and Dartmoor monuments give much food for thought, and it is to be hoped that they will be carefully studied by future students of orientation, as so many questions are suggested. I will refer to some of them.

(1) Are the avenues, chiefly consisting of two rows of stones, a reflection of the sphinx avenues of Egypt? and, if so, how can the intensification of them on Dartmoor be explained?

(2) Was there a double worship going on in the avenues and the circles at the same time? if not, why were the former not aligned on the circles? On a dead level, of course, if the avenues were aligned on the centre of the circle towards the rising or setting of the sun or a star, the procession in the *via sacra* would block the view of those in the circle. We have the avenue at Stonehenge undoubtedly aligned on the centre of the circle, but there the naos was on an eminence, so that the procession in the avenue was always below the level of the horizon, and so did not block the view.

(3) Do all the cairns and cists in the avenues represent later additions, so late, indeed, that they may have been added after the avenues had ceased to be used for ceremonial purposes? The cairn at nearly the central point of the S. avenue at Merrivale was certainly not there as a part of the structure when the avenue was first used as a *via sacra* for observing the rising of the Pleiades. I have always held that these ancient temples, and even their attendant long and chambered barrows, were for the living and not for the dead, and this view has been strengthened by what I have observed on Dartmoor.

There was good reason for burials after the sacred nature of the spot had been established, and they may have taken place at any time since; the most probable time being after 1000 B.C. up to a date as recent as archæologists may consider probable.

Mr. Worth, whose long labours on the Dartmoor avenues give such importance to his opinions, objects to the astronomical use of those avenues because there are so many of them; he informs me that he knows of 50; I think this objection may be considered less valid if the avenues show that they were dedicated to different sacred uses at different times of the year. For instance, Challacombe is not a duplicate of Merrivale; one is solstitial, the other deals with the May year, and a complete examination of them—I have only worked on the fringe—may show other differences having the same bearing.

In favour of the astronomical view it must be borne in mind that the results obtained in Devon and Cornwall are remarkably similar, and the dates are roughly the same. Among the whole host of heaven from which objectors urge it is free for me to select any star I choose, at present only six stars have been considered, two of which were certainly used afterwards at Athens; and these six stars are shown by nothing more recondite than an inspection of a precessional globe to have been precisely the stars, the "morning stars," wanted by the priest-astronomers who wished to be prepared for the instant of sunrise at the critical points of the May or solstitial year.

NORMAN LOCKYER.

THE BOTANICAL CONGRESS AT VIENNA.

THE International Botanical Congress, held at Vienna on June 11–18, was an impressive demonstration of the activity of botany as a science, and of the enthusiasm of its adherents. Vienna is not the most central town for a meeting-place, but, nevertheless, more than six hundred botanists, men and women, representing nearly all the important, and many of the less important, botanical institutions of the world, met together there. As might have been expected, the central European element predominated, but there were a goodly number of Americans representing the southern and far western as well as the eastern States, while from the Far East came a deputation of two Chinese.

On the first day of the Congress, members were invited to be present at the opening of the Botanical Exhibition, which was held in the orangery of the historic Palace of Schönbrunn, just outside the town. The exhibition was an interesting one, and gave a good idea of the present position of botany from a teaching as well as from a more general point of view. There were fine series of diagrams, and coloured photographic lantern-slides of microscopic preparations, flowers, plant associations, and other objects; living cultures of Algæ; apparatus of all kinds; and some beautiful photographs of tropical vegetation in Brazil, Malaya, and elsewhere. A remarkable feature was the unique specimen of *Fockea capensis*, a member of the family Asclepiadaceæ, which, originally brought from the Cape, still remains the only known specimen. The plant has a hard, woody rhizome, as big as a child's head, from which in the rainy season numerous shoots are developed. It was figured and described by Jacquin in his "Fragmenta" at the beginning of the last century.

The Botanic Garden of Schönbrunn brings to mind, at any rate for the systematic botanist, the name of Jacquin, and some of his manuscript and original drawings were an important feature of the exhibition, and a subject of envious admiration of certain American botanists; we in London are proud to possess some of Jacquin's work, in the form of botanical letters to Sir Joseph Banks's librarian, Dryander, copiously illustrated with exquisitely delicate drawings. His herbarium, consisting largely of plants cultivated in the Vienna and Schönbrunn gardens, was bought by Banks, and is now in the general collection at the Natural History Museum. Nicolas Joseph Jacquin was professor of chemistry and botany at Vienna from 1768–96; later in the week of the congress a bust was unveiled in his honour in the Fest-Saale of the university. To quote from Prof. Wiesner's appreciation at the ceremony:—"His broad horizon and great powers of organisation were shown in the fact that, in the second half of the eighteenth century, no scientific, and especially no natural scientific, undertaking was started in which Jacquin did not take an important part. He embodied the ideal of the academic teacher." On the same occasion was also unveiled the bust of Jan Ingenhousz (1730–99), a Netherlander by birth, who spent the greater part of his working life in Vienna. Physician to the Empress Maria Theresa and the Emperor Joseph II., botanists know him best as one of the earliest workers in the sphere of plant

physiology; to quote the inscription beneath the bust, "Qua ratione plantae aluntur, primus conspexit."

On the evening of June 11, the members met in the Hall of the "Kaufmännscher Verein," when Prof. Julius Wiesner, the well-known head of the Institute of Plant Physiology, welcomed the botanists of the world to the home of Clusius, Jacquin and Unger; and the botanists renewed old friendships or made new ones over the Abendskarte and the inevitable *Bier*. At the official opening, in the great festal hall of the university, on Monday morning, greetings were given by the famous geologist and president of the Academy of Sciences, Prof. Eduard Suess, Prof. Wiesner, and others.

The general programme included lectures or papers by well-known men on topics with which their names have become associated. Thus Prof. Goebel discussed the subject of "Regeneration," and Dr. D. H. Scott gave an account of the present state of our knowledge of the Pteridosperms—the fern-like seed-plants of the Carboniferous flora—the illustration of which, by actual specimens, in the form of lantern-slides, was especially appreciated.

The development of the European flora since Tertiary times formed the subject of a group of papers. Prof. Engler, in stating the general problems, referred to the part played by man and his works, especially during the last century. He pleaded for the preservation of such plant-formations and plant-societies as throw a light on the past history of the European flora, citing as an example the National Park in the United States of North America. In the same connection Dr. Lauterbonn asked the help of the congress towards securing the preservation of part of the primitive forests of Bosnia, which, he stated, were in imminent danger of destruction. An interesting paper on the history of the development of the flora of the North German "Tief-land" was read by Prof. Weber. Covered by the sea since Oligocene times, this area became dry land during later Pliocene times, and the earliest vegetation of this period is remarkable for the occurrence of the vine, which is now generally regarded as an introduced plant in Central Europe. The plant-life of this area was, during the diluvial period, repeatedly crushed out of existence by land-ice, the intervening periods of vegetation being remarkable for the appearance of plants indicating a milder climate than do those composing the existing flora. Another subject, taken up by Dr. Molisch and Prof. Hueppe, of Prague, was the present state of our knowledge of CO_2-assimilation. Mention should also be made of a very fine series of photographic slides with which Dr. Hochreutiner, who has just returned from a prolonged stay in Buitenzorg, illustrated his account of a botanical institute in the tropics.

But for many of the members the most important work came in the afternoon, a time devoted by the majority to relaxation, which often took the form of excursions to places of botanical interest within easy reach of the town. Meanwhile the conference on botanical nomenclature sat in the lecture hall of the Botanic Gardens. At the entrance to the gardens is the former residence of the director, and we passed the window of the room in which Kerner wrote most of the well-known "Pflanzenleben." Kerner's successor, Prof. von Wettstein, is lodged in the new Botanical Institute—a large and well-arranged building. The arrangement of the gardens is mainly a geographical one—in one bed a collection of Himalayan plants, in another plants from the Cape, and so on. The result, though doubtless helpful to the student, illustrates the limitations to which such an arrangement is subject in any one climate. The work of the conference was to discuss the recommendations of the commission on nomenclature appointed by the International Congress of Paris in 1900. These were embodied in the *Texte synoptique*, a formidable quarto volume in which the *rapporteur général*, Dr. Briquet, had collated the numerous emendations and modifications of the original code of De Candolle, which during the last five years have been submitted by various societies, institutions, groups of botanists, and individuals. The numerous suggestions had previously been voted on seriatim by the members of the commission, and from the results of the voting certain recommendations were drawn up by Dr. Briquet for the consideration of the members of the conference, about a hundred and fifty of whom were present. The new American school was strongly represented by Dr. Britton, Mr. Coville, and others, while Dr. Robinson, of Harvard, represented the more moderate school which has worked on lines similar to those adopted in England. The Berlin school was present in force, and most of the Continental botanical societies and institutions were represented. As the president, Prof. Flahault, remarked, in answer to Dr. Otto Kuntze's protest against an "incompetent congress," it would be difficult to bring together a body of botanists more competent to discuss botanical nomenclature, and, one may add, more seemingly anxious to arrive at some solution of the various problems, and some agreement on the points at issue. From three to seven or eight o'clock each afternoon the members steadily worked through the *Texte*.

It was decided at the start to refer the question of cellular cryptogams and fossils to separate commissions, which should report to the next congress. The present conference, therefore, dealt only with flowering plants and vascular cryptogams. The results will in due course be arranged and published in English, French, and German. Brief reference may be made to the more important. The code of laws approved by the conference is based on that of De Candolle, and will consist of rules and recommendations, the difference between the two sets being expressed thus:—"A name contrary to a rule cannot be kept up; a name contrary to a recommendation is not a model for imitation but cannot be rejected." The most important result was the passing by an overwhelming majority of a list of generic names, which from long established usage are to be retained, though on the principle of priority they should be rejected. There was considerable discussion on the question as to the trivial name to be adopted when a plant is transferred from one genus to another, or from subspecific or varietal to specific rank. English, and a minority of American, botanists have followed the so-called "Kew rule" of adopting the first correct binominal, while the majority of American and most Continental botanists, in common with zoologists, adopt the earliest trivial name. On this point a compromise was effected as follows:—When a change of systematic position without change of rank occurs (such as the transference of a species from one genus to another), the earliest epithet is to be used; when the rank changes (as in the elevation of a variety to specific rank), the original epithet is not insisted on. The conference was also strongly opposed to any change in a name once given, though for various reasons it might be considered inappropriate or even misleading. A name is a name, and must stand.

An account of the congress would be incomplete without some reference to the nightly meetings for social intercourse which were arranged by the organising committee on typical Continental lines. Members will carry away very pleasant memories of the Rathhaus-Keller, the Prater, and the Brauerei garden out at Hutteldorf. For, after all, the great object of a

congress is the meeting together and getting to know one's fellow-workers; and an expression of thanks is due to the organising committee under the joint presidentship of Profs. Wiesner and von Wettstein, with Dr. Zahlbruckner as the energetic secretary, to Prof. Flahault, the firm and genial president of the conference on nomenclature, and finally to Dr. Briquet, whose name must always be associated with the latest attempt to solve the vexed question of plant-nomenclature.

At the final meeting, in response to an invitation from the Belgian Government voiced by Prof. Errera, Brussels was selected as the place of meeting for the third congress, which will be held in 1910.

A. B. RENDLE.

ENTRANCE EXAMINATION TO THE INDIAN FOREST SERVICE.

ON May 11 the Secretary of State for India issued the regulations for the forthcoming entrance examinations for the Indian Forest Service. Amongst the features of these regulations two are of considerable importance.

The age limit is raised to twenty-one years on January 1 preceding the examination, so that the average B.A. who graduates usually between twenty-one and twenty-two may compete. The second point of interest is the schedule of the subjects in which he is to be examined.

According to the regulations given in the East India (Forest Service) Blue-book, Cd. 2523, the subjects in which the candidates are to be tested are four—chemistry, physics, botany, and zoology—and the schedules imply that the knowledge which the candidate is expected to exhibit is of a very limited description. Speaking roughly, the examination will be harder than the preliminary scientific examination which every candidate for a medical degree is obliged to take, but not much harder. Medical students generally pass their preliminary scientific examination during their first year, though there are cases in which they pass it while still at school. The Indian forestry students may pass their entrance examination in their third or fourth year. The Blue-book stated that each candidate must qualify in all four subjects, but for some reason or another—and probably because the entry under the new regulations is small—the Secretary of State for India has now still further lightened a very elementary examination, and is now advertising in our columns that zoology is optional. Thus men, who may be graduates, will be admitted into a great public service on an examination which comprises but three out of the ordinary four subjects which candidates for medical degrees normally pass in their first year, and judging by the schedules the amount in each subject to be "got up" is little more than in the preliminary examination for an M.B. degree.

When we remember that in the Indian Civil Service examination the standard of the subjects is that of an honours examination, and that a candidate takes not three subjects, but eight, nine, ten, or more, it is obvious that the Secretary of State is trying to recruit the forest officers from men of a markedly inferior intellectual range, and the strictures which were passed by Sir George King on the Indian foresters at the Dover meeting of the British Association will probably need repeating a few years hence.

