THURSDAY, AUGUST 25, 1892.

BRAMWELL'S CLINICAL ATLAS.

Atlas of Clinical Medicine. By Byrom Bramwell, M.D. Vol. I. (Edinburgh: Constable, 1892.)

THIS large and handsome volume is highly creditable to the author and to the Extramural School of Edinburgh, in which he is a lecturer. It consists of a series of thirty admirably coloured plates, mostly portraits of patients, with about an equal number of woodcuts, and descriptive letterpress. The account of the several diseases illustrated is so full and good that it almost makes the work a collection of illustrated monographs.

The diseases described and portrayed in this first volume are myxœdema and sporadic cretinism, Addison's disease, Hodgkin's disease, unilateral atrophy of the face, bulbar paralysis, Ophthalmoplegia externa, Molluscum fibrosum, Kaposi's disease, variola, melancholia, and mania.

There are also reports of cases of Friedreich's disease and of a few other rare morbid conditions.

The plan adopted by the author is to give a detailed account of the case or cases illustrated, and then a discussion of the disease under the heads of anatomy, diagnosis, and treatment, concluding with minute hints (such as one would give to intelligent ward-clerks) as to the points of clinical investigation. No order is observed in the sequence of subjects, and as the work is without a preface (though not, we are glad to say, without an index), it is not clear whether the author has formed any other plan than publishing interesting cases as they may come under his notice. The words "Volume I." on the title-page encourage the hope that Dr. Bramwell contemplates an additional series, and in that case it might be desirable to arrange the completed work in alphabetical or some other convenient order.

To take the first subject treated—Myxœdema—as a specimen.

There is first a brief notice of the first patient whose portrait is given; then an account of the original description of this remarkable disease by Sir William Gull in 1873; next a discussion of its geographical distribution and incidence on sex and age; the symptoms and pathology follow, and the author agrees with the conclusion of most who have studied the question, that this peculiar condition is in some way dependent on atrophy of the thyroid body; finally, the treatment is discussed, and the method of transplantation or grafting of a portion of the healthy thyroid of an animal into the patient's body is mentioned, with the results so far obtained by Bircher and Kocher.

Three portraits of patients afflicted with myxœdema follow, each with a full clinical history of the case. They are all three excellent, the colouring as well as the design being as good as chromo-lithography can produce.

This monograph is followed by one on sporadic cretinism, which Dr. Bramwell regards as "infantile myxœdema," another way of stating the true relation which Gull's remarkable insight led him to detect when he called the disease he discovered "a cretinoid condition in the adult." The paper is illustrated by seven uncoloured lithographs.

The two plates which belong to Addison's disease are the most artistic in the book; the difficulties are, of course, much less than in the case of myxœdema. Some of the other portraits are reproductions of photographs, very good in their way, but with the defects inseparable from this mode of illustration.

The three coloured plates of the singular affection described by Kaposi under the ill-chosen title of xeroderma pigmentosum are again excellent, particularly No. xviii. The illustrations of mental disease, although they display considerable power in draughtsmanship, are perhaps open to the objection of showing such fully developed and extreme aspects of the several states delineated, that they do not much help the recognition of less marked and typical examples.

We should, indeed, advise Dr. Bramwell, if, as we hope, he is encouraged to continue this valuable series of plates, to choose for illustration rather such infrequent morbid conditions as the diseases associated with the names of Graves, Addison, Raynaud, and Friedreich than the more familiar maladies which can be always studied at first hand.

It would also be well, perhaps, if in a scientific work of importance like this the catechetical method of instruction were omitted, which here and there interrupts the course of a paper. For instance, the following conversation, though no doubt an excellent paradigm of one method of class teaching, seems out of place where it stands (p. 30).

Dr. B. (to the students). The case, gentlemen, is exactly what I suspected. It is, in fact, an absolutely typical example of the disease. . . . Such are the leading facts; I shall now be glad to hear any suggestions you may have to make as to the diagnosis.

A Student. Tumour of the cerebellum.

Dr. B. No, it is not a case of tumour of the cerebellum.

And so on.

Here and there an inelegant word or sentence strikes the eye. Thus Dr. Bramwell pertinently remarks that Addison's discovery was not merely "a happy hit," but spoils the phrase by adding "it was no mere fluke." A more important error of omission is, that in quoting the interesting quotation which follows from Addison's original work, Dr. Bramwell makes no clear distinction between the graphic and marvellously accurate account of idiopathic Anæmia, and the description of Melasma suprarenale, as the discoverer named it, which begins: "It was while seeking in vain to throw some additional light upon this form of anæmia that I stumbled upon the curious facts which it is my more immediate object to make known to the profession." The fact is that Addison, in a few pages, made known the existence and clinical features of *two* rare and remarkable diseases—idiopathic (since called grave or pernicious) anæmia and Melasma suprarenale (since called Morbus Addisonii). Dr. Bramwell is well aware of these facts, but it would have been useful if he had fully stated them, particularly as so much confusion on the subject still prevails both in this country and in Germany.

In conclusion, we must repeat that the present volume is most creditable to the author, to his artist, and to the publishers. It is remarkably moderate in price, and we trust that it will be so well supported by societies and private purchasers that Dr. Bramwell will be encouraged to continue so admirable an enterprise.

MODERN DEVELOPMENTS IN NORWAY.

Handbook for Travellers in Norway. Eighth Edition, Revised. (London: Murray, 1892.)

NORWAY now shares with Switzerland the privilege of being "the playground of Europe," and would even take precedence were it not for the sea voyage there and back. The recent progress of tourist invasion is curiously displayed by reference to the various editions of Murray's Handbooks.

We have before us the tattered remnants of our old travelling companion and oracle—Part 1 of the "Handbook for Northern Europe," including Denmark, Norway, and Sweden (1849). We are there told that by the last census in 1835 the population of Christiania was 33,000. The last edition tells us that its population is now 156,000. This is good progress for a capital city, but that of the chief town of Arctic Norway is still more remarkable. Tromsö (lat. 69° 38′ N.) had in 1816 only 300 inhabitants. Its present population is above 5,700, in spite of the fact that for more than two months the sun is continuously below the horizon. On the 22nd January, when it makes its first appearance over a crag to the south of the town, there is much jubilation, general holiday, and gun firing. In the old handbook the journey from Tromsö to the North Cape is described as an adventurous expedition demanding special preparations, which are described, and ladies are warned not to attempt it. Now it is as easy as a trip from London Bridge to Ramsgate, in steam packets incomparably superior to those wh'ch carry passengers down the Thames.

In the old handbook the Skjeggedalsfos, justly described in the present edition as "more grand and picturesque than any other waterfall in Europe," is unnoticed, as also in the next edition (1858). It was then unknown to the outer world, including Norway itself, until a solitary English pedestrian—the writer—ventured to explore the valley of the Tyssedal, to climb further on, and sojourn for a night in the Ringedal. It was first described in 1859 in "Through Norway with a Knapsack." Now it is one of the primary "lions" of Norway; there is a regular passenger boat on the lake, so solitary and desolate before 1859, professional guides, and an hotel in course of erection. The other grand region of Norway—the wildest of all—the *Jotunhjem*, which in the early editions of the Handbook was merely referred to in a single paragraph of a few lines, and in 1874 in two paragraphs bracketed as a side route, was made the subject of a special section of fifteen pages in the edition of 1880, illustrated by a special map of the district. This is continued in the present edition.

The Norwegian Tourist Club has strong claims upon the gratitude of all Norwegian tourists. Besides publishing in its transactions the record of explorations which have opened up many interesting districts, it has erected huts for refuge in the Jotunhjem, rendered a visit to the foot of the Vöringfos and many similar places possible, and set up many useful sign-boards indicating paths to waterfalls, points of view, &c. The assistance thus freely given to tourists in Norway contrasts very remarkably with the twopenny tricks of British landlords, who, for a consideration, permit their tenants to put up gates and charge admission to so many of our little dribbles designated waterfalls, and other natural objects of interest.

The present Handbook is brought up to date, and improved in many respects, notably by being printed on thinner paper than heretofore, and by setting the bye routes in smaller type, as Baedekker does. There is a valuable feature altogether new, viz., a Guide to Cycling Routes in Norway. The old accounts of the old hilly roads—which are now greatly improved or wholly superseded—led to false impressions on the subject. The writer delivered a lecture on "Cycling in Norway" to the Society of Cyclists some years ago which corrected these impressions, and induced many cyclists to do Norway; this appendix to Murray's Handbook will doubtless have still greater effect. In one important respect Norway offers the cyclist unrivalled advantages, viz., its admirable national organization of "Stations" for bed and board at regular intervals of about eight miles apart, and the annual publication of an authorized guide to all the roads and all the stations thereon, of which Mr. Bennett publishes an English translation with additions and maps, which render it a very valuable handbook.

An ideal handbook of Norway is, however, still demanded. The country being a narrow strip extending from 58° to 72° of latitude, it lends itself to a scheme of simple mapping, in horizontal strips of one degree each, which would require no cross folding. Each degree on the scale of Munck's map would occupy only the depth of one of Murray's pages. The scale of this map is sufficient for pedestrians, cyclists, and carriole tourists. With such a series of maps and a small key map, the only handbook reference demanded would be designation of latitude. In 1880 the writer constructed such a series from Munck, and suggested its adoption by the publishers, but the suggestion was not carried out. The development, or rather creation, of hotels in Norway is marvellous. The night before last we stopped at the Stalheim Hotel, dined in a magnificent salon, with roomy seats for 300 guests; music at dinner; concert in capacious smoking-room every evening; several drawing-rooms and 200 beds; all the salons lighted by electricity. Formerly—at the time of our first visit—the only provision here for travellers was a very inferior "station," a little hut with two or three questionable beds; no such luxury as white bread. Much of this is due to the modern development of cruising in what may be called cooperative yachts, such as the *Ceylon* and the larger vessels of the Orient Company and others, which carry about a hundred passengers on each cruise, visit the finest fjords, and halt for inland trips, thus rendering a short holiday available for Norway, so far as the outer fringe of its grand scenery is concerned. W. M. W.

Odde, August 13, 1892.

OUR BOOK SHELF.

Ostwald's Klassiker der Exacten Wissenschaften. (Leipzig: Verlag von Wilhelm Engelmann.)

IT is extremely important that every student of science should as far as possible make himself familiar with the history of discovery in the various subjects in which he is interested. He can hope to understand thoroughly the present position of any department of science only if he understands the stages of development through which it has passed. And by far the most effective way in which this knowledge can be attained is by the study of the memoirs in which the great masters of research have recorded their discoveries and described the methods by which their results have been reached. These documents bring the student into contact with the finest intellects which have been devoted to original inquiry; and he will be surprised to find how much freshness is often given to an old doctrine when it is apprehended precisely in the way in which it presented itself to the investigator by whom it was first brought to light. Judged from the point of view of later thinkers, the achievements of even the most illustrious workers belonging to past times may be in some ways found wanting; but the mistakes of great men, when properly understood, may sometimes be almost as instructive as those of their conclusions which have stood the test of the closest and most prolonged examination.

Important as it is that the classics of science should be widely and carefully studied, they have hitherto, unfortunately, been accessible only to a comparatively small class. It was therefore an excellent idea to issue a series of them in a convenient form and at a moderate price, so that they might be brought within easy reach of all to whom the study of science is either a duty or a source of interest and pleasure. Upon the whole, those who planned the present series may be congratulated upon the manner in which their scheme is being executed. Dr. W. Ostwald is acting as general editor, while particular departments have been entrusted to specialists—astronomy to Dr. Bruns, mathematics to Dr. Wangerin, crystallography to Dr. Groth, physiology to Dr. G. Bunge, the physiology of plants to Dr. W. Pfeffer, physics to Dr. A. von Oettingen. The only serious fault we have to find is that memoirs in foreign languages have not been printed in their original form, but have been translated into German. This cannot but diminish the usefulness of the series from an international or cosmopolitan point of view; and we may doubt whether it is really the best plan even for German students. So far, at least, as English and French memoirs are concerned, there are probably few serious students in Germany who would not have preferred to have before them the actual words used by the authors themselves.

The memoirs are not being issued in chronological order. The series opens with Helmholtz's paper on the conservation of energy (1847). This is followed by papers by Gauss, Dalton, Wollaston, Gay-Lussac, Galileo, Kant, T. de Saussure, Laplace, Huyghens, Woehler, Liebig, Bunsen, Pasteur, and many other famous men of scientific light and leading.

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.*]

Aurora Borealis.

THE auroral display of Friday, the 12th inst., referred to in last week's issue of NATURE, would seem to have been visible over a wide area. Between 9.30 and 10 p.m. I observed it at Boppard, on the Rhine, a few miles above Coblence. The streamers were clearly defined, but presented no unusual features, being merely rays of whitish light which slowly dissolved as the moon rose above the crest of the range of hills running along the right bank of the river. On the previous evening I was at Strassburg where, owing, I suppose, to the gas and electric lights, I took the greyish appearance of the northern horizon to be nothing more than the usual light in that quarter at this season. Further south, in Switzerland and Austria, auroræ were seen on both nights. As to "the unusual time of year for such a display," I may mention that on Sunday, August 2, 1891, I witnessed a brilliant aurora from the Deck of the R.M.S. *Teutonic*, in latitude 48½° N., longitude 30° W. It varied considerably in intensity, and continued to do so for half an hour up to 10 p.m. HY. HARRIES.

Bayswater, August 20.

An Unusual Sunset.

THIS evening (July 29th) we were treated to a sunset of rare type, one which is unique at least in the experience of the writer.

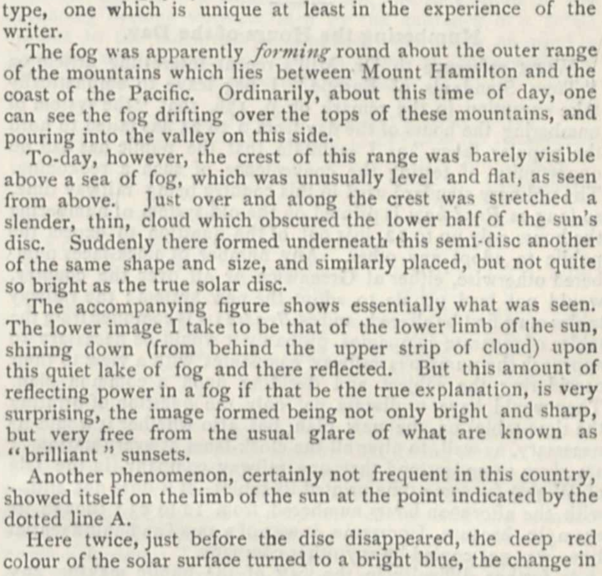
The fog was apparently *forming* round about the outer range of the mountains which lies between Mount Hamilton and the coast of the Pacific. Ordinarily, about this time of day, one can see the fog drifting over the tops of these mountains, and pouring into the valley on this side.

To-day, however, the crest of this range was barely visible above a sea of fog, which was unusually level and flat, as seen from above. Just over and along the crest was stretched a slender, thin, cloud which obscured the lower half of the sun's disc. Suddenly there formed underneath this semi-disc another of the same shape and size, and similarly placed, but not quite so bright as the true solar disc.

The accompanying figure shows essentially what was seen. The lower image I take to be that of the lower limb of the sun, shining down (from behind the upper strip of cloud) upon this quiet lake of fog and there reflected. But this amount of reflecting power in a fog if that be the true explanation, is very surprising, the image formed being not only bright and sharp, but very free from the usual glare of what are known as "brilliant" sunsets.

Another phenomenon, certainly not frequent in this country, showed itself on the limb of the sun at the point indicated by the dotted line A.

Here twice, just before the disc disappeared, the deep red colour of the solar surface turned to a bright blue, the change in



colour being just about what one would experience in examining a prominence first through the C line and then through the F. Then again at the last moment, when all had disappeared but a narrow strip at the eastern limb, this flashed out into the same light blue, an effect apparently due to the greater refrangibility of the blue rays, combined with a very steady atmosphere.

Mr. Barnard says that for half an hour after sunset he observed "a small bright spot of light" at the point where the sun had disappeared. HENRY CREW.

Lick Observatory, July 29.

The Red Spot on Jupiter.

ON August 19, at 14h. 40m., I began observing Jupiter with my 10-inch reflector, power 252. The red spot was seen slightly east of the central meridian, and it looked decidedly fainter and less definite than during the last opposition. The spot was estimated to be precisely central at 14h. 46m., and this is 14·3 minutes in advance of the time given in Mr. Marth's ephemeris (*Monthly Notices*, May, 1892). The motion of the spot has therefore shown a considerable acceleration during recent months. Between August 2, 1891, and February 2, 1892, the mean rotation period was 9h. 55m. 42·2s, but between February 2 and August 19, 1892, it was only 9h. 55m. 39·3s. This is a difference of 3 seconds, and it clearly proves that the motion of the spot is affected by some remarkable variations. A very decided retardation set in at the end of August, 1891, and continued to operate until February, 1892, but since that time the spot has exhibited an expected celerity of movement.

A large number of interesting details are now visible on the planet, but the bright equatorial spots which were so conspicuous about twelve years ago have virtually disappeared. During my observation on August 19 I saw the third satellite projected on the southern limb of the planet as a bright spot.

Bristol, August 20. W. F. DENNING.

Numbering the Hours of the Day.

WITH reference to Dr. Mill's recent interesting article on "Time Standards of Europe," I beg leave to emphatically take exception to the remark on p. 176, that "the system of numbering the hours of the day from 0 to 24 has failed to hold the popular fancy," as I maintain that the public has had no opportunity of testing the convenience of such a reckoning. The ordinary standard used in this country being railway time, so long as *Bradshaw* is printed on the old system of numbering the hours only up to 12, it is out of the question to expect the public to adopt any other. Any number of clock-faces numbered otherwise, either at Greenwich or all over the country, would not lead people to adopt the new system; the railway tables must first be altered, and as *Bradshaw* is compiled from the tables of separate companies, probably it would be necessary to approach the numerous railway companies with a view to their considering the subject and deciding upon a common plan. They would have to discuss not only the question of printing the time-tables on the new plan, but also whether it would be necessary, as well, to alter all the clock-faces at every station. I am given to understand that one railway company (in the Isle of Wight) for some time printed its tables—if it does not still—with the afternoon hours numbered from 12 to 23; though its example, because, I presume, it was of a small and uninfluential line, was not copied by any other company.

A further difficulty in the way of the public making any change is that the highest authoritative book on time matters—the *Nautical Almanac*, compiled and published by the British Government—still reckons the hours from noon. As a civil day commencing at noon is not suggested, would not the railway authorities have a ready objection to urge, and decline to alter their time-tables while time bearing the name of the national observatory, and used in the national ephemeris, were reckoned on a different plan from that which it is suggested they should adopt?