The schedules are well adapted for an elementary pass or plough examination, but are ill adapted for a competitive examination. It will be very difficult, if not impossible, to select the best candidates competing in an examination carried on on these lines.

NOTES.

AN important step in the direction of the adoption by this country of a decimal system of weights and measures has been taken by the Board of Trade. In reply to a resolution sent to the Board of Trade by the secretary of the Association of Chambers of Commerce, in which the Board was asked to authorise weights of 20 lb., 10 lb., and 5 lb. as aliquot parts of the cental, Lord Salisbury has written:—"With reference to your letter of March 14 last, in which you suggest that new denominations of weights of 20 lb., 10 lb., and 5 lb. should be legalised for use in trade, the Board of Trade have given careful consideration to the representations which have been made, and they are prepared to assent to the application. Steps will, therefore, be taken for the preparation of standards of the same octagonal form as the present 50 lb. weight." The chambers consider that this concession will save time, labour, and expense, as the 50 lb. weight has done already.

COMMANDER PEARY sailed on Sunday last to make a further attempt to reach the North Pole. Before leaving, he communicated various particulars respecting his expedition to Reuter's Agency. His plan is based upon the Smith Sound, or "American" route to the Pole, and his object is to force his ship to a base within 500 miles of the Pole itself, and then to sledge across the Polar pack. The Arctic ship *Roosevelt*, which has been specially built for this expedition, has been constructed so as to withstand the heavy ice pressure, and is so shaped that the pressure of the ice pack will have the effect of raising the vessel out of the water. The ship will carry a wireless telegraphic outfit, which, with one or two relay stations in Greenland, will keep her in communication with the permanent telegraph station at Chateau Bay, Labrador, and thence by existing lines with New York. By the same means communication with the expedition will be possible, at least for a portion of the distance, when in February next the sledge party leaves the *Roosevelt* for the northern dash. The ship will carry two years' supplies. With regard to the route to be followed, it is intended to establish a permanent sub-base at Cape Sabine, on the west coast of Smith's Sound, and, after securing the services of the necessary Eskimos, to force the vessel through Kane Basin and Kennedy and Robeson Channels to the northern coast of Grant Land or of Greenland, if the conditions should compel it, and there winter within 500 miles of the Pole. From these winter quarters a start north over the Polar pack will be made in February. The explorers will have available a probable period of five months in which to traverse the distance between their vessel and the Pole. In the event of the failure of the *Roosevelt* to force Kennedy and Robeson Channels during the first summer the dash for the Pole will have to be postponed until February, 1907.

THE seventy-third annual meeting of the British Medical Association will take place at Leicester from July 24 to 28. Addresses in medicine and surgery will be delivered respectively by Dr. H. Maudsley and Mr. C. J. Bond, and, following the precedent of last year, a popular lecture will be given (on July 28) by Prof. Wm. Stirling, who will take as his subject the phenomena of fatigue and repose.

THE Geologists' Association announces an excursion to Central Wales extending from July 24 to 29. The headquarters are to be at Llandrindod Wells.

THE first International Congress of Physiotherapy will be held at Liége from August 12 to 15 next. The questions proposed for discussion are, says the *British Medical*

Journal:—(1) the specific indications of the several physiotherapeutic agents; (2) description of the apparatus and technique required in each case; (3) (*a*) how university teaching on physiotherapy is given at the present time in the various countries where instruction is given on the subject; (*b*) how such instruction should be given in medical faculties; (4) the indication of suitable means for the vigorous repression of quackery and the abuses caused by "healers" who pretend to treat by physiotherapeutic procedures. Papers should be sent to Dr. Gunzburg, 7 Rue des Escrimeurs, Antwerp.

THE full programme of the International Congress on Tuberculosis (meeting in Paris from October 2 to 7 next) has now been issued, and is summarised in the *British Medical Journal*. In the section of medical pathology, presided over by Prof. Bouchard, the following subjects are proposed for discussion:—(1) treatment of lupus by the new methods; (2) early diagnosis of tuberculosis by the new methods. In the section of surgical pathology, presided over by Prof. Lannelongue, the following questions will be considered:—(1) comparative study of different forms of tuberculosis; (2) ileo-cæcal tuberculosis; (3) surgical interventions in tuberculosis of the meninges and encephalon; (4) tuberculosis and traumatism. In the section of protection and assistance of childhood, presided over by Prof. Grancher, the questions to be discussed are:—(1) family protection; (2) protection in the school; (3) seaside sanatoriums; (4) school mutual aid societies and the part played by them in the prevention of tuberculosis. In the section of protection and assistance of adults, and social hygiene, attention will be directed to:—(1) etiological factors of tuberculosis, economic conditions in the social etiology of tuberculosis; (2) assurance and friendly societies in the prevention of tuberculosis; (3) the part of dispensaries and sanatoriums in the struggle against tuberculosis; (4) sanitation and healthiness of the dwelling; (5) hygiene of tuberculous persons in factories, workshops, places of business, army and navy; (6) disinfection of the dwelling of the subject of tuberculosis (administrative regulations and practical measures). In connection with the congress there will be an exposition arranged in the four following departments:—(1) scientific: a museum of microbiology, experimental, medical, surgical, and veterinary tuberculosis; (2) social: ravages caused by tuberculosis, prevention, assistance; (3) historical: tuberculosis in various ages, in art and in history; (4) industrial: prevention, alimentation, private dwellings, public dwellings (schools, barracks, &c.); travel (railway carriages, ships, hotels); assistance (hospitals, dispensaries, sanatoriums).

THE Museums Association held its annual meeting last week at Worcester; the proceedings opened on Tuesday, and on Thursday the president (Lord Windsor) delivered his address.

A TABLET to the memory of Sir Humphry Davy was unveiled by Mr. Marconi at Clifton, Bristol, on Friday last. The tablet is to be placed on 3 Rodney Place, Clifton, in which house Sir Humphry Davy lived for a time.

PROF. GUIDO CORA has been elected a member of the Pontificia Accademia Romana dei Nuovi Lincei of Rome.

WE regret to see the announcement of the death, on June 29, at Washington, of Mr. George H. Eldridge, one of the geologists on the staff of the United States Geological Survey. He contributed many valuable papers to geological science, dealing with coal, petroleum, asphalt, and bituminous rock deposits.

THE death occurred on July 10 of Sir Peter Nicol Russell, who, by his gift of 100,000*l*., founded the school of engineering of Sydney University. He was eighty-nine years of age.

THE death is announced of Mr. Charles Moore, director of the Sydney Botanic Gardens and of the Government Domain and Plantations. He had attained the age of eighty-six years.

A MEETING of the central committee for physical education in Italy took place recently in Rome under the presidency of Mr. L. Lucchini. Among those present were the Italian Under-Secretary of State for Instruction, and delegates of the Ministries of Instruction, War and Marine; there were also representatives of the municipality of Rome, the gymnastic association, and the Alpine and touring clubs of the city. The main object of the committee is to stimulate interest in the physical education of the Italian people, which, it is contended, has hitherto been much neglected.

A REUTER telegram from Penang states that the Chinese Consul of that place has offered to build and equip a Pasteur institute for the Straits Settlements and the neighbouring regions. The action has been prompted by the recent outbreak of rabies in Penang, resulting up to the present in four deaths.

BOTH Messrs. Siemens and Halske, of Berlin, and the Marconi Company are in communication with the Althing, the proposal being to establish communication by wireless telegraphy between Iceland and the Continent and internally in the island. According to a Reuter telegram, the Berlin firm offers to provide the installation for about 36,666*l*., and to guarantee the efficient working of the system.

IN connection with an exhibition to be held next year at Milan, there is to be a competition of appliances designed to safeguard against accidents, and the following prizes will be offered:—a gold medal and 320*l*. for a new device which will suppress the danger to life coming from a contact formed between the primary and secondary circuits of an electric transformer; a gold medal and 40*l*. for a crane or hoist provided with a simple and practical device preventing the rotation of the cranks on the descent of the load; a gold medal and 20*l*. for a simple, strong and effective apparatus for automatically stopping cars which are moving upon an inclined plane in case the traction cable should break; a gold medal for a practical device for exhausting and collecting the dust formed during the sorting and cutting of rags by hand; a gold medal for an apparatus for localised exhaust and successive elimination of dust produced during the cardage of flax, tow, hemp, jute, &c.; and a gold medal for an effective device to prevent the diffusion of dust in places where the preparation of lime and cement is carried on. The competition is to be under the auspices of the Association of Italian Industries, and names of competitors must be sent to the secretary at Foro Bonaparte 61, Milan, before the end of the present month.

A NUMBER of prizes ranging in value from 10,000 marks to 750 marks are offered by the Internationales Arbeitsamt, Basel, Switzerland, for essays on means of combating lead poisoning. The essays must contain proposals for the elimination of the danger to which no objection can be made on technical, hygienic, or economic grounds. In proposing new apparatus or alterations in process, particulars must be given as to the cost and saving involved in such proposals. It is desired that proposals should be

made for the improvement of existing laws upon the subject in all countries, and attention directed to the alterations which would be necessary for putting the suggestions into effect. The papers, which may be in English, French, or German, must reach the Internationales Arbeitsamt by the end of the present year.

WE learn from *La Nature* that the annual prize of the French Society of Civil Engineers has been awarded for 1905 to two men of science—to M. Alphonse Tellier for his researches on motor navigation, and more particularly for his memoir on "Les canots automobiles à grand vitesse," and to M. J. Rey for his memoir on "Les turbines à vapeur en général, et plus particulièrement sur les turbines du système Rateau et leurs applications." The Alphonse Couvreux prize has been awarded to M. F. Arnodin for his work on trans-shipping bridges. The 1905 Giffard prize will be postponed until 1908.

AT the annual distribution of prizes at Guy's Hospital Medical School last week the new Gordon Museum of Anatomy and Pathology was open to inspection. The museum is, it will be remembered, the gift of Mr. Robert Gordon, who at the distribution of prizes was presented by the governors and medical staff with a replica in silver of the statue of Thomas Guy in the hospital square, together with a bound memorial volume signed by the Prince of Wales and all the members of the governing body. The specimens in the museum now number upwards of 12,000, and their re-arrangement and classification will, it is hoped, be completed within the next few months.

PROF. A. PENCK contributes an account of the progress made in the organisation and execution of the map of the world on a scale of 1 : 1,000,000 to the *Zeitschrift* of the Berlin Gesellschaft für Erdkunde. It appears that up to March of this year the four chief organisations—French, German, British, and Indian—had completed 69 sheets out of 437 planned. A sketch map shows the sheets completed and in preparation.

THE Canadian Department of Marine and Fisheries has recently published a valuable paper by Dr. W. Bell Dawson on the currents at the entrance of the Bay of Fundy and on the steamship routes in its approaches off southern Nova Scotia. The results are based on observations made by the tidal and current survey in 1904, and show that the movements of water are chiefly tidal in character, there being no marked general movement in any one direction.

THE report on the census of the Philippine Islands, taken in March and April, 1902, has recently been issued. It consists of four volumes, comprising three thousand pages, and is freely illustrated with statistical maps and diagrams. An excellent summary of this report, which includes papers on the climate and resources of the islands besides other statistical information, appears in the Bulletin of the American Geographical Society for May, from the pen of Mr. Henry Gannett.

ALMOST from time immemorial, in a zoological sense, the South American electric eel has been regarded as the type (and sole representative) of the genus Gymnotus, as *G. electricus*, and it is thus named in the "Cambridge Natural History." In a paper on the Gymnotidæ published in the *Proceedings of the Washington Academy* (vol. vii., p. 159), Messrs. Eigenmann and Ward revive, however, an old proposal that the *Gymnotus carapus* of Linnæus should be taken as the type form, and the electric eel referred to a genus apart. They even go so far as to exclude the latter species from the Gymnotidæ altogether—a proceeding which forcibly recalls the well-known saying with regard to the play of *Hamlet*. This is, indeed, in our opinion, one of those cases in which, whatever may be original rights in the matter, everything is to be gained by adhering to established practice. In the text the authors define the different genera they include in the Gymnotidæ, describing some of these for the first time.

IN another issue of the serial last quoted (*Proc. Washington Acad.*, vol. vii., pp. 27–157) Mr. W. F. Allen records observations on the blood-vascular system in the fishes of the group Loricati, that is to say, those constituting the families Scorpænidæ, Anoplopomatidæ, Hexagrammidæ, and Cottidæ. In view of the circumstance that it is at present impossible to determine whether certain features in the circulatory system of these fishes are primary or secondary, no inductions are drawn from the observations with regard to the classification of the group. Nevertheless, it is suggested that the blood-vascular system may eventually prove to have a value in the classification of families and genera, although it would be useless in the case of species.

WE have received a copy of a circular issued by the Concilium Bibliographicum of Zürich in regard to a proposed physiological bibliography. A card catalogue of literature of this description was commenced on July 1, in cooperation with the *Zentralblatt für Physiologie*, and the support of all interested in the matter is requested. To aid the scheme a committee was appointed at the sixth International Physiological Congress held at Brussels, the names of the members of which are given in the circular.

THE annual report of the Selborne Society, published in the July number of *Nature Notes*, points to a flourishing condition of that body, although more members are required if its work is to be still further developed. Mr. W. M. Webb has accepted the office of hon. treasurer, *vice* Mr. R. M. Wattson, retired. Special attention is directed in the report to the preservation and protection of places of antiquarian interest or natural beauty in the neighbourhood of London. Among these, the proceedings of the London County Council in attempting to "beautify" Golder's Hill are criticised. "What is required is to leave the place more alone, and so to give nature a chance in it. Efforts to make things appear rustic almost invariably end by making them look artificial, and this is especially the case at Golder's Hill."

IN our notice of Sir C. Elliot's description of the nudibranchs of the Scottish Antarctic Expedition the number of species should have been given as six in place of two. Four of these species are new, two, as stated in the original notice, forming the types of as many new genera.

IN a brief note published in the *Atti dei Lincei* for June 3 Prof. Cuboni notifies the appearance in the island of Sardinia, in the district of Sassari, of a peculiar and little known disease of the olive. This disease, which is known in Italian as "Brusca," entirely despoils the plant of its leaves and fruit, and is associated with the fungus *Stictis Panizzei*. This fungus has an altogether remarkable history. It was first observed and studied by De Notaris near San Remo in 1842, and twenty years later it was found at Spezia. Between the years 1863 and 1899 no mention is to be found of its occurrence, but it suddenly reappeared in 1899 in the neighbourhood of Lecce, causing great damage to the olives of the district. The study of a fungus for which apparently very special conditions of growth are necessary seems likely to give results of particular interest in vegetable pathology.

IN the *Proceedings of the American Academy of Arts and Sciences* (vol. xl., No. 23) Mr. Gilbert N. Lewis makes a study of the auto-catalytic decomposition of silver oxide under the influence of heat. It is shown that the velocity of decomposition of the oxide at a constant temperature increases as the action proceeds, and, after passing through a maximum, falls gradually to zero. The phenomenon is due to the catalytic action of the metallic silver produced, the action proceeding very regularly according to an equation representing the simplest case of auto-catalysis. During the decomposition, definite temperatures between 327° C. and 353° C. were maintained by means of a thermostat containing a fused mixture of sodium and potassium nitrates. The purity and method of preparation of the silver oxide have a very great influence on the velocity of decomposition. The theory is advanced that the influence of the silver is directed in modifying the velocity of the reversible change $O_2 \rightleftarrows 2O$.

WE have received from the Medical Supply Association a pamphlet dealing with the Gaiffe auto-motor mercury-jet interrupter and its application in producing high-frequency currents. The interrupter is a simplified form of the mercury-jet turbine type, and is so arranged that the interrupter cuts off the current for both the motor and coil. The interrupter thus works automatically, and the use of an independent motor is dispensed with. The arrangement is simple, portable, and less expensive than any other form of turbine interrupter.

SOME singular results obtained during the investigation of the activity of radiotellurium (polonium) are recorded by Prof. B. Walter in a paper in the *Annalen der Physik* (vol. xvii. p. 367). It would appear that the α rays of radiotellurium are capable of producing a species of fluorescence in the air through which they pass in such a manner that a radiation is set up having a pronounced photochemical action and similar properties to the ultra-violet portion of the spectrum lying between λ 350 and λ 290. The radiation is completely absorbed by aluminium foil 0·0091 mm. in thickness, but readily passes through a glass plate 0·15 mm. thick. In passing through a vacuum, however, the α rays of radiotellurium do not give rise to a radiation, whilst in gases other than air or nitrogen the effect is only very slight. The new radiation seems, indeed, to be produced only by nitrogen, the effect with this gas being thirty to fifty times as great as with hydrogen or oxygen. This fact is of unusual significance as tending to throw light on some of the peculiar properties of the nitrogen atom.

THE part played by the copper salt in Deacon's process of preparing chlorine from hydrogen chloride is still uncertain, although many hypotheses have been put forward to explain it. That which has been most generally adopted assumes that cupric chloride is decomposed into cuprous chloride and chlorine, and that the cuprous chloride then undergoes re-conversion into the cupric salt under the influence of oxygen and hydrogen chloride, copper oxychloride being formed as an intermediate product. In an experimental investigation of the process published by M. G. Levi and V. Bettoni in the *Gazzetta* (vol. xxxv. p. 320) it is shown, however, that neither cuprous chloride nor the oxychloride can be used with a successful result in Deacon's process, and that the oxychloride is not convertible by hydrogen chloride into cupric chloride under the conditions in which chlorine is ordinarily formed. The hypothesis of an intermediate product is rejected and a purely catalytic action assumed, according to which the velocity of the change $2HCl + \frac{O_2}{2} = H_2O + Cl_2$ is greatly influenced by the presence of the copper salt. The catalyst is supposed to help the action by its tendency to combine with the water produced in the change.

AN interesting article by M. Albert de Romeu on the industry of the abrasive materials such as corundum, emery, and carborundum appears in the *Revue générale des Sciences* for June 15.

No. 6 of vol. ii. of *Le Radium* contains a useful article by M. G. H. Niewenglowski on the development of photographic plates which have been subjected to the action of radio-active substances.

UNDER the title "From the Borderland between Crystallography and Chemistry," an address delivered before the Science Club of the University of Wisconsin by Prof. Victor Goldschmidt, of Heidelberg, is printed in the Bulletin of the university (No. 108). Attention is directed to the interesting results that have been obtained by studying the etch-figures and dissolution bodies of crystals and their significance in forming a mechanical theory of dissolution.

THE sugar and cacao industries in the West Indies formed the principal subjects of discussion at the agricultural conference held in Trinidad in January; the proceedings in connection with these matters are reported in the first number of vol. vi. of the *West Indian Bulletin*. The condition of the sugar industry in Trinidad evoked considerable discussion, the subject at issue being the small amount of cane produced by the farmers per acre. Dr. F. Watts gave some account of the establishment of a well equipped central sugar factory in Antigua. The question of shade trees for cacao was debated, but evidence was not forthcoming to show why the shade that is considered necessary in Trinidad proves to be injurious in Grenada. Mr. L. Lewton-Brain and Mr. H. A. Ballou presented papers on the fungoid diseases and insect pests of sugar canes and cacao trees.

THE route followed by Mr. B. Fedtschenko on his botanical journey through the Pamirs, as described in the *Bulletin du Jardin impérial botanique de St. Petersbourg*, vol. v., lay along the river Pianj where it runs parallel and a little to the north of the boundaries of Kashmir and Chitral; thence proceeding north the explorer returned to Osch, in Turkestan. *Anaphalis seravschanica* and *Ferula gigantea* were the most remarkable plants obtained on these stages of the journey. A malformation of the flowers of *Tragopogon pratensii* showing pedicelled florets and phyllody of the calyx is described by Mr. Dmitriew.

MR. P. H. ROLFS presented the first results of his investigations into the diseases of citrous plants and fruits caused by the fungus *Colletotrichum gloeosporioides* in Bulletin No. 52 of the Bureau of Plant Industry, U.S.A. It is there shown that wither-tip, leaf-spot, anthracnose, and fruit canker are all due to the same fungus. Wither-tip and leaf-spot can be controlled by pruning followed by spraying with Bordeaux mixture, while spraying with ammoniacal solution of copper carbonate is efficacious against disease of the fruit. A later article in the *Florida Agriculturist* (March) deals with the appearance of these diseases on grape fruit.

THE Jamaica *Bulletin of Agriculture* (May) contains an article by Mr. Fawcett on Raiffeisen agricultural banks, prompted by conditions which suggest that such a system could be advantageously introduced into the island. The

hurricane in August, 1903, caused such widespread devastation that the Government of Jamaica deemed it advisable to make temporary loans, thus assuming liabilities which would have been unnecessary had a cooperative system of borrowing money been in existence. In the same volume diverse opinions are expressed on the question of rotation of crops in connection with cotton cultivation in Jamaica. Cotton every third or fifth year, with intermediate crops of cassava or yams, maize, and legumes, is suggested; these rotations preclude the possibility of securing a second crop of cotton.

AN instructive discussion of the law of biogenesis that "ontogeny repeats phylogeny" will be found in the paper forming Publication No. 30 of the Carnegie Institution of Washington, in which Mr. G. H. Shull bases his arguments upon a study of the leaf variation in *Sium cicutaefolium*. In the seedlings the first leaf after the cotyledons is extremely variable, the second leaf is generally simpler, but subsequently a pinnate leaf is developed which passes into a much dissected type. Well marked but less regular variations occur at periods of rejuvenescence and on the inflorescence. Mr. Shull concludes that ontogenetic leaf-characters afford no satisfactory clue to phylogeny, but that differentiation is due to the changed structure of the protoplasm.

"PERCEPTION IN PLANTS" is the title of an article in *Naturwissenschaftliche Wochenschrift* (June), in which Prof. L. Kny discourses on *tropisms* and movements produced by other causes. Under heliotropism Prof. Kny mentions the views recently advanced by Haberlandt that the epidermal cells of a leaf are to be regarded as the perceptive region, and that their shape and contents enable them to act like a lens in collecting the rays of light. A photograph representing a surface view of the leaf of *Anthurium Maximiliani* tends to support this hypothesis, and also the observation that such a leaf, when submerged in water, fails to react.

WE have received from Messrs. Flatters and Garnett, Ltd., 48 Deansgate, Manchester, slides exhibiting the structure of the root in the male fern and onion. They are remarkably good, and slides such as these will be of value to collections used for teaching purposes. The preparation of the material has been carefully attended to, and the details of cell and nuclear division are well shown.

VOL. i. of the report of the Royal Commission on London Traffic (appointed in February, 1903, to inquire into and report upon the means of locomotion and transport in London) has just been issued. It will be followed by seven more volumes, dealing respectively with the following subjects:—vol. ii., minutes of evidence taken, with index and digest; vol. iii., appendices to the evidence taken, and index; vol. iv., appendices to the report and index; vol. v., maps and diagrams furnished to or prepared by the Royal Commission; vol. vi., maps and diagrams furnished to the Royal Commission; vol. vii., report of the advisory board of engineers, and index; vol. viii., appendix to same.

THE June issue of the *Bulletin de la Société d'Encouragement pour l'Industrie nationale* has been received. It contains a report, presented by M. A. Moreau on behalf of the Constructions and Fine Arts Committee, on "Ruberoid"; an account of a scheme for the extension of the international system to screws with a diameter of less than 6 mm.; and a paper by M. Maurice Alfassa on the organisation of labour in the United States. The economic notes, those on chemistry, and those on the mechanical sciences are as usual suggestive and interesting.

THE *National Geographic Magazine* for July contains many interesting communications, among which are an address delivered to the National Geographic Society by Prof. E. A. Grosvenor on the "Evolution of Russian Government," an article entitled "The Purple Veil," the "veil" being the product of the *Lophius piscatorius*, known popularly as the "goose-fish," the "all-mouth," and the "angler," and a short paper (superbly illustrated) on "The Victoria Falls." The National Geographic Society, of which the magazine is the organ, is now housed under a deed of trust in the Hubbard Memorial Hall at Washington, the building being "in trust for the sole use and benefit of the said National Geographic Society so long, and for and during such period of time, as said Society shall continue its corporate existence under its present charter, and shall continue to use and occupy the said land and premises and the improvements thereon for the objects and purposes set forth in its certificate of incorporation."

THE July number of the *Popular Science Monthly* contains an illustrated article on the University of Virginia, which, founded eighty years ago by Thomas Jefferson, has now as its first president Dr. E. A. Alderman. The illustrations contained in the paper show that the university possesses many buildings devoted to the teaching of science. Another article deals with Prof. C. A. Young, who, after more than fifty years' devotion to science, recently retired from the professorship of astronomy at Princeton University and the directorship of the Halstead Observatory.

IN view of the approaching meeting of the British Association in South Africa, a special number of *Knowledge and Illustrated Scientific News* has been issued. It contains portraits of the president and of the presidents of sections, a programme of the proceedings, with a route map, and many articles dealing with South Africa and likely, therefore, to be of interest to those taking part in the association's meeting.

MR. MURRAY announces "Noteworthy Families (Science)," by Mr. Francis Galton, F.R.S., and Mr. E. S. Galton. The work will form vol. i. of the publications of the Eugenics Record Office of the University of London. Another book to be brought out by Mr. Murray is "The Book of the Rothamsted Experiments," by Mr. A. D. Hall, the director of the Rothamsted Experiment Station.

MESSRS. JOHN WHELDON AND CO., of Great Queen Street, Lincoln's Inn Fields, have sent us part i. of their new botanical catalogue dealing with Cryptogamia, and containing some 700 titles of books and papers.

MESSRS. J. H. DALLMEYER, LTD., have just issued their new list of photographic lenses, cameras, telescopes, prismatic binoculars, &c.