As regards the existing mode of reckoning time, the art of the printer is sometimes called in to show at once, without having to refer to the tops of columns or the sides of pages, which half of the day is meant; thus in the Midland Railway's, and part of the North-Eastern Railway's time-tables thick and thin type show this, and in some other tables a short vertical line appears between the figures of the hours and those of the minutes.

If the lists of places (p. 176) at which the time of the national standard is kept and not kept are intended to be complete, may I ask if Jersey has yet adopted Greenwich time? It had not up to 1887, although Guernsey had done so.

Sunderland, August 1. T. W. BACKHOUSE.

Propagation of Magnetic Impulses along a Bar of Iron.

IF at one end of an iron bar an alternating current be passed through a coil, will there be a wave propagation of magnetism along the bar?

Mr. Trouton (NATURE, vol. xlv., p. 42) hoped to find an answer to this question by searching after nodes, when two coils are placed one at each end of the bar, and the same alternating current is passed through both coils, or when one coil is employed on a closed iron ring. The search was conducted by a secondary coil connected with a telephone. Mr. Trouton found some places of minimum, but ascertained that these were not the nodes sought for.

Mr. Trowbridge (*Phil. Mag.* [5] 33, p. 374, 1892) made use of his phasemeter; two secondary coils, each connected with a telephone, could slide along the ring on which two large primary coils were placed. Two mirrors on the diaphragms of the telephones permitted to study change of phase by Lissajous's figures.

From his experiments, Mr. Trowbridge infers that there was no wave-motion along the iron ring; he believes that the propagation of magnetic disturbances produced by forced oscillations on iron bars is closely analogous to the propagation of heat over these bars.

Though I agree with Mr. Trowbridge in his conclusions, it seems to me that neither the experiments of Mr. Trouton nor those of Mr. Trowbridge could give any but embroiled results.

In collaboration with Mr. N. G. van Huffel, Phil. Nat. Cand. at this University, I have made some preliminary experiments on this question. Firstly, it became obvious that care must be taken against direct induction of the primary coils on the secondary. Only when the secondary coil which was connected with the telephone was embedded in a mass of copper everywhere 2·5 cm. deep, with a narrowly closing aperture for the iron bar, these direct effects were eliminated if the distance of the secondary from the primary coil were not too small. I have found no indication that similar precautions were taken in the quoted experiments.

But secondly, the telephone proved to be not the proper instrument for conducting the research. In most cases the variation of the magnetic intensity goes too slow to be perceptible by the telephone.

At one end of an iron bar (5 meters long, 1·5 cm. diameter), a primary coil A was placed; along the bar the secondary coil B (within a mass of copper, and connected with a telephone) could slide. A magnetic impulse was given by sending a current through A. If B were near A, a single tick was heard in the telephone: if the distance between B and A were greater, nothing was perceived in the telephone. However, if the circuit composed of B and the telephone were interrupted by a tuning-fork P, a sound was heard during somewhat one second and a half of the same pitch as the tone of the tuning-fork P, every time the primary current was sent through A, or broken. The intensity of this sound diminished as the distance of B from A increased, but was still perceptible wherever B was placed on the bar.

Thereupon the primary circuit to which belongs the primary coil A was interrupted by a tuning-fork Q. If no tuning-fork were in the circuit of B and the telephone, then only when B was near A a sound was heard of the pitch of Q; at a greater distance nothing was heard in the telephone. But if now a tuning-fork P interrupted the circuit of B and the telephone, a continuous sound was heard, even at much greater distances of B from A. When the pitch of P differed slightly from that of Q, beats were perceived, also when the frequency of P was nearly half that of Q. The interpretation of these facts is so apparent, that I need not dwell upon it. But these facts illustrate the principle on which Van Rysselberghe based his method of simultaneously sending telegraphic and telephonic signals along the same line.

I believe that the propagation of magnetic impulses along a bar of iron has to be studied in an entirely different way. We intend to make an attempt in this direction ere long.

Utrecht, July, 1892. V. A. JULIUS.

"The Limits of Animal Intelligence."

CLOSELY in connection with an observation I made the other day with respect to an argument of Prof. Pearson's, I should like to say a few words about a paper read by Prof. Lloyd Morgan before the International Congress of Experimental Psychology, on "The limits of animal intelligence." The first proposition he advanced, "That human psychology is the only key to animal psychology," and the deductions he subsequently drew, all implied that our knowledge of human psychology differed not only in degree, but in kind, from our knowledge of that of animals. Of course it is true that my knowledge of *my own* psychology does differ in kind from my knowledge of that of animals, but it differs in exactly the same way from my knowledge of that of all other men. If in no case is "an animal activity to be interpreted as the outcome of the exercise of a higher psychical faculty, if it can be fairly interpreted as the outcome of one which stands lower on the psychological scale," the same rule should be applied to the interpretation of human activities, for the only reason for distinguishing between human and animal psychology is that their activities do, as a matter of fact, differ. Human beings are of course distinguished from animals in other ways; in the structure of their limbs, for example; but there is no *a priori* ground for inferring from such differences any, and certainly not any particular, difference in psychological powers. And so far from its being permissible to infer such a difference from greater or less complexity of brain-structure, it is only because animals which when alive displayed great activities proved, on dissection, to have possessed complex brain structure, that we can infer any connection whatever between the two phenomena. As no man has ever dissected his own brain he cannot say that any particular structure is associated with those psychological powers of which alone he has any more direct knowledge. If, for example, I say "Morality involves a perception of the relation between the actual and ideal, and is based on introspection," I say this in consequence of my personal experience. I can only infer morality, introspection, and so on, in other beings, whether animals or men, by judging from their activities. And if "most cases of so-called morality in the dog can be otherwise interpreted," so also can most cases in other men. A fundamental distinction between the psychological powers of animals and men could only be established by showing a fundamental distinction between animal and human activities, as observed from outside by a third person. And though it is easy to show that there is a difference in degree, Prof. Morgan did not adduce any cases which even tended to show that there is any difference in kind. The cases he did adduce all tended the other way; and though this was doubtless because he only adduced difficult cases in order to show that his theory was capable of explaining them away, his explanations seemed to me, for the reasons I have given, insufficient.

Note.—The quotations are from a printed *précis* of his paper distributed by Prof. Lloyd Morgan at the meeting.

EDWARD T. DIXON.

12, Barkston Mansions, South Kensington, August 5.

Tropical Cyclones.

A FEW years ago I drew up some simple mathematical rules to aid the Jamaica Weather Service when in doubt as to the indications, and thinking that these rules may be of some use to other isolated or nearly isolated stations in the Tropics, I state them here, and give an example or two as to their application.

At the time and place of observation let

p = Reading of bar in inches and decimals of an inch, corrected for instrumental error, reduced to 32° F. and sea-level, and further corrected for diurnal variation.

p_m = Mean value of p for the time of the year.

$\Delta p = p_m - p$ = fall of pressure below the mean.

v = Velocity of the wind in miles per hour.

r = Distance of the centre of the cyclone in miles.

$\frac{dp}{dr}$ = Bar-gradient, or the fall of p per mile towards the centre at the place of observation.

$\frac{dp}{dt}$ = Rate of fall, or the fall of p per hour.

$\frac{dr}{dt}$ = Rate of approach of the centre in miles per hour.

Now let us suppose that the centre is moving towards the place; in this case we have

$$\frac{dr}{dt} = \frac{\frac{dp}{dt}}{\frac{dp}{dr}} = \frac{\text{Rate of fall}}{\text{Gradient}} \quad \ldots\ldots (1)$$

In Jamaica $\frac{dp}{dr}$ is found by an exchange of telegrams between Kingston and Kempshot, these places being on the line of usual approach, and 77 miles apart.

The next equation is based upon the results of observation:—

$$r = \frac{\Delta p}{2\frac{dp}{dr}} = \frac{\text{Fall below mean}}{\text{Twice the gradient}} \quad \ldots\ldots (2)$$

This equation must not be pressed; it is intended to be used when the centre is still a long way off.

Thus we have

$$\text{Time of arrival of the centre} = \frac{r}{\frac{dr}{dt}} = \frac{\text{Fall below mean}}{\text{Twice the rate of fall}} \quad \ldots\ldots (3)$$

This is an important equation, for it shows that the direct approach of a cyclone may be ascertained by the constancy in the computed time of arrival.

As an example, let us take the cyclone which passed over Kingston, Jamaica, August 18, 1880. This was before the Weather Service was established, and the indications of the advancing cyclone were confused by the existence of a small cyclone to the north-east of Kingston; there was no wind in Kingston until 8 p.m., and rain fell quietly in showers all that afternoon from a sky covered with stratus.

Kingston, Jamaica, August 18, 1880.

	p	Δp	$\frac{dp}{dt}$	Time of arrival.
7 a.m.	29·845			
9 ,,	·807	0·178	0·0170	2 p.m.
11 ,,	·777	·208	·0142	6 ,,
1 p.m.	·750	·235	·0120	11 ,,
3 ,,	·729	·256	·0225	9 ,,
5 ,,	·660	·325	·0595	8 ,,
7 ,,	29·491	0·494	0·1808	8.30 ,,
9 ,,	28·937			

From the last column it appears that from 7 a.m. to 1 p.m. the cyclone was not directly approaching, and from the logs of vessels and other information it is certain that the cyclone was passing south of Jamaica on a westerly course, and that between 1 and 3 p.m. it turned on its course and advanced directly towards Kingston. The centre arrived at about 9 15 p.m., lowest p = 28·917.[1] A warning notice was posted at 3 p.m., but had these rules been in existence, a better notice could have been posted at 5 p.m.

Now if the gradient be not known at an isolated station, it may sometimes be deduced from the theoretical equation—

$$\frac{dp}{dr} = 0{\cdot}00007v \quad \ldots\ldots\ldots (4)$$

This equation is only to be used for considerable distances from the centre; and if v be small, or variable, or if it be mixed up with the sea-breeze, it cannot be used at all.

If $\frac{dp}{dr}$ be known, r is known from (2), and then some idea may be formed as to the magnitude of the coming disturbance. The following rule may prove useful:—

Let Δp_c be the fall below the mean at the calm centre of the cyclone; then, roughly—

$$\Delta p_c = \frac{\Delta p\sqrt{r}}{6}\left(1 + \tfrac{3}{4}\Delta p\sqrt{r}\right) \quad \ldots\ldots (5)$$

Now $\frac{dp}{dr}$ is unknown in the example above; but if we take $\frac{dr}{dt}$ = 18 from the subsequently known circumstances, (1) gives $\frac{dp}{dr}$ = 0·0012 at 3 p.m.; (2) gives r = 106 at the same hour which happens to be right; and (5) gives Δp_c = 1·3, which is a little too large, the observed fall at the centre being about 1·1.

As another example, let us take the great hurricane in Mauritius on April 29 this year. Some valuable notes by Dr. Meldrum are published in NATURE, June 9, but unfortu-

[1] See "Jamaica Meteor. Obs.," vol. i. (Introduction).

nately the readings of the barometer are not corrected for diurnal variation, although the given values of $\frac{dp}{dt}$ are so corrected; and I can only apply approximate corrections, and so obtain approximate values of Δp.

Mauritius, April 29, 1892.

	p	Δp	$\frac{dp}{dt}$	Time of arrival.
6 a.m.	29·668	0·282	0·018	2 p.m.
8 ,,	·597	·353	·029	2 ,,
9 ,,	·536	·414	·063	1 ,,
10 ,,	·440	·510	·094	1 ,,
11 ,,	29·304	0·646	0·131	1.30 ,,

The computed time of arrival is therefore 1.30 p.m., and the agreement in the last column shows that the centre was directly approaching the place of observation, and it really arrived there at 2, or 2.30 p.m.

Now at 6 a.m. the wind was 22·4 miles an hour: (4) gives $\frac{dp}{dt} = 0·0016$; (2) gives $r = 104$; and (5) gives $\Delta p_c = 1·5$, which is a little too small, the observed fall at the centre being about 2·0. If, however, we compute Δp_c for 9 a.m., we get 2·4, which is a little too large; and as in the case of time of arrival, we should be guided by a series when possible.

Jamaica, July 29. MAXWELL HALL.

A Sparrow's Antipathy to Purple.

I HAVE but just seen your number for March 10. About five years ago I knew a tame sparrow with a great antipathy for purple. It was brought up in a room, but not, or seldom, caged. It lived four or five months. A piece of blue paper placed over its food would cause it to hesitate, though if hungry it would eventually draw the paper aside; a person coming into the room wearing a blue dress would make it quite wild, and a habit of mischievously pecking at a certain part of the wall of the room was successfully stopped by hanging a piece of blue paper there. This sparrow was taught to be cleanly in its habits. I had put off writing this to you in hopes that others who saw more of the sparrow would have written a more detailed account, but trust this letter may not be too late for any one interested to get a young sparrow from the nest this year and rear it. Sparrows have not yet reached Borneo. G. D. HAVILAND.

Sarawak, June 17.

Bumping in the Lane Fox Mercurial Pump.

CAN any reader of NATURE favour me with a method by which the bumping in the Lane Fox pump may be obviated? I find that when exhaustion is pressed to a certain point, the bumping becomes so violent, in spite of the utmost care in lowering the reservoir, that the bulb of the pump is constantly cracked. D. G.

Lahore, July 25.

CARL SCHORLEMMER, LL.D., F.R.S.

CARL SCHORLEMMER having been my friend and colleague in Owens College for more than thirty years, it is with a sad pleasure that I take up my pen to record in the columns of NATURE some few details of his character and work. He had not, like his predecessor Dittmar, been a fellow student with me in Heidelberg, but had worked at chemistry in Darmstadt, where he was born, and at Giessen. In 1858 Dittmar, who up to that year had been my private assistant, obtained the College appointment of Demonstrator, and he strongly urged me to offer his vacant post to his friend Schorlemmer, a young man of great promise. From the time of his arrival in Manchester until the day of his death I do not recollect that in all the intercourse of those years Schorlemmer and I ever had a single serious difference. Whilst my private assistant he and I examined the relation which the aqueous acids exhibit as regards boiling point and composition, and I remember well the difficulties we had to contend with in distilling fuming nitric and hydrofluoric acids under pressure, and I also remember how successfully he met them. Once, I know, he got some fuming hydrofluoric acid on his hand, and he bore the scar of the serious burn to the end. This work with me was his apprenticeship. In a short time Dittmar left us, and Schorlemmer took his place as the official Laboratory Assistant, and as we had not many students at that time, he had leisure to begin the hydrocarbon work which has placed his name high in the list of organic chemists of the century. In 1861 the late Mr. John Barrow, of the Dalton Chemical Works, Gorton, brought me a sample of the light oils which he had obtained in the distillation of cannel coal. At that time our knowledge of the chemical composition of the low-boiling coal-oils was very incomplete, and I urged Schorlemmer to undertake the investigation. This was the beginning of the work which led to a result which altogether modified the existing ideas concerning the constitution of the paraffin hydrocarbons, and paved the way for the sound foundation upon which the organic portion of our science has since been successfully laid. In order to appreciate Schorlemmer's results let us for a few moments glance at the position of the question when he commenced work. Before 1848 the only known member of the paraffin series of hydrocarbons, was methane CH_4. In the above year the researches of Kolbe on the electrolysis of the fatty acids, and of Frankland on the isolation of the alcohol-radicals, opened out new fields yielding a rich harvest. Each molecule of these latter hydrocarbons was supposed to contain two molecules of the radical methyl being represented as $\left.\begin{matrix}CH_3\\CH_3\end{matrix}\right\}$, whilst together with these a second series of hydrides was believed to exist, $\left.\begin{matrix}C_2H_5\\H\end{matrix}\right\}$ ethyl hydride standing in the same relation to the radical as an alcohol does to an ether. The truth of this view seemed confirmed by Wurtz's discovery of the existence of the so-called mixed radicals in which two molecules of different bydrocarbons, such as ethyl and amyl $\left.\begin{matrix}C_2H_5\\C_5H_{11}\end{matrix}\right\}$ occurred. How was this question to be settled? Schorlemmer at once seized upon the correct method of solution and carried it out successfully. If, said he, the radical methyl $\left.\begin{matrix}CH_3\\CH_3\end{matrix}\right\}$ is identical with hydride of ethyl $\left.\begin{matrix}C_2H_5\\H\end{matrix}\right\}$ not only must these two bodies possess the same properties, but both bodies must yield the same product, viz., ethyl chloride, on treatment with chlorine. This identity he proved, not only in the above—the most simple case—but in the more complicated cases of ethyl-amyl $\left.\begin{matrix}C_2H_5\\C_5H_{11}\end{matrix}\right\}$ and of di-amyl $\left.\begin{matrix}C_5H_{11}\\C_5H_{11}\end{matrix}\right\}$ as these hydrocarbons yielded respectively chloride of heptyl and chloride of decatyl, $C_7H_{15}Cl$. and $C_{10}H_{21}Cl$. It is difficult to overrate the importance of this apparently simple discovery. It laid for ever the ghost of the existence of two sets of isomeric hydrocarbons of the paraffin series, and paved the way for Kekulé's theory of carbon combination, upon which the whole modern theory of organic chemistry is based. So to Schorlemmer belongs the credit of placing in position the foundation-stone of our science. And at once his name became known as a master wherever chemistry is studied; so that in 1871 the Council of the Royal Society admitted him to the Fellowship at once, an honour conferred nowadays on few.

But it was not only as an expert experimentalist that Schorlemmer excelled, and his thirty-two papers catalogued in the Royal Society list prove that he was a successful one. He possessed an exhaustive knowledge, uncommon amongst chemists, of the literature of his special science in all its varied departments. If any of our men wanted a quick reference to either recent or ancient work, it was always "Go and ask Schorlemmer," and they seldom came empty away. But his acquaintance with other sciences was also considerable. If he had not been a distinguished chemist he would have made an equally distinguished botanist. He likewise possessed in full measure that dogged power of work which distinguishes the German. I was especially fortunate in securing his co-operation as co-author of the Treatise. The success of my little book—as to which no one was more surprised than myself—induced me to set about the task of writing a larger and more complete work. I soon found that the other very various and pressing duties of my position rendered it impossible for me to do all the work myself, and my friend Schorlemmer joined me in this somewhat laborious business. To him the organic part almost entirely owes its being, whilst in the inorganic portion his assistance and suggestions were most valuable. We published the book simultaneously in Germany and England, and it is not too much to say that in both countries the work has become a standard one. For the last few years of his life this was his main work. Only those few men who have lately attempted the task of writing even a moderately complete treatise on modern organic chemistry can know what serious labour such work entails. Several distinguished chemists have given up the task as hopeless, and have not completed what they had begun. If Schorlemmer's life had been spared he would have brought his work to a conclusion, cost what it might. Our consolation—and it is but a poor one—at his early death (for he was only fifty-eight), must be that, so far as the chemistry of the hydrocarbons and their derivatives are concerned, his manuscript is complete, and in the hands of Messrs. Vieweg. A mass of material he has gathered together for the remaining organic compounds in which nitrogen occurs as a constituent element. It will be my task to see whether this last portion of the work is complete, and if not, how it can best be brought up to the level of the day.