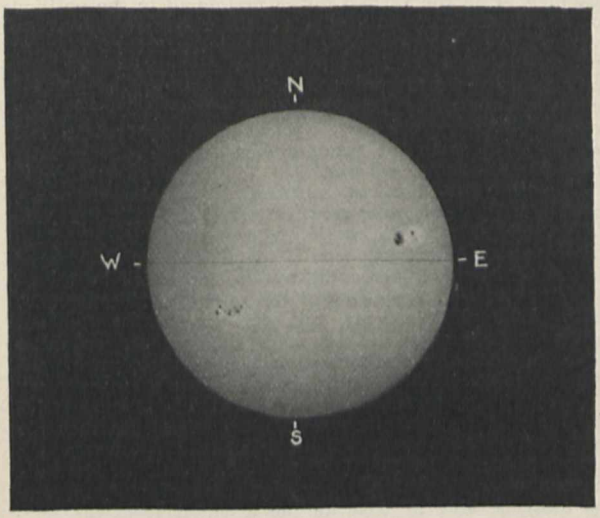
A SECOND Italian edition of "Mattoni e Pietre di Sabbia e Calce," by M. E. Stöffler and Prof. M. Glasenapp, has been published by the firm of Ulrico Hoepli, of Milan. This edition is provided with eighty figures in the text and three folded plates at the end of the volume.

THE second edition of "The Central Alps of the Dauphiny," by W. A. B. Coolidge, H. Duhamel, and F. Perrin has just been issued by Mr. Fisher Unwin. The work, which is one of the "Conway and Coolidge's Climbers' Guides" series, has been revised and brought down to the end of 1904, and the arrangement of the sections has to some extent been altered.

OUR ASTRONOMICAL COLUMN.

THE SOLAR ACTIVITY.—The "maximum" character of the present solar-activity epoch is being well maintained by the frequent appearance of large groups of spots. Observations made on July 6 showed two medium sized spots coming round the eastern limb, and as this group travelled across the visible disc it developed considerably. On July 13 it formed a large and somewhat scattered group of which the roughly estimated extent was about 100,000 miles, and which could be readily seen by the properly protected naked eye. On July 10 this group was followed by a much more striking, although somewhat less extensive, group, consisting of two exceedingly well defined and large nuclei surrounded by well marked penumbræ and smaller spots. On July 14 both groups were readily observable with the naked eye, this being the second occasion during the present year on which two naked-eye groups have been on the solar disc simultaneously.

Single groups of this character have occurred four or five times since the first appearance of the large group in February. The accompanying reproduction shows the



forms and positions of the spots at 11.45 a.m. on Thursday last, and has been taken from a photograph secured with the photospectroheliograph of the Solar Physics Observatory, South Kensington, the primary slit being adjusted on the continuous spectrum instead of on any special line.

A PROJECTION ON MARS.—A telegram from Prof. Pickering, published in No. 4030 of the *Astronomische Nachrichten*, announces that on July 2 Mr. Lowell discovered a projection on the terminator of Mars. The object was situated near to Propontis, its position angle being 19°.

It may be remembered that in the first Bulletin issued from his observatory Mr. Lowell described a projection on the terminator of Mars, discovered by Mr. Slipher on May 25, 1903, its position angle varying from 204° to 200°. In that case the observations led to the suggestion that the projection was in reality a cloud of dust some 300 miles in extent which was travelling over the planet's surface at about 16 miles per hour (see NATURE, No. 1763, vol. lxviii., p. 353, 1903).

OBSERVATIONS OF PERSEIDS.—Intending observers of the coming Perseid shower will probably find Mr. Robert Dole's account of his 1904 observations, published in No. 6, vol. xiii., of *Popular Astronomy*, of interest. During a total watch of 6h. 41m. on the nights of August 6, 9, 10 and 12, Mr. Dole, observing at Flagstaff, Arizona, saw 123 Perseids and 100 shooting stars, the horary rate of the Perseids being about 18·5. August 11 and 13 were completely cloudy, and consequently the observer was unable to determine the period of maximum of the shower. Some thirty of the apparent paths of the Perseid meteors were plotted, and are shown on a chart accompanying the paper.

THE FRENCH ECLIPSE EXPEDITIONS.—Thanks to the liberality of the French Government and the activity of M. Loewy and his colleagues, French astronomy will be worthily represented amongst the expeditions which are going to Spain, Algeria, and Tunis to observe the coming total eclipse of the sun.

Observers from the Paris and Besançon observatories will establish themselves near to Cistierna, in Leon, MM. Deslandres and Rayet are going to Burgos, whilst M. André (Lyons) will observe the eclipse at Tortosa.

The munificence of M. Bischoffsheim will enable the observers from Nice to carry out their programme on the coast near to Alcala, a station selected by M. de la Baume Pluvinel.

M. Trépied (Algiers) intends joining MM. Stéphan and Borrelly (Marseilles) at Guelma, Algeria, where MM. Nordmann and Salet (Paris) and MM. Bourget and Montangeraud, of the Montpellier Observatory, will also be located. M. Bigourdan will go to Sfax, where he intends to make actinometric observations with a Violle actinometer.

The director of the Paris Municipal Observatory, M. Jaubert, will also endeavour to make actinometric observations from the balloon *Centaure*, which is to ascend from Constantine, and a second Violle actinometer will be set up at that place for taking readings on the ground. Thermometric observations will be made on the ground and from a balloon at the Eiffel Tower, whilst actinometric observations will also be carried out at the Pic du Midi Observatory.

A REMARKABLE METEOR.—An unusually splendid meteor was observed by Dr. G. Johnstone Stoney on July 13.

The object was seen to traverse the eastern sky at oh. 56m. a.m., and presented the appearance of an intensely bright and pure white globe having a diameter equal to about one-sixth of that of the moon. The meteor travelled in a N.E. direction along a path which sloped downwards, and which was nearly parallel to a line joining a point midway between α and β Andromedæ and β Persei at a distance from that line of about 12° measured along a great circle towards the south.

Dr. Stoney was not able to see the whole of the path followed by this brilliant object, but he saw it for some 30° or 35°, and estimates that his determination of the direction may be 2° or 3° in error, and of the distance of the apparent path from the reference stars, perhaps ±2°.

THE SOCIETY OF CHEMICAL INDUSTRY.

THE annual general meeting of this society was held at University College on Monday of last week. The council reported a total membership of 4326, an increase of 192 compared with the same period last year. It referred to the very successful meeting of the society in America last year, and to the pleasure felt at the visit to England of its American president, and a considerable contingent of American and colonial members. Statistics were furnished as to the number of original papers read before the various sections of the society, and reference made to the efforts of the society and its members during the year in connection with the use of duty-free alcohol for manufacturing and other trade purposes. The report of the hon. treasurer, Mr. S. Hall, indicated the continued prosperity of the society, though the cost of the journal had appreciably increased.

Mr. Gordon Salamon, chairman of the London section, next offered a welcome to the members of the society, and especially to the American and colonial members, on their assembling in London. The president then delivered his address.

Dr. W. H. Nichols, after expressing his obligations to Prof. Edward Divers, F.R.S., who had acted as deputy president during the greater portion of the year, alluded to the extension of the American membership of the society, which had been marked during his year of office by the

establishment of a New England section at Boston. He spoke of the advantage which resulted from the holding of regular meetings within reach of members as being a considerable addition to that ensuing from the possession of the valuable journal of the society, which he described as in itself worth many times the cost of membership.

Sir William Ramsay's presidential address of the previous year dealt with the results of thirty years' experience in the education of chemists, education being understood as the production of an attitude of mind rather than the imparting of definite knowledge, though the latter could not be neglected. Dr. Nichols considered the "attitude of mind" undoubtedly the pith of the matter. The young chemist fresh from college was only, after all, just prepared to learn how to apply the knowledge he had acquired, and to build on it by his daily experiences. As to some extent taking up the question where Sir William Ramsay laid it down, he proposed to discuss the question of the management of a chemical industrial organisation. The plan he proposed to outline, though it might differ widely from the views held by others as the result of their experiences, was the outcome of many years of observation and work, and had stood the test of years in a company operating more than a score of plants, widely separated and yet all working as a unit.

Below the board of directors, with its officers and executive committee, the following departments were necessary, viz. :—purchasing, sales, transportation, finance, construction, operating, research or investigation, and statistical. To harmonise these, two committees were requisite :—(1) a manufacturing committee, consisting of the managers of the operating, construction, purchasing, and investigation departments, the chairman being the chairman of the executive committee; and (2) a sales committee, composed of the managers of the sales, operating and purchasing departments, with a member of the executive committee.

The operating department was one of great complexity and importance, and needed a manager and assistant manager. Of the chemists employed, evidence is required not merely that they have received a good education and have completed a technical course of instruction, but that they are of good judgment and capable of assuming responsibility. It is desirable that they should have some knowledge of mechanical engineering and the general principles of construction, though in his experience so rare was a complete combination found that it was usually necessary to engage good chemists with but a moderate knowledge of engineering, or good engineers with only an elementary knowledge of chemistry. It was to be hoped, however, that as a result of the improved instruction in technical chemistry now being given, men would be turned out better prepared in this respect than had hitherto been the case. The great thing, however, was that the man should be practical, trustworthy, hard-working, and possessed of natural ability and the capacity for development and advancement, or, as Sir William Ramsay puts it, "have the right attitude of mind." The beginner should be kept long enough on one subject to make rapid and accurate analyses and at the same time be encouraged to make himself familiar with all the different methods of analysis bearing upon his particular work, and to be sure that he thoroughly understands the basic principles and theory upon which the work rests. After a sufficient experience along these lines, he arrives at a position where he may be able to improve existing methods or even invent new ones; but of course all new methods must be tested by rigid experiment.

In a works laboratory a variable degree of accuracy is required, depending upon the object for which the analysis is made. In some cases a tenth of 1 per cent. variation would not be serious. In other cases a ten-thousandth of 1 per cent., or even much less, is highly important, and as the object is to turn out analyses of the required accuracy in the least amount of time, it is of great advantage for the chemist to have such general knowledge of the use to be made of each analysis as will enable him to avoid waste of time in unnecessary accuracy. For routine work it is becoming more and more the custom to employ in works laboratories bright young men, graduates of high schools. Such young men are, of course, useful, but unless they pursue their scientific studies outside, as, for instance, at night schools, they are not likely to make great advances. In every laboratory there must be a chemist in control, who in turn shall be supervised by the chief chemist of the company. Unnecessary duplications being avoided, a force thus organised becomes capable of doing an enormous amount of work in a given time and with great accuracy.

The beginner confines his duties for a number of months, and frequently for years, to a works laboratory, and incidental to his analytical work he gains a certain knowledge of the general routine which obtains at that plant. After the laboratory service, if the chemist has displayed ability to advance, he is promoted to a position which will bring him into direct contact with the manufacturing processes, and his duties will gradually change from those of analyst to those of a manufacturing assistant, until he has become proficient enough to warrant promotion to the position of assistant superintendent, to which he is thereafter advanced at the earliest opportunity, either at the works at which he has received his tuition or at another works where such a position has become vacant.

The assistant superintendent is under the direction of the superintendent, and from him should receive a regular training in all the various duties pertaining to the position of superintendent, and when such a position becomes vacant, the assistant who, in the judgment of the department, is best qualified to fill the advanced position, is recommended for the promotion. The ability to administer chemical works can be obtained only by experience, and realising this fact the most efficient superintendents should act as teachers to the younger men in their development from one position to another.

Chemists who are not attracted by outside or works positions, but who prefer research work, naturally gravitate in due time from the works laboratory to the research laboratory. Occasionally one is found whose ambitions lie in the direction of mercantile affairs, for which he thinks the experience of the chemical laboratory will best qualify him. As a rule, however, the educated chemist does not select advancement in the sales department, or other business parts of the organisation, nor does it often happen that he is qualified.

The chemist, to succeed in technical work, must strive for material results. It has been my experience that the post-graduate course seems to incline him towards the search of learning rather than to its application. He must have a clear, logical mind, a singleness of purpose, and he must be able to separate the essential from the non-essential. This is true of all professions, but it is particularly true in chemical work, where the essential must be selected from an unusually large assortment of non-essentials.

The efficiency of a navy depends very largely on the "man behind the gun." So with chemists in a works or laboratory. The personal equation has much to do with the results. There is no "royal road" to success here. The rewards are for those who are willing to pay the price, and that price includes constant and intelligent work. The habit of study is rarely acquired after college days, and if the undergraduate does not develop it he should seek a less exacting profession than that of chemistry, unless his ambitions will be satisfied with the daily grind of routine work.

The investigation department is that part of the manufacturing organisation which deals with all the new propositions of a technical nature. Its work, which is entirely distinct from current manufacturing, has to do with new, and the improvement of old processes. A new proposition remains under the control of the investigation department from the time of its inception until sufficient data have been obtained to enable the construction department to design the necessary plant, if one be authorised by the executive committee. It is turned over to the operating department only after the process is working smoothly and the results considered satisfactory.

The organisation of the investigation department should be sufficiently broad to permit the consideration of a manufacturing proposition from the points of view of the business man, the chemist, the engineer, and the patent attorney. It consists of the manager, a chemical council composed

(in addition to the manager) of the chief chemical engineer, the chief chemist who is director of the research laboratory, and such consulting chemists and engineers as the company employs. The appointments in this council are intended to cover the most varied field of theoretical and technical chemistry, and the manager is permitted to consult outside experts if the company has not the necessary talent at hand. A corps of chemists on research laboratory work, an abstractor of current chemical literature, patent experts, and a small office force complete the department staff.

In the research laboratory a body of chemists, under the supervision of the chief chemist, is employed on research work connected with investigations in hand. A limited number of men are permanently retained on pure research work.

The research laboratory reports weekly the progress on all work in hand, and at the completion of each investigation sends in a statement of the steps taken, accompanied by the chief's recommendation as to further action. These reports are passed upon by the chemical council at its regular meetings.

All the analyses required are made by the analytical laboratory, which is specially equipped for turning out quick and accurate estimations. Each works has its own analytical laboratory, but there is a central laboratory for the work of the head office. This laboratory critically examines and selects all analytical methods, which are adopted as standards and furnished to all works laboratories.

The work of the investigation department originates from sources which may, in a general way, be divided into three classes :—

(*a*) The probability of reducing manufacturing costs.

(*b*) A decision to produce well established products not previously manufactured by the company.

(*c*) New applications of science to industry.

(*a*) The largest field is perhaps that of improving the processes at present in use at the different works, and is one which usually yields very profitable results. Aside from the chronic aim of the operating department to secure uniformly low costs, a decision to investigate a process in use may result from a drop in the market price of a product on account of trade conditions, or because the process is technically unsatisfactory. There may be developed, therefore, new methods or important modifications involving reconstruction or even new plants.

(*b*) Consideration of the manufacture of products not previously produced by the company is usually given as a result of market conditions or special wants of customers. Where a large consumption of a product of interest is developing, and the raw materials prove to be available, an investigation may be undertaken with a view to the selection of a process and the construction of a plant.

(*c*) The third source of investigation originates in the distinctly new processes so frequently offered to the world. Such processes, whether for a product manufactured by the company or of prospective interest, are always given the attention which their merits seem to warrant. No one who has a sensible process to offer is refused a hearing, and the treatment accorded the inventor soon becomes public opinion. As a rule, the inventor is retained to direct the development of his process under the management of the department.

As an investigation of a new manufacture includes a thorough examination of both the commercial and technical sides of the proposition, the commercial side, in which the assistance of the manager of the sales department and other commercial branches is invoked, calls for consideration of the following :—

(1) Its relation to the interests of the company; (2) the market; (3) manufacturing costs; (4) investment necessary; (5) source of raw materials; (6) transportation.

On the technical side a study must be made of :—

(1) The process; (2) other processes; (3) raw materials; (4) quality of product required.

These topics indicate the method of working out or testing the practicability of the process. This phase of the proposition is entirely a chemical and engineering one, and calls for most of the work of the investigation staff.

In the usual order of procedure, a proposal reaching the investigation department is subjected to a preliminary consideration, and is entered for record if it is to be made a subject for investigation. It is then submitted to the chemical council, which decides on the method of investigation to be pursued. A *résumé* of the literature is generally made and a report obtained from foreign representatives on the latest European developments. We may soon have to add the Japanese. As the inquiry progresses, the chemical council, which meets weekly, is kept informed of the progress made.

The thorough consideration given at this early stage frequently prevents useless laboratory expense and much loss of time.

Where an investigation of a process in use is being made, a member of the investigation department is sent to each of the works using it, to study the methods and management and analyse its defects. His reports thereon are considered by the chemical council in the manner indicated above.

If the final result of the investigation of a new process be favourable, an experimental plant may be recommended and an appropriation asked for. This may be advisable not only to assist in reaching a decision regarding the wisdom of adopting the process, but also for furnishing data for the designing of a manufacturing plant, if one be ultimately decided upon.

In the case of the adoption of a process and the designing of a plant, the work of the investigation and construction departments is very intimately connected. An investigation covers the inquiry regarding the proper design of the apparatus or plant, as well as the process *per se*

Investigations in connection with construction naturally differ, to a certain extent, and include consideration of methods for handling the raw material, the solids, liquids and gases involved in the process; furnacing, dissolving, filtering, evaporating, crystallising, distilling, subliming, drying, &c., and the packing and handling of the finished product.

The materials to be used in different parts of the construction are determined if an investigation into that important side be necessary, whether wood, cast iron, steel, lead, tin, aluminium, alloy, earthenware, porcelain, rubber, cement, &c. Any special data requested by the construction department in carrying out its work are furnished by the investigation department, such as the selection of fuel for special work, boiler and engine tests, consumption of steam, &c., and all chemical work.

The benefits resulting from organisation in the consideration of improvements and new processes are very evident. The results of experiments in one instance are applicable to others of distinctly different character. The full use of them demands a central bureau and clearing house of information.

The conferences held so frequently are not permitted to drag. Records are kept of all decisions, and even the local heads of departments present are notified in writing.

The routine work of the department consists in the collection and filing for easy access of technical and commercial data of all kinds connected with chemical manufacturing, for immediate and prospective use. Circulars containing useful information applicable to the works, and copies of research reports that may help operations, are transmitted to superintendents. Records of failure are just as important as those of success. Every encouragement is given superintendents to confer freely on any modifications, developments, or conceptions which may occur to them. The *esprit de corps* resulting naturally reaches the junior men and foremen, so that a keen sense of responsibility and importance is felt throughout.

The frequent visits of managers and superintendents to the head office, and the periodic meetings of superintendents which are called for conference and discussion enable the responsible men to continue in perfect familiarity with the technical resources of the company.

The research department would not be complete without a laboratory plant, large enough to work out processes on a small manufacturing scale. Such a plant should have all the standard appliances, and be so arranged that the results obtained in it are sufficient to form the basis for the engineering work resulting in the experimental plant to follow the successful investigation.

After all the organisation has been perfected and the machinery lubricated and put in motion, it would be apt to run wild if some trustworthy and absolute method of control should not be at hand. This I have found completely accomplished by a department which has to do with the compilation of facts and the deductions from them. It is absolutely essential, in a company operating a number of plants, that those in control should not only know what each one of its manufactured products costs, but what enters into making up that cost, so that if for any reason there is a drain going on it will be quickly known, located and stopped; or if, on the other hand, something advantageous shall have been accomplished, that will also be noted and imitated at other points. This may seem like an exceedingly difficult undertaking in an industry of such infinite variety, but a brief consideration will show that it is not so. The statistical department, to which I allude, is not only able to advise the officers within a reasonable time after the end of each month of the cost of every product and step, but also of the profit or loss on each article and the total profit or loss of the company. These results have been so exact that for several years the profits determined by public accountants at the end of the year have not varied 1 per cent. from those which had been worked up in this statistical department month by month. The importance of this information to those in control will be readily understood. For my own part, I do not see how it would be possible intelligently to run a large enterprise involving a number of plants without some such arrangement.

The exact plan which I would recommend is as follows:—

Each factory furnishes monthly the following reports:—raw materials received; raw materials used; shipments of finished products; stocks of raw materials; stocks of finished products. Productions and statement of statistical charges (including manufacturing labour, labour on repairs, material taken from the storehouse for repairs, all material taken from the storehouse for manufacturing except fuel and raw materials), packages, dry barrels, &c., included in the selling price and not returnable, manufacturing cartage (*i.e.* teams used around the works), steam and water.

The first shows the number of pounds of raw material received, together with cost of placing in the pile, and by adding the amount of bills, freight, &c., we get the actual cost per hundred pounds of each. These figures are used in obtaining the material cost of each hundred pounds of production, which, with sundries, labour, fuel, and repairs, makes up the total manufacturing cost, and in connection with that shows what each department has accomplished during the month.

As each of the factory sheets is checked and every pound of raw material and finished product accounted for, nothing escapes which should be considered in costs.

In addition to the manufacturing cost are shown the cost per 100lb. of special factory charges (including such accounts as docks, dredging, fire equipment, laboratory, lighting, roads, maintenance of yards, watchmen, gatemen, &c.), and cost per 100lb. of goods produced due to salaries of superintendents and chemists, based on proportion of labour of each department and the total manufacturing labour.

The factory shipment sheets are checked with the accounting department as well as repairs and net selling prices obtained, lighterage, cartage, allowances, estimated freights, &c., being deducted.

By using the manufacturing costs and the net selling prices, we arrive each month at the gross manufacturing profits, and deducting taxes, insurance, office, and other general expenses, the net results are obtained.

All organisation, whether in the chemical industry or any other, would fail to attain the best and most permanent results if the personal equation be forgotten. We are not dealing with a collection of apparatus, but with an organisation of men, everyone an individual, with his own peculiarities and ambitions. The day has not come, if it ever will, when from purely altruistic motives a man will give his most efficient services. He must realise that while his best work must be done, it will not go unnoticed and unrewarded. He must be sure that he will receive just and proportionately liberal treatment. His proper ambitions must not be smothered, they must be directed. From an experience of many years, I believe the plan outlined above provides fully for this most important fact, and I can point with the greatest pleasure to many men as proof of my statement, and every one more enthusiastic than at the beginning. The places of the leaders will someday be vacant. Who, then, shall fill them? Those whose lives have been spent in preparation for the work, and who will enter into it without shock or derangement of existing conditions, but as naturally as the stream flows into the river. Thus will the natural ambition of the young man reach its fulfilment in due time, and thus will our beloved industry progress to points of attainment which some of us may dream of, but will never see.

A vote of thanks to the president for his address was then proposed by Prof. Divers and seconded by Sir Henry Roscoe, the first president of the society, in the course of which allusion was made both to the valuable character of the address to which the members had just listened, to the origin of the society some twenty-five years ago, and to the considerable growth in its membership which the council's report indicated. In responding, Dr. Nichols spoke of the advantage which ensued to the society as a whole as a consequence of the visit last year to America, followed, as it happily had been, by the present visit to England of a considerable number of members from the other side of the Atlantic. He said how much he and his fellow-countrymen appreciated the hospitality that had been already shown them, and the efforts that had been made in connection with the interesting and lengthy programme that had been arranged largely for their benefit. He said that in New York they had been anxious to provide some souvenir of their visit that they might leave behind them, and, on informing the meeting of the report of the scrutineers, which declared that Prof. Divers, F.R.S., had been elected president for the ensuing year, he desired to place in his hands the little thing that they had ventured to have prepared. This was a presidential badge formed of a medallion of Sir Humphry Davy surrounded by an emblematical device representing the union of England and America in the pursuit of chemical science. He trusted that the council of the society would authorise the wearing of the badge by all his successors in the office of president, and hoped it would help still further to cement the good feeling and cordiality which existed between members of this great society on both sides of the Atlantic. He concluded by announcing the names of the vice-presidents and ordinary members of the council who had been found to be duly elected to office.

Prof. Divers expressed, on behalf of the society, appreciation of the kindness which had dictated the offer of this valuable presidential badge.

On the motion of Dr. Bailey, seconded by Mr. Hübner, who on behalf of Manchester promised a very hearty reception, it was resolved that the next annual general meeting should be held in that city.

On the motion of Prof. Chandler, of Colombia University, seconded by Sir Boverton Redwood, the hearty thanks of the society were accorded to the senate and council of University College for granting permission to the society to meet in that building. This was responded to by Sir William Ramsay, who incidentally referred to the fact that University College as a separate corporation had just ceased to exist, having become absorbed in and an essential part of the University of London. The meeting then adjourned.

THE UNIVERSITY OF SHEFFIELD.

AS has already been noted in these columns, the new buildings of the University of Sheffield were on Wednesday of last week opened by the King and Queen, and by the act a new centre for research was created in this country.

Nothing seems to have been lacking to make the ceremony a success; all taking part, from the King downwards, entered into the proceedings with enthusiasm. In replying to the address of welcome presented by the city, the King said that he and the Queen were glad to be present to open the university buildings and to inaugurate a work which he was assured would tend to promote the

advancement of knowledge and the spread of culture among all classes in the city. He had no doubt that the establishment of the university would also afford facilities for the technical training which is now essential to success in every industrial enterprise, and concluded by saying that he should follow the progress of the university with warm interest. It may be mentioned here, as indicating His Majesty's interest in the spread of university teaching, that he has since sent through Lord Londonderry a letter to the Lord Mayor of Sheffield stating that "the opening of the new university buildings was felt by their Majesties to be an occasion of great importance. His Majesty has recognised with pleasure the desire felt in some of the great centres of industry and commerce that universities should take a prominent part in the promotion of scientific knowledge and research. . . . His Majesty recognises that in these days of constantly increased application of science and of scientific method to every department of modern life, it is to the universities that the nation must largely look for maintaining that position in relation to great commercial and industrial problems which is essential to the social well-being of his Empire."