As a historian of our science, I think that the designation of him by his German friends as the "English Kopp" is a just one. Only a few weeks before his death he talked to me with pleasure of the results of his work on an introduction to the history of chemistry, which had engaged his attention for many months past. Fortunately, he had the rare power of writing so that his manuscript was at once ready for press. Hence, although a fragment, his history so far as it goes—and I believe it goes as far as the end of the eighteenth century—is complete. We shall all look with interest to its speedy publication, and from what I know of the author's works and ways, I shall be disappointed if this fragment does not throw a new light on many dark pages in the early history of our science. One word more as to his character. I have said that we never had a difference, and I believe from what I know of his other friends that they would say the same. He was of a retiring, most modest, and unassuming disposition. To only a few of his intimates, German and English, were his true colours visible. As a laboratory teacher he was excelled by few, merely as a lecturer by many. But although, like some other eminent lecturers, his diction may have been faulty, the staple article was there, and I never met a real student amongst all those who passed through his hands who did not express his admiration for the man, and his sense of the obligation which he felt for the masterly instruction which the Professor always and most readily gave, whilst the long list of honours which his men gained in organic chemistry, both at London and afterwards at Victoria, proved that his teaching was not in vain. True to his science, he valued chiefly the respect and affection of his colleagues and pupils. In society he did not shine. nor did he take any leading part in the government of the College or in the foundation of the University, although those of us who were more active in these matters could always count upon his support in all questions in which the interests of science were concerned, and if he usually preferred to be at his own desk rather than to spend his time listening to the often tedious discussions of the Senate meetings, he was always at hand when a vote was needed to carry out some measure of scientific reform. Although for many years a naturalized Englishman, and enjoying and appreciating English freedom and English ways, he retained more than is usual, a lively interest in the welfare of the "Vaterland." I knew but little of his political views, for these he did not obtrude on his friends, though he held decided ones. He believed in popular freedom and popular rights, and was a strong supporter of the German Social Democratic party, many of the leaders of this movement, both in Germany and in England, being his intimate personal friends. But with these matters we have here little to do. We here have to recognize the scientific work which he has done amongst us, to record our appreciation of that work, and to express the regret of all interested in science at his untimely death.

H. E. ROSCOE.

SCIENTIFIC INVESTIGATIONS OF THE SCOTTISH FISHERY BOARD.

THE Fishery Board for Scotland has issued its Tenth Annual Report (for the year 1891). It is divided into two parts—the general report, and the report on salmon fisheries. We reprint from the general report the passage relating to the scientific investigations carried on since the Board was reconstituted ten years ago :—

The following is a statement of the sums which have been sanctioned during each of the following years and spent by the Board on scientific investigations :—

Year.	Sanctioned.	Spent.
1883–84	£300	£300 13 7
1884–85	1600	1430 0 11
1885–86	1500	1500 0 0
1886–87	2000	1647 5 3
1887–88	2000	1843 4 5
1888–89	2000	1804 4 3
1889–90	2000	2026 10 0½
1890–91	1800	1792 13 4
	(With £200 for travelling expenses.)	
1891–92	£1800	Do.

In addition a sum of £2500 was applied in 1886–87 for the purchase of the steamer *Garland*, and £500 per annum allowed for its maintenance, which was increased first to £900, and afterwards to £1200 a year.

When the Board commenced its operations, it was a new departure in State administration. The Fisheries Commission of the United States was only established in 1871, and we were without the experience which has since been gained in America, Germany, Norway, and other countries bordering on the North Sea. The directions of the Act of Parliament creating the Board were very general. We were appointed to "take cognisance of everything relating to the coast and deep sea fisheries of Scotland, and take such measures for their improvement as the funds under their administration not otherwise appropriated might admit of, but without interfering with any existing authority or private right." Hitherto the fisheries had been practically left to take care of themselves. During the administration of the old Board, which had existed from 1809 under the name of the Commissioners of the British White Herring Fishery, scientific investigations had indeed been made from time to time into special points, such as the spawning of the herring, the capture of immature herrings by sprat fishermen, and the action of the beam-trawl on herring spawning-beds. These inquiries were, however, limited both in character and extent, and were merely incidental to certain questions prominent for the time being. The absence of definite scientific knowledge relating to the fisheries had been felt and commented upon by Royal Commissions appointed to enquire into fishing questions; and when the new Board came into existence in 1882, it was found that, without further information as to the habits and life-history of the food-fishes, it would be impossible to submit satisfactory reports to Parliament either as to the improvement or the regulation of the fisheries. It was accordingly resolved that scientific investigations should be instituted under a committee, consisting of Prof. Ewart (Convener), Sir James Maitland, Sheriff Forbes Irvine, and Mr. Maxtone Graham. This committee acted until 1886, when it was dissolved; and, in 1887, another committee was formed, consisting of Prof. Ewart (Convener), Sir James Maitland, Mr. William Boyd, and Mr. W. Anderson Smith, which continued till 1889. Since the dissolution of this committee the scientific work has been under the immediate control of the Board, with Dr. T. Wemyss Fulton as scientific secretary, but all the members feel, and desire specially to acknowledge, the valuable assistance which has been rendered by Sir James Maitland and Mr. Anderson Smith.

Before describing the investigations undertaken, a word must be said as to the means which have been at the disposal of the Board. In 1884 a marine laboratory was established at St. Andrews, with the co-operation of Prof. McIntosh, F.R.S., who was at the time engaged in making scientific investigations for the Royal Commission on Beam-Trawling, under the late Lord Dalhousie; and this laboratory has continued in active operation ever since under Prof. McIntosh's charge. In 1885 another laboratory was erected at Tarbert, Lochfyne, which was placed under the charge of Mr. George Brook, F.L.S., and was occupied until 1887. During 1886-87 a portion of Rothesay Aquarium was made use of, and from 1884 until 1889 part of the scientific work was carried on at the Natural History Department of the University of Edinburgh, under the charge of Prof. Ewart. Subsequently a marine laboratory was built at Dunbar, which has since been added to, and in connection with which the Board are now erecting a large hatchery for the propagation of sea-fish. In addition to the laboratories mentioned, the fishery cruisers have occasionally been engaged in aiding the scientific inquiries, as have also the staff of Fishery Officers around the coast. Since 1886 the small steam-vessel *Garland*, although not at all sufficient for the work, has also rendered important services.

At the time when the scientific investigations were begun very little was known regarding the habits of sea-fishes. Fishermen, who presumably ought to know something of the life-history of the fishes they catch, knew, as Prof. Huxley has remarked, very little beyond the best way to catch them. Yet from the earliest period until comparatively lately, the practice has been to shape fishery legislation in accordance with local desires or the popular opinion prevailing at the time, and not upon ascertained conditions. A study of the statutes dealing with sea fisheries, especially those passed by Parliament from the middle of last century to about the middle of this, shows that vast sums of money have been expended uselessly, and injurious restrictions imposed for reasons which scientific investigations have now proved were illusory. About thirty years ago, however, an important change in this system was effected. Van Beneden on the continent, and Prof. Huxley, Mr. Spencer Walpole, Mr. Shaw Lefevre, and others in this country made a stand against haphazard regulations, and in Great Britain their action found practical expression in the liberating Act of 1868 (31 and 32 Vict. c. 45), which repealed or amended sixty-four fishery statutes, and restored liberty of fishing. The Royal Commissioners who brought about this reform (the late Sir James Caird, Prof. Huxley, and Mr. Shaw Lefevre) refer in their report to the absence of knowledge about the habits of sea fishes, their reproduction, spawning-places, and conditions of existence which is essential to effective regulation of the fisheries.

An indication of the lack of accurate knowledge on these subjects as lately as 1883 was afforded at the London International Fishery Exhibition in 1883, when a high authority thus described the condition of things at that time: "It is a very striking fact that the one point on which all speakers at the conferences held during the past summer at the Exhibition were agreed was this—that our knowledge of the habits, time and place of spawning, food, peculiarities of the young, migrations, &c., of the fish which form the basis of British fisheries, is lamentably deficient, and that without further knowledge any legislation or attempts to improve our fisheries by better modes of fishing, or by protection or culture, must be dangerous, and indeed unreasonable."

It is a source of satisfaction to the Board that their labours in this field of fishery work, even for the comparatively short time over which they have extended, have yielded successful results, and have contributed materially to the advancement of that knowledge of fishery problems, the want of which was felt and deplored by the Royal Commissioners of 1866. The scientific work carried on by the Board, the chief results of which have been described from year to year in their annual report to Parliament, may be summarized briefly as follows:—

(1) Inquiries into the influence of beam-trawling on the fish supply, especially within the territorial waters; the capture and destruction of immature fish by various modes of fishing; the condition of the inshore fisheries for shell-fish and the supplies of mussels and other bait for line fishermen; surveys and examination of the fishing grounds, &c.

(2) Investigations into the food, fecundity, reproduction, habits and migrations of the food fishes, the location of their spawning-grounds, and of the nurseries of young fish, the time and duration of spawning, &c.

(3) The study of pelagic and demersal ova, and of the development of the food-fishes and edible molluscs from the egg onwards.

(4) Inquiries into the micro-organisms in river waters, and associated with salmon disease, and into the food of fishes in inland waters.

(5) Observations on the temperature, salinity, and physical conditions of the sea around the coast.

(6) The artificial propagation of sea-fish and shell-fish to re-stock depleted grounds.

The investigations into the influence of beam trawling, which have been carried on with great regularity and care, have furnished a mass of scientific and statistical evidence unexampled in the history of any fishery, and have been followed by the prohibition of this mode of fishing within the territorial seas. As stated in former reports, various portions of the inshore grounds were for experimental purposes closed against beam-trawling, and by the Herring Fishery (Scotland) Act of 1889, the territorial waters were included in the prohibition, certain powers being reserved to the Fishery Board. Closely related to beam-trawling is the capture and destruction of immature fish, which is generally regarded as the most important of the fishery problems awaiting solution in the immediate future. In certain foreign States and English fishery districts the landing or sale of immature fish under certain sizes has already been made penal; and in 1890 an International Fishery Conference was specially convened in London to consider this subject so far as it affected the diminution of the fish supply from the North Sea. Extensive observations have been made by the Board as to the distribution of immature fish on the east coast of Scotland at various distances from shore and in water of different depths; the minimum size at maturity of the different species and the proportions captured by various modes of fishing, with especial reference to the mesh of trawl-nets, have been ascertained, as has also the action of the beam-trawl in destroying immature fish according to the time the net is down and the nature of the bottom. The results were embodied in a report which was prepared by Dr. Fulton, under directions of the Board, and was described (we believe with perfect accuracy) by the vice-president at the Conference "as one of the most important, if not the most important, document that had up to the present been contributed to the Fishery literature of this country."

The inquiries into the food and propagation of the edible fishes have been also prosecuted on an extensive scale. The food-material of nearly 20,000 specimens caught at various parts of the coast and at all seasons of the year has been examined, and this research has yielded valuable results both in regard to the protection and regulation of the fisheries and the increase of the fish supply by artificial means. The fecundity of nearly all the food-fishes has been determined, the nature of pelagic and demersal ova has been carefully studied, and the distribution of the former in the waters over the breeding grounds and along the coasts investigated. The development from the egg onwards, and the characteristics of the young of the majority of the edible fishes have been described—including the herring, haddock, whiting, cod, ling, turbot, plaice, lemon sole, flounder, &c., and also of the most valuable forms of bait, the mussel and the clam. The spawning of the herring and of the other food-fishes has received special attention. Since 1888 upwards of 30,000 white fish—such as cod, turbot, plaice, &c.—have been individually examined. By this means the time and duration of the breeding season has been determined, and the important fact has been proved that on the east coast of Scotland, where the investigation was mainly carried on, the spawning-grounds of the valuable food-fishes (cod, haddock, plaice, turbot, &c.) generally lie outside the territorial limit—contrary to the belief formerly held—and that only forms of comparatively little value, such as the flounder, dabs, and gurnards, &c., spawn within the three-mile limit. The importance of these facts cannot be over-estimated. They bear directly both on the question of establishing a close-time and the measures proper to be taken for the regulation of fishing on the breeding-grounds. The trawlers, driven outside the inshore waters, generally take to the breeding-grounds, for there the hauls are most abundant. The significance of this fact, in connection with the falling off in the inshore fisheries, is becoming too grave to be longer overlooked. The growth of population has been followed by an increase in the demand for fresh fish, the extension of the means of distribution has ministered to this demand, and if the floor of the ocean is to be swept without public regulation, the ordinary fishing-grounds will prove inadequate to maintain the supply. The destruction of spawning fish is proving a serious evil. In Germany, where this matter has been carefully examined, it is now held to be more important to protect the spawning-banks, than to prevent the destruction of immature fish. Some of our fisheries are, in fact, in danger of being exhausted unless judicious regulations are rigidly enforced.

During the last three years experiments have been carried on to determine the migratory movements of fish, and nearly 3000 have been labelled and returned to the sea. A percentage of these has been recovered, and steps are now being taken to apply the same method on a large scale to the herring. The experiments are not sufficiently advanced to justify any final conclusion as regards all fish, but undoubtedly as regards many of them the facts already ascertained prove that until they reach a certain size they do not leave the territorial waters.

The means of increasing the diminishing fisheries for shell-fish have received careful attention. Surveys have been made of the more important mussel-beds on the east coast, the extensive clam-bed in the Firth of Forth, the cockle-beds at Barra, and a detailed examination of the great mussel-growing area in the Clyde is at present in progress. The French system of growing mussels on wattled bouchots has been tested side by side with the bed-system, and a series of experiments have been made on board the *Garland* to test the comparative efficiency of different natural baits, and of various artificial substitutes. A physical and biological investigation has also been made of a number of sea-lochs on the west coast, in order to ascertain their suitability for the growth and culture of oysters (the Scottish oyster having sunk to a very low point), and a special lobster pond has been constructed at Brodick, Arran, in which about 200,000 young lobsters were hatched last year.

The physical observations into the temperature and salinity of the sea have been carried on on board the *Garland* and the fishery cruisers, and at ten fixed stations daily—five on the east coast and five on the west. By the courtesy of the Northern Lighthouse Board, observations are allowed to be taken daily at the Bell Rock and Oxcar Lighthouses, the lightship at the North Carr, and also at the mouth of the Tay. Many thousands of observations are thus made every year, and several valuable reports have already been published.

From this brief summary of part of the work done, it will be seen that considerable progress has been made since 1883 in extending the knowledge of the habits and life-history of the food-fishes; and it is gratifying to learn that the results obtained by the Board have been gratefully acknowledged by high authorities, and found useful in other countries.

In recent years the attention of the authorities of various maritime States, especially those around the North Sea, but also in the Mediterranean and in America, has been forcibly called to the diminution of the fish-supply within the territorial seas and on much-frequented fishing banks off-shore. The falling off in the supply of valuable flat fishes, such as turbot, sole, and plaice, from the North Sea, has led to various conferences of those engaged in the fishing industry. At the International Fishery Conference held in London in 1890, at which representatives were present from Germany, Denmark, Holland, France, Belgium and Spain, it was resolved that scientific investigations should be carried on by each country, particularly into the capture and destruction of immature fish by the beam-trawl, prior to the assembling of an official International Conference to deal with the subject by international agreement; and at a conference of representatives of the fishing industry held in London last February resolutions were passed, that in view of the diminution of the valuable food-fishes, the hatching of sea-fish should be undertaken on a large scale, and measures adopted to prohibit the sale of immature flat fishes under a certain size. The decrease in the fish supply from the off-shore banks has not yet become so marked off the Scottish coast as is the case further south; but from the statistics given below as to the yearly increasing number of Scottish beam-trawlers; the flocking northwards of English vessels from their own depleted grounds; and the actual diminution in the quantity of flat fish landed there is reason to apprehend that in the course of very few years a similar result will be brought about here. As has been stated above, the Board are at present having erected at Dunbar, by means of the ordinary vote for scientific investigation, on a site granted by the War Office and the Council of the Burgh, a large hatchery for sea-fish, with the necessary tanks and pumping apparatus, which, when complete, will permit of several hundreds of millions of the food-fishes being hatched every season and planted on the fishing-grounds. It will therefore be possible for the first time in this country to adopt active measures to directly add to the fish supply, as has already been done in the United States, Norway, Canada, and Newfoundland.

NOTES.

AMONG the honours announced at the change of Ministry the Privy Councillorship conferred upon Prof. Huxley not only establishes a precedent, but affords an indication that the neglect of the claims of men of science, whether they be servants of the Crown or not, to the ordinary national distinctions is not likely to be so marked in the future as it has been in the past. Six years ago or thereabouts, Prof. Huxley was allowed to leave the public service without the slightest recognition of the value of the work he had done in many capacities during some forty years. No better way of making the so-called "honours" ridiculous can be found than in generally omitting to confer them upon persons of distinction—persons known to the nation as devoting their lives to the national welfare in some walk or other.

WE have learned with regret a rumour to the effect that th Admiralty has declined to render the assistance in carrying observers and instruments for which the Royal Society made application some time ago to further the observations of the total solar eclipse in Senegambia next April. If this be confirmed, the expedition will in all probability be abandoned. Such a state of things requires no comment of ours.

A MEETING of the Swiss Society of Natural History is announced to take place at Basle, from September 4 to 7, under the Presidency of Prof. Hagenbach-Bischoff, and the following communications have been aranged for:—"The Origin of Swiss Lakes," Prof. A. Heim, Zurich; "The Thermal Conditions of the Lake of Geneva," Prof. F. A. Forel, Morges; "The Biological Conditions of the East-African Steppe," Prof. C. Keller, Zurich; "The Metamorphosis of Alpine Rocks," Prof. C. Schmidt, Basle; "The Evolution of Human and Animal Physiognomy," Prof. W. His, Leipzig; "Studies on the Veddahs, the Aboriginals of Ceylon," Dr. Fr. Sarasin, Berlin. A special invitation is given to foreign students to join the meeting.

ACCORDING to the *Times* a telegram has been received from Tromsö announcing that the *Manche* which left Leith on July 20, for Jan Mayen Island, in the Greenland Sea, reached its destination on the 27th. The island had not been visited for ten years. The vessel went round it and then proceeded to Spitzbergen, where it made important collections of reindeer, foxes, birds, and fossils in Ja Fiord and Bel Sound.

MR. RISELY GRIFFITHS, the Administrator of the Seychelles, visited the Island of Aldabra in May last. In a report to the Colonial Office communicated to Kew, he gives the following particulars respecting the gigantic land tortoises :—"The following morning I went on shore to visit Mr. Spurs' establishment, and observe some of the natural peculiarities of this extraordinarily-formed island, which, except here and there, appears to be one mass of very ancient coral, which has been washed for so many centuries by the sea that all the softer portions have been washed out, and the remainder is hard and ragged, and therefore is difficult to walk over. Curious to state, small trees, shrubs and vines flourish over it, and in these inextricable places, which are of vast extent, do the enormous land tortoises find a genial and apparently prolific existence. When Mr. Spurs first went to Aldabra he was of opinion there were very few of them left; but he now states that there cannot be less than one thousand in all the island. I made him repeat this statement more than once, as I was sceptical about so large a number; but he assured me that a few hundreds would not accurately describe their number."

THE Tuesday evening lectures at the Royal Victoria Hall, Waterloo Bridge Road, will be resumed in September, and on the evenings of September 6, 13, and 20, respectively, Prof. B. J. Malden will lecture on "The Wonders of the World," "A Holiday in Sweden and Denmark," and "Australia."

ACCORDING to the *North British Agriculturalist* the plague of voles from which farmers in the Border districts have for some time past suffered much inconvenience and loss, is, notwithstanding the strenuous efforts put forward for the abatement of the plague, on the increase. The grass lands are so thickly set with the nests of the voles that much difficulty is experienced in cutting them, and the vermin are now making their abode in the corn-fields, which are in consequence also being destroyed.

CÁNOVAS AND TRAYNOR, 3 Calle de Santa Catalin a, Madrid invite subscriptions to a facsimile reproduction of the first geographical chart of America (1500), by Juan de la Cosa, Columbus's sailing-master in his first and second voyages. It will be printed in the original colours, from which black, by the way, is absent. The work will be published in three forms, one—the popular—at 12s., another in vellum at 20s., and the third in parchment at £20. The parchment edition will be hand coloured.

PROF. FLÜCKIGER has sent to the President of the Pharmaceutical Society, as representing the British subscribers to the Flückiger testimonial, a bronze replica of the medal which was presented to him, and expresses the hope that it will be accepted as a sign of his gratitude and a slight proof of his appreciation of the friendship and encouragement he has always met with in England.

WE extract from the *Bollettino Mensile*, of the Meteorological Observatory of Riposto, the following details respecting the recent eruptions of Mount Etna. The crater had shown extraordinary activity from the beginning of July, and on the night of the 8th–9th, a severe shock in all the surrounding region announced the probability of an approaching eruption. At 1.20 p.m. on the 9th the south slope of the mountain burst open, at about 5000 feet above the sea, forming at once several mouths emitting lava, stones, and incandescent masses, as well as enormous quantities of sand and black smoke. At times large blocks were hurled to a height of about 1300 feet. Several of the mouths united, and formed three craters in an almost direct line from north to south, from two of which the lava encircled Monte Nero like an enormous river, while the third emitted masses of stones and cinders. The eruption continued with more or less intensity all the month, but showed signs of diminishing on the 31st. The lava devastated much fertile country, but fortunately its course was checked by the deposits of former eruptions; if this had not been the case several of the villages would have been in great danger. This eruption was noteworthy for the enormous quantities of smoke and sand emitted, and for the scarcity of seismic motions; the lava resembled physically that emitted in the eruptions of 1883 and 1886.

THE thirty-ninth Report of the Department of Science and Art of the Committee of Council on Education is now ready, as is also the Directory (revised to June 1892), with regulations for establishing and conducting science and art schools and classes.

MESSRS. GIBBONS, of Liverpool, have issued a small handbook respecting the Department of Engineering in connection with University College, Liverpool, which should prove of much service to intending students, who will find in it all the information they are likely to require with reference to fees, subjects, evening lectures and classes, scholarships, certificates, &c., &c.

THE twenty-fifth annual report of the Peabody Institute of the City of Baltimore has been issued, and seems in every respect highly satisfactory. Incandescent electric lamps and appliances have been placed in the large hall and reading-room during the year, accessions to the library have been numerous and valuable, and the lectures were attended by larger audiences than in the preceding year. Another encouraging item in the report is that there was an increase in the number of applications for books relating to science, amongst the subjects which appear to have grown in favour being anatomy, astronomy, chemistry, mathematics, medicine, and natural history.

THE annual announcement of Courses of Instruction in the Colleges at Berkeley, Cal., for the academic year 1892–93 has recently been issued.

THE Calendar of University College, Bristol, for the Session 1892—93, has just been issued.

THE second edition of Mr. W. F. Kirby's "Elementary Text-Book of Entomology" has been published within the last few days by Messrs. Swan Sonnenschein and Co. The author has not thought it necessary to make any extensive alterations in the text or plates, but the following additions have been made to the work :—An appendix, giving further particulars respecting many of the insects mentioned or figured, and a complete index.

IN the *Board of Trade Journal* for August are to be found articles on "Chemical Industry in Germany," the "Sicilian Sulphur Industry," and "Cinchona and Indigo Cultivation in India."

THE current number of the *Journal of the Society of Arts* is, in the main, devoted to the publication of Prof. George Forbes' first lecture on "Developments of Electrical Distribution."

THE June number of the *Agricultural Gazette of New South Wales* contains the continuation of two articles by Mr. P. Turner, on "The Grasses of Australia," and "New Commercial Crops for New South Wales," "Notes on Economic Plants," "The Sugar Cane Disease on the Richmond and Clarence Rivers," and many other items of interest.

THE *Korean Repository* for June, which has just come to hand, has an interesting article by Rev. D. L. Gifford on "Ancestral Worship as practised in Korea."

MESSRS. CROSBY LOCKWOOD AND SON announce for early publication a new work by Mr. J. E. Gore, entitled "The Visible Universe, Chapters on the Origin and Construction of the Heavens."

British Rainfall for 1891, compiled by Mr. G. J. Symons and Mr. H. T. Wallis, has been published, and in consequence of the exceptional character of the year of which it treats, is rather later in making its appearance than its predecessors have been. The Devonshire blizzard was the cause of much work, and praise is due to those observers who were brave and persevering enough to take their observations, notwithstanding the very exceptional difficulties by which they were confronted. One observer was barricaded with five feet of snow against every door, and another—a lady—finding that the wind had swept the grass clean all round the rain gauge and piled the snow more than five feet deep near the entrance gates to her house, wrote to enquire what she was to enter as the depth of the snow.

Symons's Monthly Meteorological Magazine for August contains a summary of the climate of the British Empire for the year 1891, compiled from sixteen representative stations. The highest shade temperature occurred at Melbourne, 103° in January. This is the first occasion since the publication of these interesting tables in 1884, that the temperature of Melbourne has exceeded both Adelaide and Calcutta. In connection with high temperature, attention is drawn to the record at Alice Springs in the centre of Australia, which shows an absolute shade maximum of 117° in December, and an average maximum of above 100° for the month. The extreme maximum in the sun 165°, and the lowest mean humidity 57 per cent, were recorded at Adelaide. Winnipeg, as usual, had the lowest shade temperature, − 34°·5, in February, as well as the greatest total range 128°·1, and greatest mean daily range 22°·9. Ceylon recorded the highest mean temperature, 80°·7, and also the least range in the year, there being only 21°·3 between the maximum of the hottest day and the minimum of the coldest night. Malta usually has the smallest rainfall or the least cloud; this year, however, Adelaide had the least rainfall, 14 inches, and Bombay the least cloud, the average amount being 3·6. The greatest rainfall was at Colombo, Ceylon, 119 inches. It is unfortunate that both the West Indian returns have had to be omitted owing to incompleteness.

ABOUT the middle of last week the low pressure areas which advanced over this country from the south-westward caused a rapid rise of temperature in England, the maximum shade temperatures reaching 83° in the south and east. These conditions were accompanied by violent thunderstorms over the southern, midland, and eastern counties on Thursday and Friday, the area embraced by the storm extending from Devonshire in the west to Norfolk in the north-east, while the rainfall was very heavy, amounting to 1·4 inch in several parts. During the early part of the present week the temperature continued high over the greater part of England, being about 10° above the mean for the time of year, but was much lower in Scotland and Ireland. Conditions were again unsettled on the 23rd, and about 1·5 inch of rain was measured in the south-west of Ireland on that morning, while areas of low pressure lay over our south-west coasts, and severe thunderstorms occurred in the evening over all the southern half of England. The heat on the Continent has been excessive, the thermometer in the shade registering 100° and upwards at many stations, and even reaching 108° at Biarritz and Bilbao. During the last few days, however, the weather has become somewhat cooler over Europe, although very high temperatures were still maintained. During the week ended the 20th inst. the rainfall exceeded the mean in Ireland and Scotland, but in most of the English districts there was a considerable deficit (except in the south and east, where there was an excess, owing to the thunderstorms). There still exists a deficiency in all districts from the beginning of the year amounting to 5 inches in the south and to 8·6 inches in the south-west of England.

THE firm of P. J. Kipp and Sons, Delft, have constructed a new form of their electrodynamometer for the measurement of telephonic currents, in which several improvements have been introduced. As in the old form, in accordance with the suggestion of M. Bellati (Atti del R.I. Ven. 1883), a cylinder of soft iron wires takes the place of the usual movable bobbin. The cylinder becomes magnetized under the action of the current in the fixed coil; its magnetization being proportional to the strength of the current when sufficiently weak, and becoming reversed on the reversal of the current. The instrument is therefore eminently suitable for the measurement of weak alternating currents. The coil is wound in two parts, which may be used in series or in multiple arc, the resistance of each being about 250 ohms. A damping arrangement, similar to that employed in Thomson's quadrant electrometer, can be used. When the vibrations are not damped, speaking in a low voice into a Siemens telephone in connection with this instrument produces a deflection of 180mm. on a scale placed at the proper distance from a mirror which is attached to the iron cylinder. If one speaks at the distance of three or four metres from a microphone placed in the primary circuit of a small induction coil—the electrodynamometer being in the secondary circuit—a deflection of 48mm. is obtained. The price of the instrument is 225 or 240 francs, according as a concave, or a plane, mirror is supplied. A guard ring of soft iron can be supplied for twenty-two francs additional. The firm believe that the instrument will be of great use to physiologists. It is largely used in continental laboratories.

REPORTING lately to the Société d'Encouragement on the industrial preparation of carbonic acid in France, commenced by M. Gall, M. Troost points out that in Germany, which preceded France in this matter, what greatly stimulated the work was the consumption of beer, as it was found that by pressure of carbonic acid on beer, the latter could be brought up from cellars to bars in excellent condition, while compressed air spoiled the beer. In France, on the other hand, success has been due to the large quantities of salicylic acid used in medical treatment, this substance being largely produced by the reaction of liquid carbonic acid on sodium-phenol. The *Compagnie générale des produits antiseptiques* has works near Hermes (Oise), directed by M. Gall. Pure carbonic acid is there produced very economically by combustion of coke; is collected in a gasometer, from which it is drawn, to be dried and compressed with pressures of 5, 25, and 70 atmospheres, and stored in iron bottles. Most of the acid is used for making salicylic acid; but other applications occur, and M. Gall is increasing the power of manufacture. At present 300 kilogrammes are produced daily, but it will be possible ere long to produce 1000 kilogrammes. The liquid is now supplied in Paris at 60 c. the kilogramme (say 6d. for 2½ lbs.). Thus the French production is in a condition to compete with the German. Among other uses besides those already mentioned are the manufacture of aerated waters, the filtering of wine, cooling by virtue of the great absorption of heat in vaporizing, and solidification of fused metals under high pressure (which greatly improves the quality).

FROM a recent report on the telephone system in Belgium (which has grown rapidly since 1883) we learn that the State has considerably supplemented the work of the companies constructing and working various small lines, and using on all of them the double wire (while the companies have mainly continued the single one). The material used is the phosphorus bronze of Montefiore. The subscription varies largely, from 250 fr. in a radius of 3 km. in Brussels and Antwerp, to 125 fr. in Louvain and Malines. One interesting feature of the Belgium lines is that they are all connected with the principal telegraph offices, so that subscribers can send to these, by telephone, any telegrams they wish sent, and similarly they can receive telephonically any telegrams addressed to them. A copy of the telegram is sent at the same time. The number of telegrams thus sent by telephone in 1889 was 371,000; in 1890 it grew to 440,000. To facilitate the development of telephonic relations the country is divided by Government into a number of circles, containing several towns provided with central offices communicating with each other by means of a double wire. Thus the inhabitants of a small town like Heyst are able to speak with Bruges, Blankenburgh, Ostend, Middlekerke, and Nieuport. The system is being extended wherever clients are probable, and the telephone now enters largely into Belgian habits.

IN the south-east of the valley of Mont Dore (Puy-de-Dôme is a curious natural formation in the basalt, called the Creux-de-Souci. A crater-shaped depression about 80 ft. wide communicates by a central hole with a larger circular cavern, 170 ft. diameter, the bottom of which is occupied by a small lake with about 10 ft. of water. The shape is like that of two cups with bases opposed; the lower one the larger. From an examination of the place this summer by M. Martel and some friends (*La Nature*), it appears that carbonic acid is plentiful in the cavern. Several times they went down by rope-ladder, hoping to use a boat lowered previously; but they could not get below about 13 ft. from the water (which was about 70 ft. from the orifice); they experienced headache, progressive suffocation, &c., while matches and candles went out. The cavern is probably closed; there is no sign of a stream; nor are there any stalactites. The lake is merely fed by water filtering through the basalt; after heavy rain this is considerable. The temperature is exceptionally low, which M. Martel explains thus: Snow lies several months on the neighbouring ground, and when this melts in spring its water penetrates into the Creux-de-Souci at a temperature near 0°C. Thus the air is cooled, and, being denser than that outside it, accumulates below; it is not renewed from above. No air-current was observed. The accepted view that there is water communication with Lake Pavin (about 270 ft. lower) is considered a mistake. It would be interesting, M. Martel says, to make methodical observations, in different seasons, both as to the carbonic acid and the temperature.

MR. C. DAVIES SHERBORN asks us to state that the grant from the British Association, stated by us as being made towards "Index to Plants," &c., was really towards "Index Generum et Specierum Animalium," a work which has already been referred to on two occasions in NATURE—May 15, 1890, and July 2, 1891.

THE additions to the Zoological Society's Gardens during the past week include a Japanese Ape (*Macacus speciosus*, ♂) from Japan, presented by Mr. H. H. Jacobs; two Rhesus Monkeys (*Macacus rhesus*, ♂ ♀) from India, presented by Mr. R. Dodman and Mr. C. W. Emlyn respectively; a Macaque Monkey (*Macacus cynomolgus*, ♀) from India, presented by Mr. R. Rocca; two Crowned Lemurs (*Lemur coronatus*) from Madagascar, purchased; a Common Cormorant (*Phalacrocorax carbo*), British, presented by Capt. Salvin; two Spotted-sided Finches *Amadina lathami*) from Australia, purchased; twenty-five Cambayan Turtle Doves (*Turtur senegalensis*) from East Africa, deposited by General Mathews; three Cambayan Turtle Doves (*Turtur senegalensis*) from East Africa, presented by General Mathews; three Hardwickes Mastigures (*Uromastix hardwicki*) from India, purchased; a Robben Island Snake (*Coronella phocarum*) from South Africa, presented by Miss M. Rutherford; a Nilotic Monitor (*Varanus niloticus*) from East Africa, presented by Gen. Mathews; a Nilotic Monitor (*Varanus niloticus*) from East Africa, presented by Mr. Frank Finn, F.Z.S.; two Smooth-clawed Frogs (*Xenopus eævis*) from East Africa, presented by Mr. Frank Finn, F.Z.S.; a Common Boa (*Boa constrictor*) from South America, presented by Messrs. F. Sander and Co.; four Indian Wild Swine (*Sus cristatus*), born in the menagerie.

OUR ASTRONOMICAL COLUMN.

NOVA AURIGÆ.—In *Wolsingham Observatory Circular*, No. 33, it is stated that Mr. H. Corder having informed the Rev. T. E. Espin that the Nova Aurigæ had increased, it was examined August 21, and found to be 9·2, spectrum monochromatic; one intense line (500?).

THE OPPOSITION OF MARS.—At the Lick Observatory, up to the middle of August, many of the supposed canals on Mars discovered in 1877 by Schiaparelli were mapped, but none of them seemed to be double. On the night of the 17th inst., however, Profs. Schaberle, Campbell, and Hussey made three entirely independent drawings, each showing the canal marked Ganges on Schiaparelli's map to be distinctly double, and thus confirming in 1892 Schiaparelli's discovery of 1877.

THERMAL ABSORPTION IN THE SOLAR ATMOSPHERE.—In *Astronomische Nachrichten*, Nos. 3105-06, Mr. E. B. Frost sets forth the results of his observations with reference to thermal absorption in the solar atmosphere. As the paper is of considerable length, we will only concern ourselves with the broad results, leaving our readers to look up the details for themselves. The instrument—made by Mr. Frost himself, and used throughout the experiments—was a double thermopile, or, rather, two thermopiles, of considerable length; and the back junctions, after being carefully insulated and imbedded in sealing-wax, were inserted in the two ends of a brass U-shaped tube, the front faces of the piles projecting a little out of the tube, while their back parts were in contact in the middle. To ensure an equality of temperature at the two back junctions, this part of the tube was enveloped in a cylinder filled with water, thus eliminating practically accidental thermo effects in the metals of the thermopiles. Mr. Frost's original intention was to employ both these piles, one for receiving the projected image of the sun, and the other for the direct rays, but, as he became acquainted with the "disproportionately greater intensity of the latter," he was obliged to employ as a screen a thin silk gauze, thus using this pile as a counterpoise to eliminate such effects as air currents, reflected radiations, &c.

Let us deal first with the photosphere. The following table shows the differences between observation and theory. The column headed O is obtained from a curve based on the observations, that of C is the result of theory and gives the values of $I : I_0$ as obtained from the ratio $\frac{I}{I_0} = \frac{e^{-f \sec \theta}}{e^{-f}}$. ρ represents the distance of the point observed from the centre of the sun (radius = 100), and θ the angle at the sun's centre between the line to the observer and the radius to the point observed.