His Majesty has also sent the following reply to the address presented to him by the university authorities:—"I view with lively satisfaction the establishment of this and other universities in large industrial centres, and it gives me great pleasure to open the handsome and spacious buildings provided for the University of Sheffield. I have never ceased to watch with great interest the great development of the wide movement for the encouragement of a sound and liberal education among all classes of my people, and I am well assured that the expectations of those patriotic and enlightened men by whose efforts were established the institutions from which the University of Sheffield derives its origin will be justified by the achievements of those who are educated within these walls."

The opening ceremony was preceded by the reading of the above-mentioned address from the University by the Chancellor—the Duke of Norfolk—from which we extract the following sentences:—"We bear in proud and grateful memory the fact that on more than one previous occasion members of your Royal House have shown an interest in the instructions from which the University of Sheffield derives its origin, and we gladly recall what has been already achieved in the course of your reign to advance that wider movement of which this university is but a sign and symbol. The early years of your Majesties' reign must always be remarkable as having witnessed that more general awakening on the part of your Majesties' subjects to the advantages of higher education in all branches of learning and that better understanding of its needs and requirements which is evidenced by the almost simultaneous creation of five independent universities, at Birmingham, Manchester, Liverpool, Leeds, and Sheffield. The distinction conferred upon the inauguration of our university by the gracious presence of your Majesties here to-day is of the happiest omen for its future, and we can only hope and pray that the teaching given within these buildings, the learning acquired within these walls, and the influences that will follow from them, may prove not unworthy of the great honour you have done us, and may be a constant source of profit and of ever-increasing usefulness to all classes of your Majesties' loyal and loving subjects within these districts."

The Duke of Norfolk then addressed the King, and in the course of his remarks, after paying tribute to the men to whom the university movement in Sheffield is mainly due, stated that it was now three years since it had been thought necessary to gather into one home the various sources of educational work which the university ought to supply; and the faculties of arts, of pure science, and of medicine have now been gathered together. Applied science is in another very adjacent building. He stated that every class in Sheffield has shown keen interest in the work, and that the sum of 20,000*l.* is needed to meet the expense of erecting and endowing the university.

Reference having been made to the granting in May last of the charter to the university, the King was handed a key and requested to declare the university open. This he did, speaking as follows:—"I have great pleasure in declaring these beautiful buildings open; and it is my fervent hope and desire for the long-continued prosperity of the University of Sheffield."

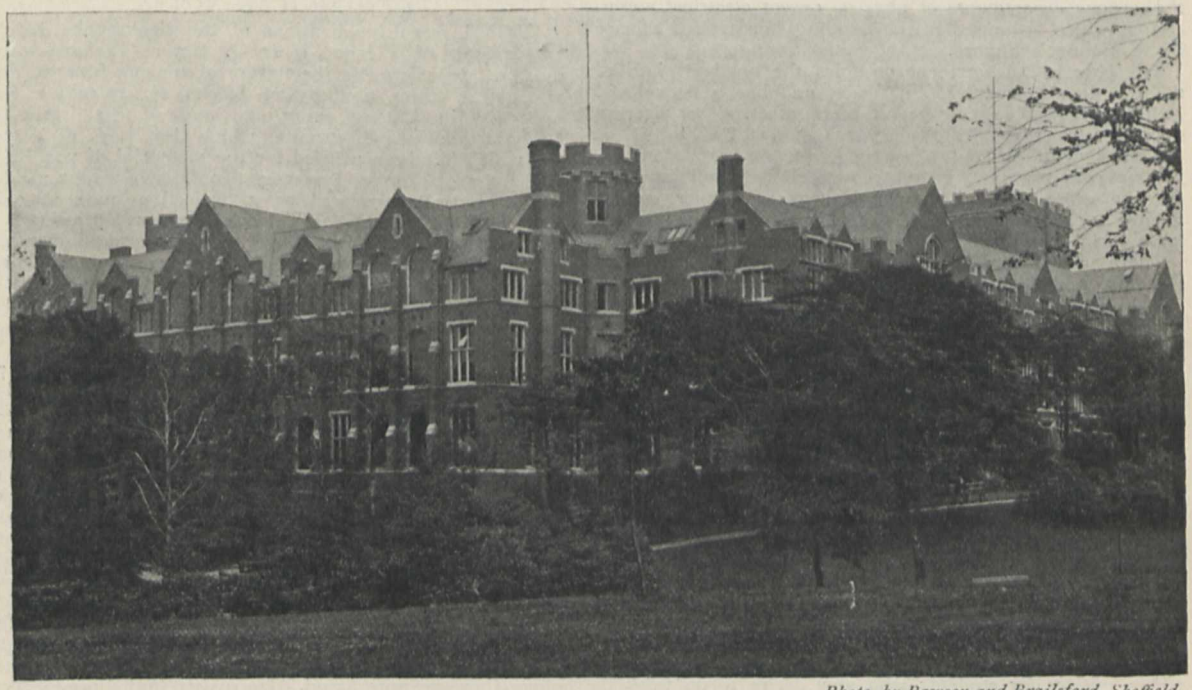


Photo. by Pawson and Brailsford, Sheffield.

FIG. 1.—The University Buildings from Weston Park.

The following is a short description of the new buildings. The illustration (which we are able to give by permission of Messrs. Pawson and Brailsford, of Sheffield) is a view of the university from Weston Park.

The buildings are constructed of red brick and stone in the Tudor style of architecture, form three sides of a quad-

rangle, and are situated upon a site overlooking Weston Park. A tower has been erected at one corner of the quadrangle, octagonal turrets at two of the other corners, the site of the third turret together with the fourth side of the quadrangle being left vacant in order to provide for future extensions. The building on the south side, which faces Western Bank, contains the large hall of the University; this hall is to be known by the name of the Firth Hall, after the founder of Firth College. The Firth Hall is designed to accommodate an audience of about 800 persons. In the same building are the administrative offices, the council room, the common rooms and refectories. The building on the west side provides for the departments in the faculties of arts and pure science, that on the north for the departments in the medical faculty. The faculty of applied science is located on a separate site about four minutes away in St. George's Square.

The physical laboratories contain a superficial area of 10,000 square feet, and are self-contained on three floors connected by a spiral staircase and apparatus lift, the rooms on each floor being arranged on either side of a central corridor except those on the lower ground floor, which, owing to the slope of the ground, are confined to the quadrangle front. Accommodation is provided for all the various departments of physics, except electrical engineering, which is housed in the buildings for applied science in St. George's Square.

The chemical department occupies the northern half of the top floor in the western block, and has a floor area, including corridors, of 7400 square feet. Two lecture theatres are provided. The larger, 30 feet by 40 feet, is furnished with seating accommodation for 110 students. A preparation room for lecture experiments adjoins this. On the other side of the corridor is a smaller lecture theatre to accommodate 34 students; this will be utilised for tutorial work, and for work with small classes.

There are laboratories for elementary and advanced students, and a small one for research work.

The biological department, which includes the two subjects of zoology and botany, adjoins the chemical department, and occupies the southern half of the top floor of the west wing. A lecture room is also allotted to this department on the first floor, and the whole of the upper part of the tower. There are two lecture rooms, the larger having accommodation for about 80 students. The general laboratory, with a raised platform and table for the purpose of practical demonstrations, and the botanical laboratory afford accommodation for 30 students each; there is also a zoological laboratory for advanced students, besides zoological and botanical research laboratories.

The anatomical department includes a large lecture theatre, a museum, several research laboratories, and private rooms for the professor and demonstrators. Accommodation for microscopes and stereoscopes is provided, also a set of the most modern anthropological instruments, and requisites for students who may desire to do work in modern developments of anatomy.

The physiological department has an area of about 5400 square feet. There are nine rooms in the department, and no corridors, the rooms opening into each other; the three largest of these are the general laboratory, 70 feet by 25 feet, the chemico-physiological laboratory, 50 feet by 25 feet, and the lecture theatre. Another large room in the department is the general research room, 25 feet by 30 feet. The rooms in this department, like all the other rooms on the north front, are lighted with specially large windows in order to facilitate microscopical work, and have several concealed sinks in the floor, which, when opened, reveal supplies of gas, water, and electricity, thus avoiding the necessity of fixed benches, their place being taken by movable tables.

The pathological department occupies the whole of the upper floor of the medical block; the main feature is the large students' laboratory facing north, 70 feet by 26 feet, divided by two partitions. There are adjoining this two laboratories, one large and one small, intended for the bacteriological work to be done in connection with the City Health Department. A special feature consists of an incubating room in the centre of the department, so arranged that it can be kept at a constant temperature; this room will replace the ordinary incubating ovens. There is a large lecture theatre in the department, a museum with a top and a south light, a special research laboratory, also private rooms, photographic and store rooms—the last two mentioned being in the roof and the turrets above the department.

The new buildings allotted to the engineering department consist of four floors; the lowest floor or basement contains a large extension of the original laboratories. The main engineering laboratory contains a plant which can be used both by mechanical and electrical engineering students. There is also a very complete electrical equipment in the new building to demonstrate the applications of electricity to lighting, traction, and power transmission.

The department of metallurgy has had special attention paid to it, seated as it is in a city where the chief national metallurgical industry is carried on. As a natural consequence of this, so far as iron and steel metallurgy is concerned, the metallurgical laboratories of the University of Sheffield are unique. These laboratories are divided into two sections, the scientific and the practical. In the first named there are nine, and in the second two laboratories.

GEOLOGICAL NOTES.

AMONG recent publications of the Geologische Reichsanstalt of Vienna, Herr G. Geyer (*Verhandlungen*, 1904, p. 363) discusses the nature of the pre-Jurassic floor of Austria, from a study of blocks of crystalline rock embedded in Liassic sandstone, and of the island-like "Klippe," formed of granite, which lies N.W. of Weyer, and which has been utilised for the memorial of von Buch. This mass of granite, by-the-by (Toula, *ibid.*, 1905, p. 89), was correctly appreciated as a projecting mass of older land, and not as an erratic block, by von Hochstetter as far back as 1869. Herr Geyer refers to many instances of "exotic blocks" north of the Alps, and points out the influence of the old gneissic and granitic foundation on the subsequent folding in the region of the Enns. Herr R. J. Schubert (*ibid.*, 1904, p. 461) adds greatly to our knowledge of the Upper Eocene and Oligocene beds of Dalmatia, while Dr. Franz Kossmat (*ibid.*, 1905, p. 71) shows how the Sava began to flow eastward on the uplifted floor of a Miocene gulf, and formed the plain near Laibach by filling in a depression that developed during the latest movements of the Alps. In the department of palæontology, Dr. Katzer (*ibid.*, 1905, p. 45) furnishes an interesting account of the microscopic structure of the Devonian Tentaculite-limestones of Bohemia, which may be regarded as a valuable supplement to Novák's work on Tentaculites (*Beiträge zur Pal. Oesterreich-Ungarns*, ii. Bd., 1882). Herr Theodor Fuchs (*Jahrbuch der k.k. Reichsanstalt*, 1904, p. 359) reviews in considerable detail a number of recent papers on fucoids, and concludes that these problematic organisms were not washed into the strata after the manner of floating seaweeds, but arose where they are now found. He insists that museum-specimens in such cases are likely to be misleading, and that a study of fucoids in the field shows that some, at any rate, run perpendicularly to the strata by which they are surrounded. Herr G. Stache (*Verhandlungen*, 1905, p. 100) again investigates the globular Cretaceous organism named by him Bradya, and gives it new interest by showing its resemblance, in structure and mode of occurrence, to Brady's recent genus Keramosphæra, described in 1882 from the deep sea south of Australia. Bradya has long been connected with Steinmann's hydrozoan form Porosphæra; but Stache is now able to revive it, and once more to refer it to the foraminifera. Students of our well known British form Parkeria will find much to interest them in this paper. Herren Hofmann and Zdarsky (*Jahrbuch*, 1904, p. 577) discuss and illustrate the dentition of Deinotherium, and the abundant remains of a species of antelope, from the Miocene beds of Leoben.

The *Transactions of the Geological Society of South Africa* for January to April contain several stratigraphical and structural papers by Dr. Molengraaff and others; but general interest will be raised by the illustrated description of the great Cullinan diamond, by Messrs. Hatch and Corstorphine, on p. 26. In the *Transactions of the South African Philosophical Society*, vol. xvi. (1905), Mr. Rogers

(p. 1) confirms his discovery of a glacial conglomerate, the Pakhuis bed, in the Table Mountain series near Clanwilliam. A thousand feet of sandstones, probably fluviatile, overlies these glacial strata, and the Devonian Bokkeveld beds follow, so that the antiquity of the conglomerate, as compared with the well known Dwyka beds, is put beyond a doubt. Mr. Schwarz (*ibid.*, p. 9) makes a block of gneiss from the volcano of Tristan d'Acunha serve as the text for a dissertation on oceanic islands in general, which he expands further into a treatise on several points in theoretical geology. We confess to a feeling of nightmare, as the one innocent specimen leads us on into enormous fields of speculation, where a considerable area is occupied by the slaying of the slain. When, after twenty-six pages, we reach the question, "What, after all, are volcanoes?" we are tempted to turn over the next eight, to where the description of "the rocks of Tristan d'Acunha" nestles humbly as an appendix. Mr. A. L. du Toit (p. 53) furnishes a serious paper on the forming of the Drakensberg, which summarises many recent observations. Stress is laid on the numerous volcanic necks and lava-flows, which are later than the Cave Sandstone. In some cases, the vents contain no igneous matter, but merely masses of exploded sandstone and shale, in a ground of pulverised grit. Dr. R. Broom re-opens (*ibid.*, p. 73) the whole question of the age and affinities of Tritylodon. Those who were present at the memorable meeting in London in 1884, when Owen laid upon the table what was believed to be the oldest known mammalian skull, will read with some surprise of the doubt which hangs over the locality and horizon of the fossil. Dr. Broom believes that it came, as then stated, from Basutoland; if so, it is from the Stormberg beds, which he regards as of Lower Jurassic age. As was pointed out in NATURE, vol. lxxii. p. 36, the reference of the reptilian beds of South Africa to the Permian may carry back the Stormberg beds also, and this will make Dr. Broom's defence of Tritylodon as a mammal, and not a reptile, of even greater interest as research goes on.