ρ	θ	O	C	C-O
0	0	100·0	100·0	0·0
10	5·7	99·9	99·8	− 0·1
20	11·5	99·4	99·3	− 0·1
30	17·5	98·4	98·4	0·0
40	23·6	96·3	97·1	+ 0·8
50	30·0	93·6	95·1	+ 1·5
60	36·9	89·8	92·2	+ 2·4
70	44·4	84·6	87·8	+ 3·2
80	53·1	77·9	80·6	+ 2·5
90	64·2	68·0	65·6	− 2·4
100	90·0	(39)	—	—

The differences in the last column might, as Mr. Frost says, be somewhat reduced by the introduction of another constant in the formula, but even then sufficient difference would remain to indicate the inability of the formula to cope with the present conditions.

In the attempt to ascertain whether there was a difference in the thermal conditions for the poles and the equator, taking points equidistant from the centre of the sun's disc, the conclusion Mr. Frost draws is that there is none. The difference between the two hemispheres also he finds "to be exceeding small, if real." With regard to the spots he says, "A rather surprising result of these observations was that spots are occasionally relatively warmer than the surrounding photosphere." Whether the position of the spot on the disc had anything to do with it is uncertain, but where the observations were referred to it was found that "the two spots with the highest relative temperature were very near the sun's edge." He further suggests that if further observation should establish this fact, viz., that spots suffer less absorption than the neighbouring photosphere, we might consider them "to be in a higher stratum than the photosphere."

HYDROGEN SPECTRUM IN THE SOLAR ATMOSPHERE.—M. Deslandres, in the *Comptes Rendus* for July 25, communicates a brief note concerning the spectrum of hydrogen that was photographed by him in a prominence on the 4th of May last. This spectrum, besides containing many metallic lines, shows also ten ultra violet radiations of hydrogen and five other new ones, the latter of which, as he says, follow so regularly the former series that one is led to consider them as due to hydrogen. It may be remembered that Mr. Balmer indicated a simple function of whole numbers which represented exactly the series of 14 radiations of hydrogen. This function, which is applicable to most of the metals, is $N = A - \frac{B}{n^2}$ where N is the number of vibrations, A and B two constants, and n a whole number. In the following table we give the result of M. Deslandres' measures with regard to the new addition to this series, to show how close an agreement exists between the calculated and observed values :—

Whole Nos. of the formula n.	No. of vibrations: Deslandres.	Ames.	Calculated.
12	266·565	266·575	266·566
13	296·685	267·715	267·694
14	268·585	268·615	268·586
15	269·310	269·330	269·309
16	269·890	—	269·898
17	270·385	—	270·387
18	270·795	—	270·797
19	271·140	—	271·142
20	271·460	—	271·448
21	271·700	—	271·694

REFRACTION IN MICROMETRIC AND PHOTOGRAPHIC MEASURES.—A very simple method by which the effect of differential refraction may be eliminated from the results of micrometric observations or from the measures of photographic plates is given by Dr. S. C. Chandler in the *Astronomical Journal*, No. 271. The principle underlying this method is the position of the plate about to be measured, which here is inclined at a certain angle in the vertical direction to the focal plane of the telescope. In the measurement of distances this inclination necessitates the application of a small correction, but this is soon accomplished by the aid of a simple formula, which can be considerably modified by determining the screw revolution directly from the plate. One might at first think that by this means the stellar images would be slightly affected, but Dr. Chandler informs us that he thinks that "attentive examination will show that the difference of definition will be inappreciable."

THE RECENT EARTHQUAKES.

THE first of the earthquake shocks felt on the 18th inst. in Ireland, Wales, and the West of England was evidently one of unusual strength for this country, and it is very desirable that both it and the subsequent slighter shocks should be thoroughly investigated, with a view to discovering their origin and their relations to one another. As I have been engaged for several years in working at our British earthquakes, and am now occupied in studying these recent shocks, I should be greatly obliged if you would allow me to ask your readers who felt the shocks for assistance in obtaining the necessary materials.

It would be of great service to know simply the names of as many places as possible where one or more of the shocks were felt and the accompanying sounds heard. With this knowledge the boundaries of the disturbed area and the sound-area of each shock may be determined—points of considerable importance. But for a complete study of the shock it is desirable to have further details, such as would be given by answers to the questions printed below, especially to those numbered 3, 4, 6, and 7. I shall be most glad and thankful to receive accounts of the earthquakes from any place whatever, and I may add that no account, however scanty the information given, can fail to possess some value or to help in throwing light on the nature and origin of the shock.

(NOTE.—If more than one shock was felt it is important that the notes relating to each should be kept separate.)

(1) Name of place where the shock was felt.

(2) Situation of the observer: (*a*) Whether indoors (and on which floor of the house) or in open air: (*b*) How occupied at the moment of the shock.

(3) Time at which the shock was felt, if possible, to the nearest minute.

(4) Nature of the shock, description of the: (*a*) The number of vibrations: (*b*) Their relative intensity: (*c*) Whether there was any tremulous motion before or after the principal vibrations: (*d*) Whether any vertical motion was perceptible, and if so, whether the movement was first upward and then downward, or first downward and then upward.

(5) Duration of the shock in seconds, not including that of the accompanying sound.

(6) Intensity of shock: Was it strong enough (*a*) to make windows, doors, fire-irons, &c., rattle: (*b*) To cause the chair or bed on which the observer was resting to be perceptibly raised or moved: (*c*) To make chandeliers, pictures, &c., swing, or to stop clocks: (*d*) To overthrow ornaments, vases, &c., or cause plaster to fall from the ceiling: (*e*) To throw down chimneys, or make cracks in the walls of buildings?

(7) Sound-phenomena: (*a*) If any unusual rumbling sound was heard at the time of the shock, what did it resemble? (*b*) Did the beginning of the sound precede, coincide with, or follow, the beginning of the shock, and by how many seconds? (*c*) Did the end of the sound precede, coincide with, or follow, the end of the shock, and by how many seconds? (*d*) Did the sound become gradually louder and then die away? (*e*) Were the principal vibrations felt before, at, or after the instant when the sound was loudest?

(8) The names of any other places where the earthquake was noticed would be most useful, together with answers for each place (if possible) to the following questions:—(*a*) Was the shock felt? (*b*) Was it strong enough to make doors, windows, fire-irons, &c., rattle? (*c*) Was any unusual rumbling sound heard at the time of the shock? CHARLES DAVISON.

38, Charlotte Road, Birmingham, August 23.

CHEMISTRY AT THE BRITISH ASSOCIATION.

AFTER the President's address, the first paper was read by Prof. Crum Brown on "Electrolytic Synthesis," descriptive of work carried out in conjunction with Dr. J. Walker.

He showed how, by an extension of the electrolytic methods which had been already fully worked out in relation to potassium acetate, the higher fatty acids of other series could be synthesised. Thus, starting from the ethyl potassium malonate the ether of succinic acid was obtained in considerable quantity and with great readiness. Similarly adipic, sebacic and other ethers had been obtained. Secondary products were formed which in the higher members of the series accumulated in inconveniently large quantities.

Professor Ramsay gave a communication on the "Impurities in Chloroform." He found that when the purest chloroform that could be prepared was exposed to light between the months of March and July, it emitted an acrid odour when opened, due to the formation of phosgene gas. The reaction by which this had been brought about was :—

$$2CHCl_3 + O_2 = 2\ COCl_2 + 2\ HCl.$$

The second day of the meeting was devoted almost entirely to the consideration of the phenomena accompanying the combustion of gases. Messrs. Lean and Bone gave an account of the results obtained in exploding ethylene with less than its own volume of oxygen. They had found that there was always a considerable rise of pressure, and that the resulting products contained, in addition to hydrogen and carbon monoxide, small percentages of carbon dioxide, unsaturated hydrocarbons, and some saturated hydrocarbon, presumably marsh gas.

The unsaturated hydrocarbons consisted largely, if not entirely, of acetylene. Carbon is also formed as a product of the reaction, due in all probability to the decomposition of heavy hydrocarbons into marsh gas and carbon at high temperatures. The experiments show that oxygen combines with carbon in preference to hydrogen.

Prof. Lewes, in his paper on the "Luminosity of Hydrocarbon Flames," described the results of the analyses of the gases drawn from an ordinary coal gas flame at different heights. He had found that the heavy hydrocarbons which occur in the non-luminous part of the flame are almost entirely converted into acetylene before they reach the luminous zone. The luminosity of the flame is, in his opinion, brought about by dissociation of the acetylene, the temperature required for this dissociation varing with the degree of dilution of the acetylene. Under the circumstances already described, where the amount of acetylene present was 1·1 to 1·3 per cent., the temperature was 1200°, whilst in the flame of a paraffin lamp, where about double the amount of acetylene was present, the temperature was found to be 1000°.

On passing ethylene through a heated tube at different temperatures he found that at 900° the chief products were methane and acetylene; at 1000° there was still no hydrogen and no carbon, but more oil and heavy hydrocarbons, whilst at a still higher temperature hydrogen and carbon appeared amongst the products; above 1200° there was much carbon and little or no hydrocarbons. The actual temperature of the gas flame used was 500° at a distance of half an inch above the burner; 1279° at the top of the non-luminous zone, and 1370° at the top of the luminous zone.

Prof. Smithells followed with a number of very beautiful "Experiments on Flame." He held that the ordinary candle flame showed four and not three zones as usually described. He considered that the phenomena of combustion in flames ought to be studied by using gases of simple and definite composition rather than a variable and complex mixture such as coal gas.

He showed, by means of experiments, the two distinct zones in the non-luminous Bunsen flame, and how these could be separated, and their character varied according to the amount of air admitted, and similar illustrations were given by burning a jet of air laden with benzene vapour. Under the conditions of the Bunsen flame he had found that whatever hydrocarbon was used the products withdrawn from the inner cone consisted of carbon monoxide, carbon dioxide, hydrogen, and water vapour, whilst in the case of the benzene flame described, when the air supply was so regulated as to produce a luminous zone between the inner and outer zones, acetylene was found amongst the gases withdrawn from that zone.

His experiments had led him to conclude that when the hydrocarbon is starved of oxygen the carbon burns preferentially to the hydrogen.

Prof. Smithells then introduced a spray of cupric chloride solution into the gas, and showed that the inner flame remained unaltered in appearance, whilst the outer flame became green.

He is of opinion that the decomposition of the salt takes place in the inner flame, and that the colouration of the outer flame is due to the projection of the products of decomposition through the outer flame. A discussion followed these papers, in which Sir G. G. Stokes described the experiments he had performed with a view to determine whether the luminosity of the flame was due to carbon or to hydrocarbons. He was not in favour of the idea that the colouration of the flame was due to chemical reactions taking place within it. Sir Henry Roscoe thought it due to the separation of metal in the flame, and not to the oxide. Prof. Liveing quoted the results of his observations on the spectrum of oxygen, and expressed his adherence to the hydrocarbon theory of luminosity. Prof. Ramsay supported Prof. Smithells' contention. The discussion came to a conclusion with the replies of the authors of the papers.

Dr. J. A. Harker then followed with a description of "The Reaction of Hydrogen with Mixtures of Hydrogen and Chlorine." He finds that as had been previously observed by Horstmann, Bunsen, and others, the hydrogen combines partly with the oxygen and partly with the chlorine, but that the reaction varies with the quantities of the constituent gases present, and takes place in accordance with the law of Guldberg and Waage.

Prof. Clowes gave the results of the investigations which he had taken up in order to produce a safety lamp which should indicate with greater accuracy the presence of inflammable gases and vapours in air. In confirmation of previous observations he had found hydrogen to be by far the most sensitive flame, and he described a means by which hydrogen could be burnt in an ordinary oil safety lamp with greater convenience than had hitherto been possible.

A discussion which was to have been held in conjunction with Section D on the "Chemical Aspects of Bacteriology," fell through.

Prof. Roberts Austen gave a paper on the "Effect of Small Quantities of Foreign Matter on the Properties of Metals." The addition of two-tenths per cent. of lead or bismuth to gold was found to render it quite brittle, whilst extremely small quantities of phosphorus, magnesium, and zinc made nickel malleable. Such phenomena had no doubt been of great interest in ancient times to the alchemist, but to-day they constituted all-important questions for the engineer. Experimenting on gold, which could be obtained more readily than most other metals free from impurities, either solid or gaseous, he found that the tenacity was decreased by the addition of small quantities of elements whose atomic volumes were greater than that of gold, whilst those elements whose atomic volume was the same or smaller than that of gold, increased its tenacity. Lithium and aluminium acted in an exceptional manner. Furthermore, whilst the addition of 10 per cent. of aluminium gave an alloy melting at 400° lower than gold, 23 per cent. of the admixture yielded a brilliant alloy having a higher melting point than gold. He pointed out also that gold during the process of cooling showed abnormalities similar to those shown by iron, which, however, disappeared when the operation was carried out under pressure. Prof. Hartley had found that iron required to be slightly oxidised before it could be melted, even at a temperature which sufficed to melt platinum. He had always found that silver and copper, unless prepared with special precautions which he described, contained gold.

Dr. Gladstone submitted a communication on the "Molecular Refraction and Dispersion of Metallic Carbonyls and of Indium, Gallium and Sulphur." The observations made on a sample of the iron pentacarbonyl supplied to him by Mond indicated an extreme dispersion for iron, even taking the highest value for carbonyl previously recorded. He attributed, however, a still higher value (11·2) to carbonyl, and assigned a chemical formula in accordance therewith. With regard to sulphur he had found that the values obtained varied only slightly, whether the sulphur was in the liquid, solid or gaseous condition. Prof. Liveing found that the same thing held for oxygen and nitrous oxide in the liquid and gaseous conditions, and considered that this pointed to the continuity of the gaseous and liquid states.

Dr. G. H. Bailey gave a paper on "Impurities of Town Air." He pointed out that the amount of air taken into the system daily greatly exceeded that of the liquid and solid food, whilst according to Tyndall expired air was very free indeed from solid particles, and that air was undoubtedly the medium by which many diseases were propagated, and that in towns, as a matter of fact, the death-rate rose to very abnormal proportions during those periods when the air was most polluted. Under these circumstances it was a matter of surprise that so little attention had been devoted in recent years to the determination of the impurities in air. A very large amount of information had, it was true, been obtained relating to the carbonic acid in air, and this had led to valuable results; but with the exception of Dr. Russell's extremely interesting reports, hardly anything had been done in the direction of determining the sulphurous acid and organic matter with which town air, especially at certain seasons, was laden. He then described the methods which had been adopted by the Air Analysis Committee of Manchester for determining these impurities, showing how it was not only possible to arrive at a measure of the amount of suspended organic matter, but also to ascertain proximately how far it was of a noxious character. Such analyses may appropriately be supplemented by a bacteriological examination of air. Some hundreds of analyses of the air of London, Manchester, and Liverpool had been made, and the following conclusions were drawn from them:—(1) That in clear breezy weather the amount of sulphurous acid in town air does not exceed one milligramme per 100 cubic feet of air. (2) That in antiyclonic periods, and especially in times of fog, diffusion is seriously interfered with, and the quantity has been found as high as 50 milligrammes. (3) That the organic impurities in air also increase under similar conditions to those which promote the accumulation of sulphurous acid to 40 or 50 times their normal amount at least.

In the discussion which followed Sir Douglas Galton expressed himself well satisfied with the enquiry, and hoped that the work would be continued. He called attention to the tendency for decaying matter to collect, especially in certain areas of large towns and the danger of allowing such accumulations. Mr. A. E. Fletcher, Chief Inspector of Alkali Works thought the house fire was a large contributor to the evil and a most difficult one to contend against. He suggested filtering the air for the house through cotton wool filters and had found that it could be applied with great success. Mr. Warrington criticised the methods of analysis and would like to see the determinations extended so as to show in what quantity the respective sulphur compounds existed in the air. Dr. Rideal had found the method of determining sulphurous acid most reliable and preferable to the Gas Referee's test used for the estimation of sulphur in coal gas. Messrs. Hartog, Fairley, Thomas, Dr. Clowes and the President also spoke on the paper, and Dr. Bailey replied to various points which had come up in the discussion.

Subsequently, Prof. W. H. Perkin described methods of synthesis with the aid of butane and pentane tetra-carboxylic ethers the constitution of the methylene ring compounds being illustrated by Prof. Crum Brown by means of a very ingenious set of models.

A number of papers were carried over to the last day of the meeting mainly dealing with atomic weights and analytical work. Amongst these. Prof. Ramsay and Miss Aston contributed the atomic weight of boron (*a*) by determination of the water of crystallization in borax (*b*) by conversion of anhydrous sodium borate into sodium chloride. The value obtained was 10·966. Mr. Hartog drew attention to the results just published of a determination of the atomic weight of boron by the late Dr. Abrahall.

Prof. Ostwald read a communication on the assumed potential difference between metals in the solid and in the molten state. His experiments failed to detect any such difference of potential; it is at any rate below $\frac{1}{1000}$ of a volt. Prof. McLeod showed that the iodides of sulphur, SI_6 and S_2I_2, if they existed at all as chemical compounds, were of a most unstable nature; the only evidence of definite combination having taken place in S_2I_2 was that it melted at a lower temperature than either of its constituents.

BIOLOGY AT THE BRITISH ASSOCIATION.

SO many important and interesting papers were submitted to the Organizing Committee of D this year that it was found necessary to divide the section into the three departments of Zoology, Botany, and Physiology. The plan of adjourning for lunch at half-past one, and resuming work again at two, with some attractive papers for the afternoon, was tried and found a success. Practical demonstrations and exhibitions were also given in the afternoons in the laboratories above the lecture-room.

On Thursday, August 4, after the president's address, the following series of reports by committees appointed at the Cardiff meeting was submitted: (1) The Zoology and Botany of the West India Islands; (2) the Naples Zoological Station; (3) Zoology of the Sandwich Islands; (4) Botanical Laboratory at Ceylon; (5) Migration of Birds; (6) Plymouth Laboratory; (7) Deep-Sea Tow-net; (8) Protection of Wild Birds' Eggs. All of these committees have this year been re-appointed with or without grants. Three papers were then taken in the afternoon, viz.: (1) Renewed experiments on the modification of the colours of Lepidopterous larvæ, with exhibition of specimens, by E. B. Poulton, F.R.S.; (2) Prof. Preyer, of Berlin, on the physiology of protoplasm; and (3) Prof. Hartog on the alleged personality of the segments of the nucleus, and Weismann's "Idant" theory of heredity. Prof. Preyer attributed an important part to the absorption of oxygen by the protoplasm in the formation of pseudopodia. Prof. Hartog contended, from previously ascertained facts, and from his own recent researches, that the view that the segments that constitute the young nucleus persist during its maturity is untenable, and that Weismann's "Idant" theory of heredity being founded thereon must necessarily fail.

On Friday, in the Botanical Department, important papers were read by Dr. Scott (on Secondary Tissues in Monocotyledons), Prof. Goebel (on the Simplest Form of Mosses), Prof. Errera (Physiological Action at a Distance), Prof. Bower (Morphology of Spore-bearing Members in Vascular Cryptogams), and others; these will be noticed elsewhere.

In the Department of Physiology there were the following:—

(1) Prof. Waymouth Reid gave a paper on Vital Absorption, in which he showed that the older views of Dutrochet and others as to the process being a physical one due to osmosis must be modified in the direction of showing that the vital activity of the cells composing the absorbing membrane must be taken into account. We know that changes are wrought upon substances during the process of absorption, such as the regeneration of serum-albumen from peptone. In the case of the intestine of the rabbit in full digestive activity, one can get evidence of a stream passing from within outwards so long as the tissues are alive. Scraping off the epithelium diminishes the transfer or puts a stop to it. By the addition of pilocarpine to the fluids used, it is possible to reverse the direction of the stream.

(2) Prof. Rosenthal, of Erlangen, read a paper on Animal Heat and Physiological Calorimetry. The apparatus he made use of has an air calorimeter. In fever, produced by injection of putrid matter, he finds that heat production is not augmented; although in a few experiments he made on man he found a small augmentation of heat production.

(3) Dr. Lockhart Gillespie communicated a paper on Proteïd-hydrochlorides, in which he stated that all proteids have an affinity for hydrochlorides, and the lower proteids combine with a greater percentage of HCl than the higher. These results were supported by the amount of silver which is contained in a series of the different proteid salts of silver, the ratio of silver to albumen being highest, and that of silver to peptone being lowest. The different stages of gastric digestion of a meal he finds to be:—1, the amylolytic stage—no free HCl being present, but some combined proteids—duration about ten minutes; 2, combined hydrochloric acid (proteid-hydrochloride)—acidity considerable, no free HCl, small amount of lactic acid present—duration about half an hour; 3, free HCl stage—some free HCl, but mostly combined, lactic acid disappearing; 4, the chief absorption stage—acidity falling, but proportion of free to combined HCl rising—from three to four or five hours; 5, evacuation—propulsion of contents of stomach into duodenum at fourth or fifth hour.

(4) Dr. E. W. Carlier gave an account of the hibernating gland of the hedgehog, which is situated along the cervico-dorsal and in the axillary regions, and attains its maximum dimensions in October—*i.e.*, just at the commencement of hibernation—and its minimum shortly after the animal has awakened from winter sleep. Histological examination shows that towards the close of hibernation many of the cells change. The chromation in the nucleus diminishes, the fat stored in the cell gradually disappears, and finally the whole cell breaks up. Dr. Carlier considers that the hibernating gland is not merely a storehouse for fatty matter, but actually secretes some nutritive material of great service to the animal during its winter sleep.

(5) Dr. G. Mann read a paper on the Functions, Staining Reactions, and Structures of Nuclei, in which he endeavoured to prove that the achromatic elements of a cell are the most important, and that the nuclear chromosomes are organs for the assimilation of food, while the centrosome is a trophic centre for the nucleus.

In the Department of Zoology, the following papers were read:—

(1) Dr. Henry C. McCook (Philadelphia), on the Social Habits of Spiders. This paper considered the claims of certain species of the Araneæ to possess in some degree the communal tendencies of the Social Hymenoptera. The eminent French araneologist, M. Eugène Simon, in his studies of South American spiders, finds a temporary sodality among certain orb-weavers (*Epeira Badelieri*) at the cocooning season, which Dr. McCook thought might be explained by the well-known fact that female spiders when cocooning often choose the same locality and mass their egg-bags, the one mother overlaying the cocoon of another. But this is quite incidental, and occurs with species which are known to be solitary. The close grouping of Simon's *Uloborus republicanus* was regarded as no proof of a sodality, but simply showed an assemblage of snares in proximity which is not uncommon. The gathering of males in groups on the outer lines of the webs is quite what one sees in other species with which there is no departure from the solitary habit. The third example of supposed social spiders (*Anelosimus socialis*) shows characteristics closely resembling those of young spiders of various genera, who will weave around themselves upon the foliage where they lodge a tent of delicate spinning work within which they dwell for a short space, and then scatter, every individual at once assuming the solitary habit. If Simon's observations be here confirmed, we shall have the transfer of this trait of young spiders in many species to the adult period of at least one species. The fact

would revolutionize our ideas of the universal prevalence of the solitary habit. The paper was illustrated with a number of large painted figures.

(2) Prof. A. Crum Brown, F.R.S., on a Use of the External Ear. The form of the external ear enables us to find the altitude of the source of sound by rotating the head about a horizontal right and left axis.

(3) Prof. Lloyd Morgan, the Method of Comparative Psychology. The object of this communication was to show that our interpretation of animal intelligence is necessarily based on a double or two-fold process of observation: 1st, the activities of animals have to be carefully observed as objective phenomena; 2nd, our own mental processes have to be carefully observed and cautious inductions drawn from them. Finally the objective phenomena reached by the first process have to be interpreted in terms of conclusions obtained through the second. In the higher animals there is abundant evidence of ability to sense or feel relations, but little or none of the perception or cognition of the relations of introspection or of reflection, and possibly herein we have a limit to animal intelligence.

(4) Mr. J. E. S Moore, on the Relationships and Rôle of the Archoplasmic Body during Mitosis in the larval Salamander. The author has extended the discovery of the archoplasmic body in the spermatocyte of the salamander to the somatic cells of both the larva and adult, and especially to the cells of the germinal blastema and the leucocytes. He demonstrated for this vertebrate a distribution and functional activity of the archoplasmic body identical with that recorded by Platner for the invertebrate *Helix*; and concluded that the archoplasmic body is the sole agent in the formation of the achromatin spindle-fibres.

(5) Prof. J. C. Stewart exhibited with remarks an abnormal fore foot of a horse, in which two large digits and vestiges of others were present.

(6) Dr. G. Mann read a paper on the Origin of Sex, in which he contended that any sexual cell might be transformed into either a male or female cell, according to the facilities of acquiring and assimilating food material.

(7) Dr. J. Beard, on Larvæ and their Relations to Adult Forms. The author attempted to show that all metazoa above cœlenterata developed through the intermediation of a larva (often disguised by the presence of food yolk), and, in fact, upon the latter. He urged that the recapitulation theory was no explanation of the phenomena of embryology; at best it held good to a limited extent for the ontogeny of certain organs. The views of the author led him to regard metazoon development as a sort of alternation of generations.

(8) Professor W. A. Herdman, F.R.S., on the Exploration of the Irish Sea to the south of the Isle of Man now being carried on by the Liverpool Marine Biology Committee.

On Saturday, August 6th, the section did not break up into departments. The following papers were read:—

(1) Prof. McKendrick, F.R.S., demonstrated by means of a new form of myograph a method of recording and projecting simultaneously upon a screen, through the aid of lime light, curves of muscular contraction. He also showed a method of measuring and recording the time occupied by short voluntary movements, such as those of the fingers in writing, or the movements of the tongue.

(2) Prof. G. Fritsch (Berlin), on the Origin of the Electric Nerves in the *Torpedo*, *Gymnotus*, *Mormyrus*, and *Malapterurus*. Prof. Fritsch pointed out that there are two kinds of electric organs found, the one being modified muscles, as is the case in *Torpedo*, *Gymnotus*, *Mormyrus*, and *Raia*, while the other belongs to the cutaneous system, and is probably transformed gland cells of the skin, as in *Malapterurus*. In electric organs originating from muscles there are many ganglion cells, but in those derived from skin organs there are only two ganglionic cells, one on each side, and only one nerve fibre belonging to each cell, which fibre is formed by a combination of protoplasm-processes at a certain distance from the gigantic ganglion cell.

(3) Prof. Miall, F.R.S, gave an account of the leaf of the water plant *Victoria regia*, illustrated by lantern slides, in which he described the peculiarities of its structure, and the way in which it is modified to suit its special environmental conditions.

(4) Dr. J. Musgrove, the Blood-vessels and Lymphatics of the Retina. The author pointed out that the distribution of the vessels in the retina was as regular as that occurring in the arm or the leg. The blood-vessels of the retina of the ox may be divided into three sets. There are upper and lower sets of branches of large vessels, and there is an intermediate zone entirely free from large vessels except in so far as it is traversed by the main stems of artery and vein in their course to the upper part of the retina. This intermediate zone the author regards as the homologue of the yellow spot found in the human retina. The capillary vessels on a transverse section of the retina are seen to lie chiefly in the nerve cell layer, the inner molecular layer, and the inner nuclear layer. Only rarely are capillaries found beyond the inner nuclear layer, and they never extend as far as the outer nuclear layer, so that the outer layers (the rods and cones, &c.) are entirely free from vessels.

(5) Mr. H. O. Forbes exhibited a recently discovered series of sub-fossil bones of extinct birds of New Zealand and the Chatham Islands, and made remarks upon the localities where they had been found and upon their distribution. From the Chatham Islands the specimens were in a remarkably fine state of preservation, and included the species described under the names of *Aphanapteryx hawkinsi*, *Fulica newtoni*, and *Corvus moriorum*, along with portions of *Nestor* and *Harpa*. From New Zealand, *Bizuira*, *Cereopsis*, *Cygnus*, and the type specimens of *Cnemiornis gracilis*, Forb., were exhibited, and also the larger part of the skull of *Harpagornis moorei*, Haast.

(6) Dr. J. Clark, on the Natural Relations between Temperature and Protoplasmic Movements. The author showed that the minimum temperature for protoplasmic movements depended on the nature, habits, and natural surroundings of the plants, and that change of conditions of growth induced change of minimum.

(7) Dr. J. Clark, Experimental Observations on the Functions of the Nucleus in the Vegetable Cell. By divesting the vegetable cell of its wall, and also by mechanically separating the protoplasmic contents of a cell into two equal parts, the author tried to show the relations between the nucleus and cell-wall formation, and between mechanical stimulus and nuclear activity.

(8) Dr. Francis Warner, Co-ordination of Cellular Growth and Action by Physical Forces. The facts accumulated in a report on 50,000 children observed by the author appear to show that defects in development of the body are largely co-related with defects of the nerve system in its power of co-ordination and mental function.

(9) M. Louis Olivier, La Canalisation des Cellules et la Continuité de la Matière vivante chez les Végétaux et les Animaux. The author has for some time recognized, even in highly differentiated tissues, the canalization of the cell wall and the free passage of protoplasm; and lately he has obtained evidence, photographic and otherwise, that in highly organized forms, such as Dicotyledons, the protoplasm is continuous from the extremity of the roots to the tips of the leaves.

(10) Dr. John H. Wilson, some Albucas and their Hybrids. The author has formed crosses between hybrids and the parent forms in several species of the African liliaceous genus *Albuca*.

On Monday, Section D was occupied in the forenoon by a discussion on "Sea-Fisheries":—

(1) Prof. McIntosh, F.R.S., opened the discussion by a paper entitled "A Sketch of the Scotch Fisheries, chiefly in their scientific aspects, during the past decade, 1882-92," in which he gave an interesting account of the condition of the fisheries, and of the investigations which have been carried on by the Fishery Board of Scotland, and at the St. Andrews Marine Laboratory, and elsewhere.

(2) Prof. Ewart followed with a general paper on our sea-fisheries, in which he showed that some of our valuable fishes are becoming scarce, and discussed various remedial measures which have been suggested. He considered that fish-hatching was not of much practical use if the young were merely returned to the sea when hatched.

(3) Mr. E. W. L. Holt read a paper, drawn up by himself and Messrs. W. L. Calderwood and J. T. Cunningham, of the Marine Biological Association, on the Destruction of Immature Fish, and a discussion of remedial measures. In this paper the authors dealt chiefly with the protection of immature fish by the imposition of a size limit. It was contended that the size limits proposed at the conference at Fishmongers' Hall last February are altogether too small, and that no limit can be useful which is not based upon the size at which a fish is for the first time able to reproduce its species. Tables were given showing the variation which exists in this respect in the different districts. The authors gave figures showing the immense destruction of immature fish on certain grounds lying on the east side of the North Sea, and the opinion was expressed by Mr. Holt, who has had

charge of the Association's work in that district, that the imposition of a reasonable size-limit for plaice alone would do more to cause the trawlers to leave these grounds unmolested than could be effected by any scheme of closing based on international agreement.

Various zoologists and fishing experts, including Prof. Ray Lankester, Prof. McIntosh, Prof. Ewart, Dr. Fullerton, Mr. Olsen, Mr. Stebbing, Mr. Walker, and Prof. McKendrick, took part in the discussion which followed.

(4) Dr. W. Ramsay Smith, The Food of Fishes. This statistical paper gives the result of observations made by the naturalists of the Fishery Board for Scotland on over 10,000 food fishes collected in the Firth of Forth and St. Andrews Bay during the last four years. The author considers the statistics so extensive as to reduce the limit of the errors of observation to such an extent as to allow general conclusions of a trustworthy character to be drawn now for the first time.

(5) Mr. E. W. L. Holt, Notes on Teleostean Development.

(6) Mr. A. P. Swan, The Effect of Sea-water on the Vitality of the Salmon Fungus. The author showed that immersion in sea water even diluted with any lesser proportion than three parts of fresh water is fatal to the fungus; and from the continuous nature of the hyphæ it is certain that the disease is destroyed on the stay of the fish in the sea, and that the recurrence of the disease on the return to fresh water must be due to re-infection. In the discussion that followed Mr. George Murray expressed his acceptance of the author's results.

(7) Prof. E. G. Prince, on the Formation of Argenteous Matter in the Integument of Teleosteans. The fibrillated substance to which the integument of many fishes owes its silvery lustre is formed in a layer of granular plasma which belongs to the mesoderm.

(8) Prof. E. E. Prince, The Development of the Pharyngeal Teeth in the Labridæ. The grinding plates in the pharynx of wrasses are developed from rounded dental sacs formed from the cells of the mucous layer.

(9) Dr. Carlier, on the Skin of the Hedgehog. The skin of the dorsal surface is very thick, and very rugose. The spines spring from depressions between the rugosities. On section the mucosa is very thick, and devoid of blood vessels except beneath. Sweat and sebaceous glands are absent: radiation of heat is thereby almost prevented. The spines which are morphologically hairs, are fixed in the cutis vera by a broad base, near which is a rich capillary plexus. The spines, consist of cuticle, cortex, and medulla. The cortex is strengthened internally by twenty-two or more longitudinal septa. The medulla is divided into loculi by transverse imperforate septa, which divide at their margins into secondary septa, which again divide into tertiary, enclosing respectively secondary and tertiary loculi. The erector pili is very large, and somewhat fan-shaped. The skin of the ventral surface is much thinner, and is covered with soft hairs between which and the spines there is a gradual transition on the flanks. Sebaceous and sweat glands are present, and also much adipose tissue, and a thin skin muscle.

(10) Rev. Alex. S. Wilson, on the Industry and Intelligence of Insects in relation to Flowers.

(11) The following demonstrations were also given:—Dividing Pollen Mother Cells, by Prof. M. Hartog; Hibernating Gland of Hedgehog, by Dr. Carlier; Variations in Arrangement of Feathers in Wings of Birds, by Mr. Goodchild; Embryo-sac of Angiosperms, by Dr. G. Mann.

On Tuesday, Aug. 9, the Section again separated into Departments. In the Botanical Department, papers were read by Prof. Schmitz (Knöllchen am Thallus einiger Florideen), Mr. Carruthers (on the Structure of the Stem of a typical Sigillaria), Mr. T. Hick (on Calamostachys Binneyana), Mr. A. C. Seward (on Myeloxylon from Millstone Grit and Coal Measures), Prof. Hillhouse (Disappearance of native Plants from their local Habitats), and others which will be noticed elsewhere.

Mr. G. Murray drew attention to a comparison of the Marine Floras of the warm Atlantic and Indian Ocean, his remarks being illustrated by a printed table of statistics. He dealt with the question whether since the last period of a warm climate at the Cape when the two tropical marine floras mingled, the genera and species had had time to vary much, or remained the same in the warm Atlantic and Indian Oceans now separated by the colder flora at the Cape.

Mr. Harold Wager read a paper on the Structure of *Cystopus candidus*, a fungus found parasitic on the shepherd's purse. He pointed out that the nuclei are similar in structure in many respects to the nuclei of higher plants. In the formation of the oospore a number of nuclei are restricted to the periplasm, and at a late stage a number of nuclei are found in the oospore surrounding a large central oil globule. During fertilization the protoplasm and nuclei contained in the antheridium pass over into the fertilizing tube, but whether any of the contents pass into the oospore was not determined.

A paper, by Mr. James Britten, was read protesting against certain proposed changes in Botanical nomenclature.

Two papers were given by Prof. G. Gilson (Louvain), on the Affinity of Nuclein for Iron and other substances, and a Method of Staining Nuclei by Chemical Means. It is now certain that dead nuclein, as well as other substances found in the cell, have a strong affinity for the various compounds of iron and of other metals and negative chemical bodies. Thus the difficult question arises, Is the presence of iron in the nuclear elements constant and normal during life, and is this metal necessary for the chemical activity of the nucleus?

Dr. C. H. Bailey, Manchester, discussed the conditions affecting plant life in a town atmosphere, especially the falling off in the amount of light received, and the increase in sulphurous acid. Finally, a paper was read by Dr. G. Mann, which contended that the view first put on record by the author, viz., that the embryo-sac of Angiosperms corresponded to a sporocyte, and not a macrospore, was confirmed by the observations of Guignard, Dodel, and Overton, and that the eight cells within the embryo-sac were eight female sexual cells corresponding to the eight male sexual cells derived from a pollen mother-cell.

In the Department of Zoology the following papers were read:—

(1) Baron Jules de Guerne, Présentation de Planches inédites de Zoologie concernant les Recherches du Yacht *l'Hirondelle*.

(2) Baron Jules de Guerne, Crustacés Copepodes des Eaux sursaturés de Sel de la France et des Canaries.

(3) Dr. Arthur Robinson, Observations on the Development of the Posterior Cranial and Anterior Spinal Nerves in Mammals. At an early stage (eleven protovertebral somites) a continuous cord of nerve cells extends backwards from just within the posterior part of the auditory depression along the dorso-lateral angle of the medulle and spinal cord. At the time of formation of the secondary optic-cup this cellular cord loses a connection it had with the dorsal extremity of the neural tube, thickens between auditory vesicle and first somite, remains relatively small from first to fourth somite, and beyond the fourth somite gives origin to a series of swellings, the spinal ganglia. The ganglionic enlargement in the presomitic region becomes the root-ganglia of the glosso-pharyngeal and vagus nerves. An enlargement in relation with the fourth somite becomes the first cervical ganglion. Other enlargements in second and third somites become connected either with spinal accessory or (in cat) with posterior root of hypoglossal nerve.