Dr. A. E. Salter (*Proceedings of the Geologists' Association*, vol. xix. p. 1) produces a large amount of original evidence bearing on the sources of the superficial deposits found above the Jurassic and Cretaceous strata to the south, north-west, and west of London. The area studied is a wide one, and Dr. Salter traces fluviatile action in it to an epoch before the deposition of the "Boulder-clay." Among his interesting conclusions, we note that a large amount of "drift" material in the lower basin of the Thames is of southern origin, suggesting that "the southern slope was formerly more extensive than at present," the distribution of such material having been probably aided by earth-movements. In support of this latter contention, it is shown that Lower Greensand chert from the Wealden area occurs 650 feet above the sea at Goring Gap. The Lower Thames Valley is thus held to be of recent geological age (pp. 17, 25, &c.). Other evidence is adduced of the modification of the general direction of drainage by earth-movements since the higher gravels were deposited.

Dr. O. Mann begins, in the *Sitzungsberichte der Gesellschaft Isis* (1904, p. 61), what promises to be a detailed account of the tin-deposits of the Erzgebirge, including a microscopic examination of the veins of quartz, tourmaline, and cassiterite.

Dr. J. W. Spencer further emphasises his views as to submerged river-channels and continental shelves in two notices of the work of Hull and Nansen (*American Geologist*, vol. xxxv. pp. 152 and 222). He provides us also with a useful bibliography of the subject in relation to America (*American Journal of Science*, vol. xix. p. 341).

A preliminary note on the geology of the provinces of Tsang and Ü in Tibet, by H. H. Hayden (*Records, Geol. Survey of India*, vol. xxxii. p. 160), forms a pleasant outcome of the recent political expedition. Marine Cainozoic beds are found north of the Sikkim border, and there is evidence of a former considerable extension of glaciers northward from the Himalayas. The granite near Lhasa is intrusive in a wide area of Jurassic strata, which have suffered much from crushing and metamorphism. The country does not appear rich in minerals, and even the gems are imported. G. A. J. C.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Amongst the list of donations to the university benefaction fund which was recently published by the Vice-Chancellor the following sums may be mentioned:—the Right Hon. Lord Rayleigh, 5000*l.*; the Right Hon. Lord Iveagh (further donation), 1000*l.*; C. J. Heywood, Esq., 100*l.*; J. Lumb, Esq., 100*l.* Besides these a number of smaller sums have been received, some of which are especially allocated to the Huddersfield lectureship in pathology. In addition to these sums the Cambridge University Association has collected more than 6000*l.* towards the fund for the university library. The success of this is due almost entirely to the energy of the registrary. The Schuter scholarship in St. Bartholomew's Hospital has been awarded to Mr. R. B. S. Sewell, late scholar of Christ's College.

DR. T. G. PINCHES has been invited to join the staff of the institute of archæology of the University of Liverpool as assyriologist.

THE resignation of Mr. H. J. L. Beadnell from his position on the Geological Survey of Egypt is announced. Mr. Beadnell has been connected with the survey since 1896, *i.e.* from the time it was established.

FROM a long list of recent changes we extract the following appointments to professorships at technical colleges:—Prof. M. Disteli at Dresden, for descriptive geometry; Mr. Camillo Körner and Prof. K. Zsigmondy at Prague, for machine construction and mathematics respectively; Dr. Leo Grünmach at Berlin; Dr. Gustav Rasch at Aachen; Dr. Clarence Feldmann at Delft, for electrotechnics; Dr. A. Tobler at Zurich, for applied electricity; Prof. F. Schilling at Charlottenburg, for geometry. W. König, of Greifswald, has been appointed professor of physics at the University of Giessen, and Dr. Karl Stöchl professor of mathematics and physics at Passau.

THE proposal made by the Emperor of Germany for the temporary interchange of professors with America for a course of lectures is leading to a number of important results. Harvard University has invited Prof. Ostwald, of Leipzig, to give a half year's course, Columbia University has secured lectures from Prof. V. F. Bjerknes, of Stockholm, on "Fields of Force," and from Prof. H. A. Lorentz, of Leyden, on "Extensions of Maxwell's Electromagnetic Theory." Is Great Britain with its usual insularity going to keep aloof from the new movement? It is hardly likely that any proposal from our country would fail to obtain hearty support either in Germany or in America.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 9.—"The Rate of Transmission of the Guatemala Earthquake of April 19, 1902." By R. D. **Oldham.**

This paper contains a complete study of an earthquake from the point of view of the rate of transmission. The time and place of origin are known with a sufficient degree of accuracy, and the shock was of sufficient power to give distinct records even at 160° from the origin. Three phases of wave motion are recognised, the third phase including all those which are distinguished in Japan by the symbols P_3 . . . P_8, as the author believes that it is doubtful whether there is any real difference in the character of the wave motion, or whether, in these so-called phases, we have not waves of essentially similar nature, but varying rates of propagation. The first and second phases are, however, of distinct character, being mass-waves, differing from each other not only in rate of propagation but in character of wave motion. Of these, the first phase shows a continuous increase in the apparent rate of propagation as the distance from the origin becomes greater, and seems to emerge almost simultaneously at all points more than 145° from the origin. The second phase shows an increase in the apparent rate of propagation up to 100°, and a decrease beyond this; the result is unexpected, but the author, while remarking that it must not be rejected on that

account, also points out that the second phase is much less well marked in the distant records than in the nearer ones. From the figures given in the paper, it appears that the times taken by the three phases of wave motion to travel from their origin to its antipodes are respectively about 20, 50, and 100 minutes.

Physical Society, June 30.—Dr. R. T. Glazebrook, F.R.S., past-president, in the chair.—The comparison of electric fields by means of an oscillating electric needle: D. **Owen.** This paper describes experiments which show how an "electric needle" may be used to measure electric fields in a manner similar to that in which a magnetic field is measured by an oscillating magnetic needle. The needles used were cylindrical in form, of aluminium or of brass, and were suspended by quartz fibres three or four inches in length. The couple on the needle when disturbed from the direction of the field is proportional to the square of the field strength. For small displacements the needle vibrates isochronously, the frequency being proportional to the electric force. It may be used in alternating as well as in steady fields, and may be applied to illustrate many of the laws of electrostatics. The disturbing effect of the needle upon the field is considered; in particular its effect when placed in a uniform field. It is shown by experiments that the disturbing effect falls off rapidly with the distance from the needle, and is inappreciable (in the case of a needle $1\frac{1}{2}$ cm. long) at a distance of twice the length of the needle. With regard to the effect of the dimensions of the needle upon the frequency (for given field), while the restoring couple decreases rapidly with decrease of size, yet the moment of inertia decreases more rapidly, so that the smaller the needle the greater the frequency, and also the smaller the disturbing effect. The shielding effect of some dielectric materials was examined in the following way:—A needle was suspended centrally in the uniform field between a pair of parallel plates. A thin-walled cylinder of the dielectric was placed around the needle, and the shielding action denoted by a fall in frequency of the needle. Glass and mica were found to effect perfect shielding. Ordinary paper shields; but when thoroughly dried by heat the electric field is transmitted undiminished only to fall off to zero after a minute or two's exposure to the air. Dry paper soaked in melted paraffin-wax transmits the field perfectly and for an indefinite time. The paper concludes by pointing out that an electric needle suspended between a pair of parallel plates forms a simple means of measuring high voltages, since the frequency of vibration is simply proportional to the voltage between the plates.—The magneto-optics of sodium vapour and the rotatory dispersion formula: Prof. R. W. **Wood.** It has been shown in a previous paper that the vapour of metallic sodium is an ideal substance for investigating the effect of a strong absorption band on the magnetic rotation of the plane of polarisation. The preliminary work was not very satisfactory, as the method employed did not admit of very accurate determinations of the wave-lengths. Improvements in the methods of observation and design of the apparatus have been accompanied by an increase in accuracy, and accurate readings have been obtained for as many as nine different values of λ between D_1 and D_2. Rotations as great is 1440° (four complete revolutions) have actually been observed, and this with a 10 cm. column of not very dense vapour in a field of 2000 C.G.S. units. In the present paper the magneto-optics of the vapour for light travelling along the lines of force are discussed. The sodium was heated in a tube of thin steel, the ends of which projected from the helices of the magnet. It was found that the field strength within the steel tube did not differ greatly from that obtained when glass tubes were used. A short piece of small brass tubing is brazed into one end of the steel tube, through which the steel tube is exhausted. A good vacuum is essential, all traces of rotation disappearing in hydrogen or nitrogen at atmospheric pressure. Light from an arc-lamp made parallel by a lens is passed through a Nicol's prism, the steel tube, and a second Nicol, after which it is brought to a focus upon the slit of a spectroscope by means of a second lens. In the present case, a concave grating of 14 feet radius was used instead of a spectroscope, the observations being made both visually and by means of photography. The paper then describes the phenomena which are presented when the sodium vapour is formed in the magnetic field. In the case of very dense vapours the rotation has been measured over a considerable range of wave-lengths, namely, throughout the region comprised between $\lambda=5840$ and $\lambda=5922$. The rotation constant of D_2 was found to be about double that of D_1. Drude, in his "Lehrbuch der Optik," has given two formulæ for the magnetic rotatory dispersion, the first of which, developed from the hypothesis of molecular currents, calls for an anomalous effect on crossing the band, and does not apply to sodium vapour. The second, developed from the Hall-effect hypothesis, predicts rotations of similar sign and equal magnitude for wave-lengths symmetrically situated in the spectrum, with respect to the centre of the absorption-band. It seems likely that the molecular currents play some part, and that the formula built up on the hypothesis of the Hall-effect is incomplete. However, the latter formula represents the rotation outside of the D-lines with great accuracy, while between the lines it gives in some cases a curve which is elevated somewhat above the experimental curve. The paper concludes with an account of the bright-line spectrum produced by magnetic rotation which presents itself when the Nicol's prisms of the apparatus are crossed. The spectrum, which at first could only be seen with difficulty, was finally obtained of such brilliancy that it could be photographed with a 14-feet concave grating. A good vacuum was found to be an essential condition, the presence of inert gases causing a faintness of the lines.—The fluorescence of sodium vapour: Prof. R. W. **Wood.** The fluorescence of sodium vapour has been investigated by allowing light of various wave-lengths to illuminate the vapour, and then studying the light emitted with a spectroscope. Approximately homogeneous light of any desired wave-length is obtained by means of a monochromatic illuminator. Some sodium is placed in a horizontal steel tube fitted with steel ends, in one of which is a circular aperture bored just above the centre. The tube is heated and the vapour rises until it reaches the hole. The light from the monochromatic illuminator passes through the hole and falls upon the vapour. The fluorescent light is then observed by means of a spectroscope either visually or by photography. It is essential that the incident light should not traverse an appreciable amount of the vapour, or the fluorescent effects are masked by those of absorption. The bright lines of the fluorescent spectrum are by no means the exact complement of the absorption spectrum. Very remarkable effects have been observed when the vapour is illuminated with a *very* narrow band of approximately homogeneous light, the lines in the fluorescent spectrum changing their position and appearing to dance about with the slightest change in the wave-length of the exciting light. The motion is of course only an illusion, lines disappearing and others re-appearing, like the sparks of a spinthariscope. Stokes's law is violated in a most flagrant manner, bright lines coming out on both sides of the excited region. The behaviour of the spectrum indicates that we are dealing with a number of groups of electrons, each group containing a large number of vibrators. The excitation of one of these vibrators sets the whole group going, but does not start disturbances in the other groups.

EDINBURGH.