(4) Prof. J. C. Ewart, on the Cranial Ganglia. The author discussed chiefly the ganglia of the glossopharyngeal and facial nerves in elasmobranch fishes, and their relations to the branches of the cranial nerves.

(5) Prof. W. A. Herdman, F.R.S., gave two short notes, one on the Geographical Distribution of Ascidians, in which he drew attention to the great predominance of species and individuals, and also of gigantic specimens in Arctic and in Antarctic seas; the other on the Presence of Atrial Tentacles in various genera of Tunicata, with a suggestion as to their function. The various forms in which up to now atrial tentacles have been found are phylogenetically rather closely related, and most of them are species in which the animals are in the habit of living closely aggregated together. Possibly under these crowded conditions it is an advantage to the animals to have the power (as some have) of reversing the usual current of water, or of using the atrial for a time as the inhalent aperture, when the atrial tentacles would have important functions to perform.

(6) Mr. E. B. Poulton, F.R.S., gave two interesting exhibitions of series of specimens, the one illustrating renewed experiments on the modifications of the colours of Lepidopterous pupæ, and the other being an observation bearing on the non-transmission of characters acquired by certain pupæ.

(7) Dr. J. Symington, on the Cerebral Commissures in the Marsupialia and Monotremata. The author held that in these two divisions of the Mammalia the Corpus Callosum was absent, the only transverse fibres that exist being those known as the

hippocampal commissure and the anterior commissure. These results support the conclusions of Owen, and are opposed to those of Flower.

(8) Prof. J. Playfair McMurrich, the Early Development of the Isopods. The author described the structure and mode of segmentation of the typical centrolecithal ovum of the Isopod *Jæra*, calling attention to the early differentiation of the germ layers, which may be traced back to the eight-celled stage. The mesoderm forms at first a band of cells surrounding the embryo, and later concentrates towards the ventral surface to form the blastodisc, behind which is the endoderm, these two layers becoming later enclosed by the ectoderm, which grows back over them by teloblastic proliferation.

(9) Dr. J. Beard gave some notes on Lampreys and Hagfishes.

(10) Prof. G. B. Howes and Mr. J. Harrison, on the Skeleton and Teeth of the Australian Dugong. The authors described the process of vertebral-epiphysis formation, showing that epiphyses, so far as represented, are formed late, and are rapidly merged into the substance of the vertebral body. They described the formation of structures which might, perhaps, be regarded as anticipatory of supernumerary phalanges, and pointed out that their observations lent no support to Kukenthal's view of the epiphysial nature of such phalanges. Five mandibular teeth were found to be present in the anterior region of each ramus in the manatee, and one of these they claimed as a canine. They recorded the discovery of milk predecessors to the first upper and the four lower incisors (?) of the dugong, and of the two anterior mandibular cheek teeth of the manatee; and discussed the bearings of these facts on the inter-relationships and affinities of the order Sirenia.

(11) Dr. H. C. McCook—Can Spiders Prognosticate Weather Changes? Dr. McCook first stated briefly the widespread popular opinion that spiders fairly indicate the weather by ceasing to spin before foul weather, and weaving freely before fine weather. He then gave a few extracts from his journal of observations on this point extending over six years, the tenor of which is that the popular opinion has no basis in fact. Many species of orb-weavers, which were colonized and kept under close observation, made snares freely before rains and storms, frequently even in the intervals between heavy rains.

(12) Mr. G. Swainson, some Notes on Marine and Freshwater *Chironomus*.

(13) Rev. Hilderic Friend, on British Earthworms. The author distinguishes between the four genera—*Lumbricus*, *Allolobophora*, *Allurus*, and *Dendrobæna*—to which British earthworms belong, and gives an account of the different species, some of which are new to science.

(14) Mr. H. Newman Laurence, the Human Body as a Conductor of Electricity.

(15) Prof. J. B. Haycraft, Fertilization of the Eggs of the Stickleback.

The two following papers, also on the programme, were taken as read:—

(16) Prof. Emile Yung, la Fonction Dermatoptique chez le Ver de Terre, and

(17) M. J. Richard, Note sur l'Œil Latéral des Copepodes du genre Pleuromma. The lateral eye in *Pleuromma* is variable in position, but is more often on the right side than on the left, and seems more constant in males than in females.

The following demonstrations were also given during the afternoon:—The Formation of Pearls (by Mr. Albert F. Calvert), Interesting British Food Fishes (by Mr. E. W. L. Holt), and the Structure of *Myeloxylon* (by Mr. A. C. Seward).

GEOGRAPHY AT THE BRITISH ASSOCIATION.

THE work of the Geographical Section was overtaken in four meetings, the large attendance at which was evidence that the papers read met at least with popular approval. It is more satisfactory to gather from the opinions expressed by specialists that many of the papers were solid and original, and that from the scientific standpoint the average work was of high excellence. Without doubt the most important of the new results announced to the Section was Dr. Schlichter's admirable development of a photographic process for determining longitude by the almost disused method of lunar distances. The practical value of the invention is very great, especially with regard to the mapping of partially known continents.

Like all other departments of the Association, Section E owed much of its success to the distinguished foreigners who took part in its proceedings. The papers by the Prince of Monaco and the occasional remarks of Baron von Richthofen were much appreciated. Two ladies read papers, Mrs. Bishop recounting her adventures on the borders of Tibet with her well-known literary grace, and Mrs. Grove giving a short, bright account of the rainless regions of Chile.

Prof. James Geikie's presidential address, although based entirely on geological reasoning, was truly geographical in so far as it utilized geology only for the purpose of explaining the origin of the existing surface conditions of the globe. As presenting the only sound basis of physical geography, this opening address proved to be one of the best and most original with which Section E has ever been favoured. Unfortunately, Prof. Geikie was prevented by illness from presiding at all the meetings, but his place was taken by the vice-presidents, Colonel Godwin Austen, Mr. H. J. Mackinder, Mr. E. G. Ravenstein, and Mr. Coutts Trotter.

The First Ascent of Oraefa Jökull.—In the absence of the author, Mr. J. Coles read an account by Mr. F. W. W. Howell of the first ascent of Oraefa Jokull in Iceland. Mr. Howell succeeded in making the ascent on August 12 last year, after several previous failures. Although only 6550 feet in height the mountain presented remarkable difficulties on account of the irregularity of the ice.

Place Names.—Dr. J. Burgess, in the course of a paper on place names, urged a uniform system of transliteration from Oriental alphabets as more scholarly and more satisfactory than any attempt to represent the sound of names phonetically. In no other way could uniformity of spelling be arrived at, and the diverse spellings now in use made the study of Asiatic geography in particular very toilsome and irritating. With regard to Gaelic names there were several serious errors in spelling on the ordnance map, but at the suggestion of Sir Charles Wilson a Committee of the Royal Scottish Geographical Society had taken the matter up, and aided by local committees were introducing important corrections. A lively discussion followed the reading of this paper, in which Sir Charles Wilson, Mr. Mackinder, Prof. Thomas Smith, and others took part. A Committee of the Association was formed to co-operate with the Scottish Society, and received a small grant to aid in the thorough revision of the orthography of Gaelic place names.

Effects of Rainfall in Formosa.—Mr. John Thomson, of London, gave an account of the effect of rainfall on the scenery of Formosa, illustrated by a number of fine photographs. The situation of the island and its mountainous structure conspire to give prominence to the effect of rain-action; the wind blowing in from the warm current of the *Kuro Siwo* strikes against a mountainous ridge which runs the whole length of the island and culminates in a summit 12,000 feet high. The mountain side to windward is scored with deep ravines, and the streams choked with huge boulders in course of transport to the coast-plains, which are deeply covered by fine alluvium washed down from the heights.

The Windings of Rivers.—Mr. J. Y. Buchanan, in a short paper, discussed the windings of rivers from the standpoint of hydrodynamics.

Lesser Tibet.—Mrs. Bishop (Miss Isabella Bird) described a journey undertaken in 1889, on the borderland of Tibet, which she approached from Leh, in Kashmir. The intensity of radiation at great altitudes, giving very hot days and cold nights, was observed to lead to a very rapid disintegration of the rocks, resulting in the formation of immense fields of gravel. Although presenting a vivid picture of the topography and scenery of the trans-Himalayan borderland, Mrs. Bishop entered more fully into the characteristics of the people, contrasting the false, suspicious, and cringing natives of Kashmir with the truthful, trustful, and independent people of Tibet, who always welcomed her warmly and dealt with her fairly.

The North Atlantic.—The Prince of Monaco read two papers on his oceanographical work, the first bearing on his experiments with floats on the surface circulation of the Gulf Stream, and its associated system of currents. About 10 per cent. of the floats thrown over from the Prince's yacht have been recovered, and by taking into account the position in which they were found and the date, important confirmation of the theoretical system of circulation was obtained. The current was found to be a circular whirl, with its centre a short distance south-west of the Azores. Floats thrown over near the centre were not recovered for many years, but those launched to the north or the south were thrown ashore more speedily on the coast of France, Spain, Portugal, North Africa, or in the West Indies. The only escape from the whirl was the Gulf-Stream drift towards Norway and the Arctic Sea. The mean rate of circulation was calculated as about $4\frac{1}{2}$ miles per day, and the rate of movement was found to be more rapid in the western than in the eastern half of the whirl. The Prince's second paper set forth the advantages which would accrue to meteorology and to navigation if the atmospheric conditions of the North Atlantic could be observed and telegraphed daily to Europe. He pointed out that the Bermudas, the Azores, Madeira, the Canaries, and the Cape Verd Islands were, or would very soon be, in telegraphic communication with Europe. If high and low level observatories were established in these islands it would be possible to construct very fair synoptic charts of the North Atlantic, and vastly improve upon the useful Pilot Charts now compiled by the Washington Weather Bureau. The Prince was willing that all observations should be collected at Monaco, where the Government of the Principality would discuss and publish the data, and he suggested that the Governments most interested should send delegates to a conference to be held next winter at Monaco in order to discuss the feasibility of the scheme. Dr. A. Buchan, in commending the Prince's suggestions, said that the surface temperature of the North Atlantic had been proved to have an influence on the direction of cyclones crossing it, and consequently on the weather of the British Islands and western Europe. He thought a properly equipped low-level station on the Bermudas was the first desideratum; then a similar station on the Azores, to be followed by a high-level observatory. The results at Ben Nevis warranted the expectation of great advances, not only in knowing the weather of the Atlantic, but in forecasting weather for Western Europe, if the Prince's scheme received the encouragement which it deserved.

Detailed Oceanography and Meteorology.—Mr. J. Y. Buchanan described his observations on the temperature and density of the water in the Gulf of Guinea in connection with the counter-equatorial current. Dr. H. R. Mill gave a brief account of the physical geography of the Firth of Forth, dwelling particularly on the relation between tidal and solar variations of temperature in the water. The puzzling fact that in the Firth of Forth the water at high tide is saltest when that phase occurs in the afternoon was explained by the high water of spring tides occurring at that hour. Mr. H. N. Dickson, in a short paper, urged the claims of meteorology as a subject of instruction with special regard to its place in physical geography.

The Desert of Atacama.—Mrs. Lilly Grove, of Oxford, gave a vivid description of a journey through the Atacama desert, including a trip by rail from Antofagasta to Uyuni at an elevation of 13,000 feet in the Andes.

Photography and Surveying.—Colonel Tanner explained the system of photographic surveying which he has developed on the Himalayan survey. By the use of a finely ruled grating the angular intervals between prominent objects could be estimated, and in cases where detailed triangulation was impracticable very fair maps could be compiled from photographs taken from several prominent centres.

Determination of Longitude by Photography.—Dr. H. Schlichter communicated a most important paper, summing up a long series of experiments, and an investigation of the mathematical formulæ required in calculating longitude from lunar distances. His method enables him in favourable circumstances to fix the longitude to within 6″, an approximation hitherto only possible by telegraphic time comparisons. His summary is as follows:—

"Lunar distances as a means for the strictly accurate determination of geographical longitudes have been little used of late, partly on account of the splendid chronometers with which ships are now provided, and partly owing to the inaccuracies of the instruments commonly employed for lunars. For exploring expeditions on land, however, chronometers are of little value, and the other astronomical phenomena which may be used besides lunar distances are either too difficult for accurate observation by the majority of travellers, or occur too seldom, or are not accurate enough. The author therefore introduces a new method of observation and measurement of lunar distances, viz. by obtaining a parallel series of photographs of the moon and a fixed star or planet on one plate, and afterwards measuring the distances on the plate. For the elimination of all possible inaccuracies of the photographic film or of the lens, the lunar distances thus registered are checked by repeatedly photographing on the same plate two fixed stars, the positions of which are given in the *Nautical Almanac*, and the angular distances of which can easily be computed therefrom. The angular distances of the photographic lunars are then found by a simple proportion. The time for taking a set of eight photographic lunars on one plate does not exceed three or four minutes, and micrometric measurements show with perfect accuracy the change of the lunar distances (owing to the movement of the moon) during each interval of the eight observations. The minute accuracy of the method is hereby established. The micrometric measurements on the plate are made by means of the same *réseau* which is employed by the principal observatories for stellar photography, and the measurements may therefore be regarded as absolutely correct. Results thus obtained give the correct longitude of the place of observation. The author proposes to use this method for scientific expeditions into the interior of continents, &c., as well as for the further determination and correction of secondary meridians in navigation. For both purposes it is especially adapted on account of its minute accuracy and great simplicity."

African Travels.—The whole of one day was devoted to the reading of papers bearing on Africa, almost all having reference to South Africa. Mr. E. Wilkinson described two journeys which he had made in the Kalahari Desert. Mr. Theodore Bent summarized in an interesting manner the results of his explorations at Zimbabwe; a paper on the orientation of which was also read by Mr. Swan. In the report of the committee appointed to assist in the exploration of Zimbabwe, it was announced that Mr. and Mrs. Bent intended to pursue their investigations into African ruins of the Zimbabwe type in Abyssinia. Mr. John Buchanan gave an account of the industrial resources of Nyasaland, which his long experience there enabled him to do with authority. The fertility of the soil, and the intelligence and willingness to work of the people, were advantages common to few parts of tropical Africa. A staple commodity was still wanting, but there were unmistakable signs that this would before long be found in coffee, which has been grown with great and increasing success. Firm government of the country, the absolute suppression of the slave-trade, and of intertribal wars, were almost certain to result from the recent extension of the British protectorate; but the problem of communication remained as a bar to the effective development of the country. With really free traffic on the Zambesi and lower Shire, and a railway, or at least a steam tramway, on the new road from Chilomo to Lake Nyasa, the success of Nyasaland commercially would be assured. Lieutenant Crichton-Browne gave a popular account of a recent journey to Lobengula's capital, and of an interview with that monarch. At the close of this paper Mr. Joseph Thomson, whose health is still in a very unsatisfactory state, made a few remarks, the first he has been able to make in public since his return invalided from Africa a year ago. Dr. A. H. Hallen described the Haussa country, in the language of which he is specially interested. He hopes to be able, under the auspices of the recently-founded Haussa Association, to proceed to the western Sudan, and continue his studies in the country itself. Mr. Ravenstein submitted the report of the Committee on African meteorology, of which Mr. Symons, F.R.S., was secretary. The Committee has collected a considerable number of unpublished records of meteorological observations in tropical Africa, and has charged itself with exercising a friendly influence over existing stations and the equipment of new stations likely to promote a better knowledge of the climatological conditions of the continent. Instructions of an eminently practical kind have been drawn up, and by the circulation of these and the grant of sets of instruments to suitable observers, it is hoped that the special difficulties of tropical observing may be overcome. The committee has been re-appointed, with the addition of Dr. H. R. Mill as secretary.

Proposed New Map of the Globe.—Mr. E. G. Ravenstein explained Prof. Penck's scheme of a new map of the world, on the scale of 1 to 1,000,000, or about sixteen miles to an inch. It was proposed to draw each sheet on an independent projection, the sheets embracing 5° in each direction, except those for latitudes higher than 60°, which would have a width of 10° of longitude. The map would be contoured at 100, 300, 500, and 1200 metres, hills would be printed in brown, and rivers in blue. The official spelling of all names written in the Roman alphabet would be adhered to, accepted names in other alphabets would be transliterated on a system to be afterwards agreed on, and names in unwritten languages would be rendered phonetically. The land surface of the globe would be represented in 769 sheets, and on an edition of 1000 copies it is estimated that there would be a deficit of over £100,000 if the sheets were sold at 2*s*. This sum would require to be subscribed by the Governments interested, or by private individuals. The practicability of such a map is proved by the fact that Mr. Ravenstein has himself produced with the aid of the Royal Geographical Society 46 five-degree sheets of a map of Africa. The utility of the new map is universally conceded.

Recent Travels.—Mr. Walker Harris described an adventurous journey through Yemen in the early part of this year, during a rebellion of the Arabs against the Turks. In spite of many difficulties, including imprisonment by the Turkish authorities, Mr. Harris succeeded in reaching Sanaa from Aden, and found the country to be well watered, of magnificent fertility, and by no means badly cultivated.

Mr. Coutts Trotter summarized the recent advances in the exploration and organization of British New Guinea.

Mr. H. O. Forbes described a visit to the Chatham Islands, where he discovered the bones of a remarkable flightless bird, identical with an extinct species also found in New Zealand, which is separated by 450 miles of deep water. The inevitable inference is that a land connection must formerly have existed between the two groups of islands. The importance of a careful search for similar remains in other islands of the southern hemisphere in the light of geographical distribution and speculations as to former lands is obvious.

Mr. W. R. D. Beckett, of the British Consular service in Siam, was the first Englishman to descend the Mekong river from the Eastern Laos States to Saigon, and described the various incidents of his adventurous journey.

Mr. C. W. Campbell, of the British Consular service in China, described his journey through Northern Korea, reporting favourably on the people as compared with the Chinese in their treatment of strangers.

Other Papers.—Prof. P. H. Schoute brought forward a new scheme for draining the Zuyder Zee, and Mr. Yule Oldham, lecturer on geography at Owens College, recalled attention to the early discoveries of Cadamosto on the west of Africa in the fifteenth century.