Royal Society, June 19.—Dr R. H. Traquair in the chair.—A comparative study of the dominant phanerogamic and higher cryptogamic flora of aquatic habit: George **West.** The paper referred to three loch areas of Scotland, namely, Loch Ness, the district between Nairn and Forres, and the Island of Lismore. In the first district the waters were peaty, in the third they were heavily charged with lime and were free of peat, while in the second district the waters were neither limey nor peaty, but were turbid and unwholesome in appearance, due to the presence of marsh gas. These characteristics influenced in a marked degree the habit of the aquatic flora, the distribution and growth of which were also dependent on the direction of the prevailing winds. Interesting details were given.—Les concrétions phosphatées de l'Agulhas Bank (Cape of Good Hope): Dr. Léon W. **Collet**; avec

une description de la glauconie qu'elles renferment, par Gabriel W. **Lee.** The work was undertaken under the direction of Sir John Murray, whose large collection of phosphatic nodules had been greatly enriched by the concretions dredged off the Cape of Good Hope by the steamer of the Department of Agriculture, and presented by Dr. Gilchrist, the Government biologist. The concretions were found beyond the 100-fathom line down to depths of 800 fathoms. Their occurrence, as already pointed out by Sir John Murray, is closely connected with the oceanographical question of the variability of temperature in certain regions. The mingling of two currents of different temperature is necessarily attended by a great mortality among the creatures living in these waters, and their dead bodies falling to the bottom produce ammonia and phosphate of lime. There can be little doubt that the glauconite and phosphates found in geological strata have been formed under similar conditions. In the material from the Agulhas Bank two kinds of nodules were found:—(1) those with Foraminifera and other calcareous organisms; (2) those without carbonate of lime and with the glauconite grains cemented together by phosphatic matter. These implied different modes of formation. Mr. Lee recognised two kinds of glauconite in the phosphatic nodules, the occurrence in the one kind being in the form of grains with definite contours, in the other in the form of a diffused pigment.—Note on some of the magnetic properties of demagnetised and annealed iron: James **Russell.** The iron was demagnetised by one of three methods, namely, by decreasing reversals of magnetic force co-directional with the field to be afterwards applied in the study of the permeability, by decreasing reversals of a transverse force, or by annealing. The permeabilities after these processes of demagnetisation were carried out were then compared, and various interesting conclusions arrived at. One very remarkable result was that, however much the values of the permeability differed under these varied conditions, the value of the coercive force (as defined by Hopkinson) was almost exactly the same in all cases.—Certain mathematical instruments for graphically indicating the direction of refracted and reflected light rays: J. R. **Milne.** These simple devices were not only useful in demonstrating the course of reflected and refracted rays, but could also be effectively used in graphically solving problems in geometrical optics the algebraic solution of which presented insurmountable difficulties in the way of carrying out the necessary eliminations.—On the hydrodynamical theory of seiches: Prof. **Chrystal.** This paper contained the mathematical solution of problems suggested by the phenomena of seiches in lakes, and showed how the periods of the various possible seiches and the positions of the nodes were affected by the contour of the lake bottom.—On a group of linear differential equations of the second order, including Chrystal's seiche-equations as special cases: Dr. **Halm.** This formed an important sequel to the foregoing paper, giving a mode of arriving at a solution of a case in which the direct method led to a slowly converging series, ill-suited for numerical determinations.—A monograph on the general morphology of the myxinoid fishes, based on a study of myzine, part. i., the anatomy of the skeleton: Frank J. **Cole.** By controlling the dissections by charts reconstructed from serial sections, the author obtained many results of importance in working out the micro-anatomy of the skeleton. Previous descriptions have thus been much extended, and the phylogenetic origin of the myxinoid skeleton may now be shown to be much simpler than has been hitherto supposed.

July 3.—Prof. Geikie in the chair.—The plant remains in the Scottish peat mosses, part i.: Francis J. **Lewis.** The paper contained a detailed account of the botanical stratification of peat mosses in the Scottish southern uplands, the discussion being in every case based upon evidence derived from freshly cut holes or from borings. The geological horizons were determined in most cases by the fact that the mosses rested on moraines which were known to belong to one of the Glacial periods. The conclusions were in full accord with the views originally put forward by Prof. James Geikie, and demonstrated the existence of the third, fourth, and fifth periods of glaciation in Scotland, those, namely, which are distinguished as (3) the district ice sheets, (4) the mountain valley glaciers, (5) the corrie glaciers.—Dissociation of the action of the auricles and ventricles: Dr. W. T. **Ritchie.** The paper contained an account of curious cases of heart block, a subject first studied scientifically by Gaskell. The graphs of the various pulse rhythms were obtained side by side, enabling the eye at a glance to contrast them and so prove the absolute independence of the action of the auricles and ventricles.—Cape hunting dogs (*Lycaon pictus*) in the gardens of the Royal Zoological Society of Ireland: Prof. D. J. **Cunningham.** The chief interest attached to these dogs was that they had been for the first time reared in captivity. The parents had been got from Holland, and during the four years 1896 to 1900 there had been four litters, but only three of the puppies had been brought to maturity. The peculiar colouring of the adult dog with its yellow and white patches was absent in the puppy stage, but gradually appeared as the animal grew older; also the dark band down the forehead became more marked with age. The animals were very intractable in captivity. An attempt to obtain a cross with a collie failed, the collie when introduced into the cage showing symptoms of excessive fear, while the male Lycaon paid not the least attention to her. The period of gestation in the case of the Cape hunting dog was found to be eighty days, somewhat longer than in the case of the domestic dog.—The Alcyonarians of the Scottish National Antarctic Expedition: Prof. J. A. **Thomson** and James **Ritchie.** The collection contained six new species, and specimens of three forms previously obtained by the *Challenger*. These were found in various latitudes, the furthest south specimen having been obtained in S. lat. 74°, off Coats Land. Our knowledge of the geographical distribution has been thus much extended. Of the beautiful *Umbellula durissima* the *Challenger* obtained one young specimen from the south of Yedo, while Mr. Bruce was fortunate in obtaining about a score of specimens, some of which are larger, older, and of more vigorous growth than that which Kölliker described in the *Challenger* reports.—The theory of determinants in the historical order of development up to 1852: Dr. Thomas **Muir.**—On the action of radium bromide on the electromotive phenomena of the eyeball of the frog: Prof. **McKendrick** and Dr. W. **Colquhoun.** It has been known since 1871 that when the fresh excised eye of a frog is connected by unpolarisable electrodes with a sensitive galvanometer an electric current may be detected, and that definite variations take place in that current when the retina is exposed to the action of light. It is also well known that salts of radium are luminous in the dark, and that when a tube containing radium is pressed against the closed lid of the eyeball a luminous effect is produced. It was of interest to ascertain whether this luminosity was due to the radium causing fluorescence of any of the structures of the eyeball, or whether it was due to the direct action of the radium emanations on the retina itself. The radium employed was kindly lent by Dr. Hardy, of Cambridge. The conclusions were as follows:—(1) The light emanating from radium bromide affects the electromotive phenomena of the living retina of the frog in a manner similar to that of light, although to a considerably less degree; (2) its action is not due to fluorescence of any of the structures of the eyeball, but to direct action on the retina; (3) the retina of the frog will respond to emanations of radium passing through cardboard, blackened paper, thin glass, and aluminium foil, emanations which, when allowed to fall on the human eye in a perfectly dark chamber, do not give rise to a luminous sensation; (4) the frog's eye is sensitive to the feeble light emitted from the surface of fluorescible minerals and fluids rendered fluorescent by radium; (5) the β rays are responsible for most of the effects observed, but after they have been largely excluded by thick glass a slight effect still persists, due presumably to the γ rays; (6) monochromatic light employed in a photographic chamber may still affect the electromotive phenomena of the living retina of the frog; (7) no satisfactory evidence could be obtained of the action of the ultra-violet rays of a lamp filtered through a Wood's screen. The slight movement of the galvanometer observed with light "off" might possibly be ac-

counted for by mechanical disturbance of the apparatus. As already pointed out by Prof. Gotch, there is great advantage in "adapting" the eye to darkness or to coloured light for three or four days.

DUBLIN.

Royal Dublin Society, June 20.—Prof. W. Noel Hartley, F.R.S., in the chair.—On the supply of water to leaves on a dead branch: Prof. H. H. **Dixon.** The fading of leaves on a branch killed by the application of heat is shown experimentally to be due in many cases at least to the introduction into the transpiration current of substances which cause a loss of turgescence of the leaf cells; consequently this fading does not prove that the water supply in these cases is inadequate, but rather that it is contaminated. A diminution, however, of the water supply may be caused by the high temperature, if this latter determines the rupture of the water columns of the tensile transpiration current or brings about the exudation of clogging substances into the conducting tracts from the dying cells. The conclusion, based on the withering of leaves on a killed branch, that the intervention of living cells is necessary to the elevation of the sap is thus rendered superfluous.—On the diagnosis of the eye by means of pinhole-vision: Prof. W. F. **Barrett,** F.R.S. The self-examination of the eye by looking through a pinhole in an opaque screen was termed *entoptic diagnosis* by Listing, who submitted this method to careful examination more than fifty years ago. The author was independently led to a similar discovery by noticing fixed shadows on his own retina when a bright spot of light was looked at. These shadows proved to be due to cataract, and led the author to the construction of an instrument which he calls an *entoptoscope*, whereby the patient can easily draw the exact extent of the obscuration in either eye. By means of two closely adjacent pinholes in a revolving diaphragm in the eye-piece and a transparent scale, the actual magnitude and position of the opacity in the eyeball can be accurately determined.—On secondary radiation (part iii.): Prof. J. A. **McClelland.** A continuation of the author's researches.

PARIS.

Academy of Sciences, July 10.—M. Troost in the chair.—On a calculation of the elastic resistance offered by a tube without longitudinal tension to inflation by a contained liquid column: J. **Boussinesq.**—On some experiments relating to the radio-activity induced by uranium: Henri **Becquerel.** This paper contains a study of the properties of the body formerly discovered by precipitation from the mixed barium and uranium chlorides by sulphuric acid, and since probably identified with Crookes's uranium X. It shows a remarkable stability of activity at very high temperatures.—On the treatment of trypanosomatous disease (surra, mbori) by arsenious acid and trypan red: A. **Laveran.** Extending his investigations on this method of treatment, the author has definitely cured the disease in dogs, animals in which it has always previously proved fatal. No trace of infection could even be found in the blood of the cured dogs.—On the treatment of bone fractures by movement: J. **Lucas-Championnière.** This new method follows a law which surgery hitherto has ignored, that, in spite of their rigidity, bones, like other tissues, require movement to ensure the vitality necessary for recuperation. The practice which the author follows is a peculiar form of massage, and not only conduces to the formation of the hard tissue, but is also favourable to the quick reparation of other neighbouring organs, such as muscles and tendons, involved in the fracture.—On the use of rockets against hail: E. **Vidal.** This paper explains how they are effectual in those cases where the storm centre is at a low altitude.—Researches on algebraic integrals in the motion of a solid heavy body about a fixed point: Édouard **Husson.**—On a new preparation of rubidium and cæsium: L. **Hackspill.** The author finds that these metals can be obtained by a method similar to that for obtaining potassium or sodium, viz. by reduction at a dull red heat of the alkaline chlorides with calcium. The resulting metal does not even attack glass.—A comparison of properties, tests, and classification of ternary steels: Léon **Guillet.**—On the molecular transformations of hydrated ferric sulphate: A. **Recoura.** If a concentrated solution of ferric sulphate be allowed to stand for some days a deposit forms, which rapidly grows until the liquid becomes practically solid. This occurs through the formation of a mixture of basic sulphate and free acid.—On dextro-dilactide: E. **Jungfleisch** and M. **Godchot.**—On the hydrogenation of the ketoximes. A synthesis of new amines: A. **Mailhe.** Among others, acetoxime by reduction with finely divided nickel gives a mixture of isopropylamine and di-isopropylamine.—On the synthesis of a new leucine: L. **Bouveault** and René **Locquin.** This body is probably one of the four possible amino-butyl-acetic acids.—On sparteine, and the symmetric character of the molecule: Charles **Moureu** and Amand **Valeur.**—On a sulphate of chromium which resists the action of reagents: Albert **Colson.**—On the figures formed by pressure or percussion on plastic crystalline metals: F. **Osmond** and G. **Cartaud.** These consist of groups of lines, curved on iron, straight on other plastic metals of the cubic system.—On some points in the morphology of the schizopods: H. **Coutière.**—On the segmentary organs at the moment of sexual maturity among the Hésionians and the Lycoridians: Louis **Fage.**—On the retraction of the mouth in the Chetopods: C. **Viguier.**—On an estimation of the red corpuscles in human blood made at the summit of Mont Blanc: Raoul **Bayeux.** After giving a table of results, the author concludes that a rapid increase in the number of red corpuscles takes place with increasing altitude. This number soon falls off with some rapidity, but remains abnormally high even some time after a return to the lowest point.—On intestinal poisons (their nature, and precautions to be taken against them): MM. **Charrin** and **Le Play.**—On the preparation and properties of protoplasmic extracts from blood corpuscles: Auguste **Lumière,** L. **Lumière,** and J. **Chevrotier.**—On the activity brought about in pure pancreatic juice by the combined influence of colloids and electrolytes: Larguier **des Bancels.** An inactive pancreatic juice becomes under these conditions capable of digesting albumin.—On the decomposition of albuminoids by Actinomyces: E. **Macé.**—On the Tertiary beds of Ouennougha and Medjana (Algeria): E. **Ficheur** and J. **Savornin.**

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