Sub-section on Chemical Oceanography.—A joint meeting of Sections B and E was held under the presidency of Mr. Buchanan for the consideration of a series of papers on oceanography. Mr. Buchanan communicated the result of some observations of the density of the water at a depth of 2000 fathoms off the coast of South America made by Captain Thomson, of the telegraph ship *Silvertown*. They are held to demonstrate that the deep water there has come direct from the Antarctic Sea. Prof. Pettersson gave a detailed and elaborate paper on the hydrography of the Kattegat and Baltic, illustrated by numerous special maps. Observations were made simultaneously at a number of points in the Baltic and its approaches; samples of water were preserved in sealed tubes for estimation of gases, and the density was in all cases measured on shore by means of Sprengel's pyknometer. The excess of precipitation over evaporation was found to cause an outflow of comparatively fresh water and a progressive decrease in the salinity from the Skagerrak inward. The fresh Baltic stream flows close round the coast of Norway as it escapes into the Atlantic. An under-current of salt water inward takes place, partly by reaction and partly by the rising up of the deeper layers against the ridges which divide the Baltic area into basins. This action is not uniform, but occurs by successive impulses and pauses. The physical boundary between the North Sea and the Baltic is not in the Belts, but along the ridge joining Rügen and Felster. The great mass of Baltic water from Rügen to the Gulf of Finland is of uniform salinity; it grows salter toward the North Sea, and freshens rapidly in the Gulf of Bothnia. In this region of uniform salinity temperature appears to be the chief cause of circulatory movement. By winter cooling a layer of intermediate minimum temperature is usually formed, in which flakes of ice may be produced that rise to the surface and consolidate there. Indications derived from observations fourteen years apart point to a partial or complete stagnation of the water in the deeper parts of the Baltic basin. The fresh Baltic stream is felt in summer far to the north along the Atlantic coast of Norway, but in winter it is greatly reduced, and comparatively warm North Sea water (4° to 6° C.) comes into the Skagerrak. This influx is coincident with the commencement of the great herring fishery, which comes to an end when the cold Baltic outflow is re-established in spring.

Dr. Andrussoff, of St. Petersburg, summarized the results of the recent Russian investigations on the Black Sea, the most remarkable discovery being the fact that below the depth of 200 fathoms the great mass of the water is stagnant, and so highly charged with sulphuretted hydrogen that all life is impossible.

Each paper was followed by animated discussion, in which Dr. John Murray, Dr. Buchan, Prof. Hartley, Dr. J. Gibson, Mr. Irvine, and Dr. H. R. Mill took part.

THE AMERICAN ASSOCIATION, PRESIDENT'S ADDRESS.[1]

A DIVISION of science has a work of its own to do, a work that well might be done for its own sake, and still more must be done in payment of what is due to the other divisions. Each section of our Association has its just task, and fidelity to this is an obligation to all the sections. Those engaged in any labour of science owe a debt to the world at large, and can be called to give an account of what they are doing, and what they have to do, that the truth may be shown on all sides.

If it be in my power to make the annual address of this meeting of any service at all to you who hear it—in your loyalty to the Association—I would bring before you some account of the work that is wanted in the science of chemistry. Of what the chemists have done in the past the arts of industry speak more plainly than the words of any address. Of what chemists may do in the future it would be quite in vain that I should venture to predict. But of the nature of the work that is waiting in the chemical world at the present time I desire to say what I can, and I desire to speak in the interests of science in general. The interests of science, I am well assured, cannot be held indifferent to the interests of the public at large.

It is not a small task to find out how the matter of the universe is made. The task is hard, not because of the great quantity in which matter exists, nor by reason of the multiplicity of the kinds and compounds of matter, but rather from the obscurity under which the actual composition of matter is hidden from man. The physicists reach a conclusion that matter is an array of molecules, little things, not so large as a millionth of a millimetre in size, and the formation of these they leave to the work of the chemists. The smallest objects dealt with in science, their most distinct activities become known only by the widest exercise of inductive reason.

The realm of chemical action, the world within the molecules of matter, the abode of the chemical atoms, is indeed a new world and but little known. The speculative atoms of the ancients, mere mechanical divisions, prefiguring the molecules of modern science, yet gave no sign of the chemical atoms of this century, nor any account of what happens in a chemical change. A new field of knowledge was opened in 1774 by the discovery of oxygen, and entered upon in 1804 by the publications of Dalton, a region more remote and more difficult of access than was the unknown continent toward which Christopher Columbus set his sails three centuries earlier. The world within molecules has been open for only a hundred years. The sixteenth century was not long enough for an exploration of the continent of America, and the nineteenth has not been long enough for the undertaking of the chemists. When four centuries of search shall have been made in the world of chemical formation, then science should be ready to meet a congress of nations, to rejoice with the chemist upon the issue of his task.

It is well known that chemical labour has not been barren of returns. The products of chemical action, numbering thousands of thousands, have been sifted and measured and weighed. If you ask what happens in a common chemical change you can obtain direct answers. When coal burns in the air, how much oxygen is used up, can be stated with a degree of exactness true to the first decimal of mass, perhaps to the second, yet questionable in the third. How much carbonic acid is made can be told in weight and in volume with approaching exactness. How much heat this chemical action is worth, how much light, how much electro-motive force, what train-load of cars it can carry, how long it can make certain wheels go round,—for these questions chemists and physicists are ready. With how many metals carbonic acid will unite, how many ethers it

[1] Address by Prof. A. B. Prescott, the retiring President, delivered at the Rochester meeting of the American Association for the Advancement of Science, August, 1892.

can make into carbonates, into what classes of molecules a certain larger fragment of carbonic acid can be formed, the incomplete records of these things already run through a great many volumes. These carboxylic bodies are open to productive studies, stimulated by various sorts of inquiry and demands of life. Such have been the gatherings of research. They have been slowly drawn into order, more slowly interpreted in meaning. The advance has been constant, deliberate, sometimes in doubt, always persisting and gradually gaining firmer ground. So chemistry has reached *the period of definition.* Its guiding theory has come to be realized.

"The atomic theory" has more and more plainly appeared to be the central and vital truth of chemical science. As a working hypothesis it has directed abstruse research through difficult ways to open accomplishment in vivid reality. As a system of knowledge, it has more than kept pace with the rate of invention. As a philosophy, it is in touch with profound truth in physics, in the mineral kingdom, and in the functions of living bodies. As a language it has been a necessity of man in dealing with chemical events. Something might have been done, no doubt, without it, had it been possible to keep it out of the chemical mind. But with a knowledge of the primary elements of matter, as held at the beginning of this century, some theory of chemical atoms was inevitable. And whatever theory might have been adapted, its use in investigation would have drawn it with a certainty into the essential features of the theory now established. It states the constitution of matter in terms that stand for things as they are made. The mathematician may choose the ratio of numerical notation, whether the ratio of ten or some other. But the chemist must find existing ratios of atomic and molecular mass, with such degree of exactness as he can attain. Chemical notation, the index of the atomic system, is imperfect, as science is incomplete. However defective, it is the resultant of a multitude of facts. The atomic theory has come to be more than facile language, more than lucid classification, more than working hypothesis, it is *the definition of the known truth in the existence of matter.*

The chemical atom is known, however, for what it does, rather than for what it is. It is known as a centre of action, a factor of influence, an agent of power. It is identified by its responses, and measured by its energies. Concealed as it is, each atom has given proof of its own part in the structure of a molecule. Proofs of position, not in space but in action, as related to other atoms, have been obtained by a multitude of workers with the greatest advantage. The arrangement of the atoms in space, however, is another and later question, not involved in the general studies of structure. But even this question has arisen upon its own chemical evidences, for certain bodies, so that the "configuration" of the molecule has become an object of active research.

Known for what it does, the atom is not clearly known for what it is. Chemists, at any rate, are concerned mainly with what can be made out of atoms, not with what atoms can be made of. Whatever they are, and by whatever force or motion it is that they unite with each other, we define them by their effects. Through their effects they are classified in the rank and file of the periodic system. The physicists, however, do not stop short of the philosophical study of the atom itself. As a vibratory body its movements have been under mathematical calculations; as a vortex ring its pulsations have been assumed to agree with its combining power. As an operating magnet its interaction with other like magnets has been predicated as the method of valence. There are, as I am directly assured, physicists of penetration and prudence now looking with confidence to studies of the magnetic relations of atoms to each other.[1] Moreover, another company of workers, the chemists of geometric isomerism, assume a configuration of the atoms, in accord with that of the molecule.

The stimulating truth of the atomic constitution of the molecule, a great truth in elastic touch with all science, excites numerous hypotheses, which, however profitable they may be, are to be stoutly held at a distance from the truth itself. Such are the hypotheses of molecular aggregation into crystals and other mineral forms. Such are the biological theories of molecules polymerizing into cells, and of vitality as a chemical property of the molecule. Such are the questions of the nature of atoms, and the genesis of the elements as they are now known, questions on the border of metaphysics. Let all these be held distinct from the primary law of the atomic constitution of simple molecules in gaseous bodies, an essential principle in an exact science. The chemist should have the comfortable assurance, every day, as he plies his balance of precision, that the atom-made molecules are there, in their several ratios of quantity, however many unsettled questions may lie around about them. Knowledge of molecular structure makes chemistry a science, nourishing to the reason, giving dominion over matter, for beneficence to life.

Every chemical pursuit receives strength from every advance in the knowledge of the molecule. And to this knowledge, none the less, every chemical pursuit contributes. The analysis of a mineral, whether done for economic ends or not, may furnish a distinct contribution toward atomic valence. The further examination of steel in the cables of a suspension bridge is liable to lead to unexpected evidence upon polymeric unions. Rothamsted farm, where ten years is not a long time for the holding of an experiment, yields to us a classic history of the behaviour of nitrogen, a history from which we correct our theories. The analysis of butter for its substitutes has done something to set us right upon the structure of the glycerides. Clinical inspection of the functions of the living body fain finds a record of molecular transformations too difficult for the laboratory. The efforts of pharmaceutical manufacture stimulate new orders of chemical combination. The revision of the pharmacopœa every ten years points out a humiliating number of scattered errors in the published constants on which science depends. The duty of the engineer, in his scrutiny of the quality of lubricating oils, brings a more critical inquiry into the laws of molecular movement. There is not time to mention the many professions and pursuits of *men who contribute toward the principles of chemistry* and hold a share therein. If it be the part of pure science to find the law of action in nature, it is the part of applied science both to contribute facts and to put theory to the larger proof. In the words of one who has placed industry in the greatest of its debts to philosophic research, W. H. Perkin, "There is no chasm between pure and applied science, they do not even stand side by side, but are linked together." So in all branches of chemistry, whether it be termed applied or not, the best workers are most strongly bound as one, in their dependence upon what is the known of the structure of the molecule.

Studies of structure were never before so inviting. In this direction and in that especial opportunities appear. Moreover the actual worker here and there breaks into unexpected paths of promise. Certainly the sugar group is presenting to the chemist an open way from simple alcohols on through to the cell substances of the vegetable world. And nothing anywhere could be more suggestive than the extremely simple unions of nitrogen lately discovered. They are likely to elucidate linkings of this element in great classes of carbon compounds, all significant in general chemistry. Then certain comparative studies have new attractions. As halogens have been upon trial side by side with each other, so for instance silicon must be put through its paces with carbon, and phosphorus with nitrogen. Presently, also, the limits of molecular mass, in polymers and in unions with water, are to be nearer approached from the chemical side, as well as from the side of physics, in that attractive but perplexing border ground between affinity and the states of aggregation.

Such is the extent and such the diversity of chemical labour at present that every man must put limits to the range of his study. The members of a society or section of chemistry, coming together to hear each other's researches, are better able, for the most part, to listen for instruction than for criticism. Still less prepared for hasty judgment are those who do not come together in societies at all. Even men of eminent learning must omit large parts of the subject, if it be permitted to speak of chemistry as a single subject. These considerations admonish us to be liberal. When metallurgical chemistry cultivates scepticism as to the work upon atomic closed chains, it is a culture not the most liberal. When a devotee of organic synthesis puts a low value upon analytic work, he takes a very narrow view of chemical studies. When the chemist who is in educational service disparages investigations done in industrial service, he exercises a pitiful brevity of wisdom.

The pride of pure science is justified in this, that its truth is for the nurture of man. And the ambition of industrial art is honoured in this, its skill gives strength to man. It is the obligation of science to bring the resources of the earth, its

[1] "The results of molecular physics point unmistakably to the atom as a magnet, in its chemical activities."—A. E. Dolbear, in a personal communication.

vegetation and its animal life, into the full service of man, making the knowledge of creation a rich portion of his inheritance, in mind and estate, in reason and in conduct, for life present and life to come. To know creation is to be taught of God.

I have spoken of the century of beginning chemical labour, and have referred to the divisions and specialities of chemical study. What can I say of the means of uniting the earlier and later years of the past, as well as the separated pursuits of the present, in one mobile working force? Societies of science are among these means, and it becomes us to magnify their office. For them, however, all that we can do is worth more than all we can say. And there are other means, even more effective than associations. Most necessary of all the means of unification in science is the use of its literature.

It is by published communication that the worker is enabled to begin, not where the first investigation began, but where the last one left off. The enthusiast who lacks the patience to consult books, presuming to start anew all by himself in science, has need to get on faster than Antoine L. Lavoisier did when he began, an associate of the French Academy in 1768. He of immortal memory, after fifteen eventful years of momentous labour, reached only such a combustion of hydrogen as makes a very simple class experiment at present. But however early in chemical discovery, Lavoisier availed himself of contemporaries. They found oxygen, he learned oxidation: one great man was not enough, in 1774, both to reveal this element and show what part it takes in the formation of matter. The honour of Lavoisier is by no means the less that he used the results of others, it might have been the more had he given their results a more explicit mention. Men of the largest original power make the most of the results of other men. Discoverers do not neglect previous achievement, however it may appear in biography. The masters of science are under the limitations of their age. Had Joseph Priestley lived in the seventeenth century he had not discovered oxygen. Had August Kekulé worked in the period of Berzelius, some other man would have set forth the closed chain of carbon combination, and Kekulé, we may be sure, would have done something else to clarify chemistry. Such being the limitations of the masters, what contributions can be expected in this age from a worker who is without the literature of his subject?

In many a town some solitary thinker is toiling intensely over some self-imposed problem, devoting to it such sincerity and strength as should be of real service, while still he obtains no recognition. Working without books, unaware of memoirs on the theme he loves, he tries the task of many with the strength of one. Such as he sometimes send communications to this Association. An earnest worker, his utter isolation is quite enough to convert him into a crank. To every solitary investigator I should desire to say, get to a library of your subject, learn how to use its literature, and possess yourself of what there is on the theme of your choice, or else determine to give it up altogether. You may get on very well without college laboratories, you can survive it if unable to reach the meetings of men of learning, you can do without the counsel of an authority, but you can hardly be a contributor in science except you gain the use of its literature.

First in importance to the investigator are the original memoirs of previous investigators. The chemical determinations of the century have been imported by their authors in the periodicals. The serials of the years, the continuous living repositories of all chemistry, at once the oldest and the latest of its publications, these must be accessible to the worker who would add to this science. A library for research is voluminous, and portions of it are said to be scarce, nevertheless it ought to be largely supplied. The laboratory itself is not more important than the library of science. In the public libraries of our cities, in all colleges now being established, the original literature of science ought to be planted. It is a wholesome literature, at once a stimulant and a corrective of that impulse to discovery that is frequent among the people of this country. That a good deal of it is in foreign languages is hardly a disadvantage; there ought to be some exercise for the modern tongues that even the public high schools are teaching. That the sets of standard journals are getting out of print is a somewhat infirm objection. They have no right to be out of print in these days when they give us twenty pages of blanket newspaper at breakfast, and offer us Scott's novels in full for less than the cost of a day's entertainment. As for the limited editions of the old sets, until reproduced by new types, they may be multiplied through photographic methods. When there is a due demand for the original literature of chemistry, a demand in accord with the prospective need for its use, the supply will come, let us believe, more nearly within the means of those who require it than it now does.

What I have said of the literature of one science can be said, in the main, of the literature of the other sciences. And other things ought to be said, of what is wanted to make the literature of science more accessible to consulting readers. *A great deal of indexing is wanted.* Systematic bibliography, both of previous and of current literature, would add a third to the productive power of a large number of workers. It would promote common acquaintance with the original communications of research, and a general demand for the serial sets. Topical bibliographies are of great service. In this regard I desire to ask attention to the annual reports of the committee on Indexing Chemical Literature, in this association for nine years past, as well as to recent systematic undertakings in geology, and like movements in zoology and other sciences. Also to the Index Medicus, as a continuous bibliography of current professional literature.

Societies and institutions of science may well act as patrons to the bibliography of research, the importance of which has been recognized by the fathers of this Association. In 1855, Joseph Henry, then a past president of this body, memorialized the British Association for cooperation in bibliography, offering that aid of the Smithsonian Institution which has so often been afforded to publications of special service. The British Association appointed a committee, who reported in 1857, after which the undertaking was proposed to the Royal Society. The Royal Society made an appeal to her Majesty's Government, and obtained the necessary stipend. Such was the inception of the Royal Society Catalogue of scientific papers of this century, in eight quarto volumes, as issued in 1867 and 1877. Seriously curtailed from the generous plan of the committee who proposed it, limited to the single feature of an index of authors, it is nevertheless of great help in literary search. Before any list of papers, however, we must place a list of the serials that contain them, as registered by an active member of this Association, an instance of industry and critical judgment. I refer to the well-known catalogue of scientific and technical periodicals, of about five thousand numbers, in publication from 1665 to 1882, together with the catalogue of chemical periodicals by the same author.[1]

Allied to the much needed service in bibliography, is the service in compilation of the Constants of Nature. In the preface of his dictionary of solubilities, in 1856, Prof. Storer said "that chemical science itself might gain many advantages if all known facts regarding solubility were gathered from their widely-scattered original sources into one special comprehensive work." That the time of the philosophical study of solution was near at hand has been verified by recent extended monographs on this subject. In like manner Thomas Carnelley in England, and early and repeatedly our own Prof. Clarke in the United States,[2] bringing multitudes of scattered results into co-ordination, have augmented the powers of chemical service.

What bibliography does for research, the Handwörterbuch does for education, and for technology. It makes science wieldy to the student, the teacher, and the artisan. The chief dictionaries of science, those of encyclopædic scope, ought to be provided generally in public libraries, as well as in the libraries of all high schools.[3] The science classes in preparatory schools should make an acquaintance with scientific literature in this form. If scholars be assigned exercises which compel reference reading, they will gain a beginning of that accomplishment too often neglected, even in college, how to use books.

[1] "Bolton's Catalogue of Scientific and Technical Periodicals" (1885: Smithsonian) omits the serials of the Societies, as these are the subject of Scudder's "Catalogue of Scientific Serials" (1879: Harvard Univ.). On the contrary, Bolton's "Catalogue of Chemical Periodicals" (1885: N. Y. Acad. Sci.) includes the publications of Societies as well as other serials, Chemical technology is also represented in the last-named work.

[2] The service of compilation of this character is again indicated by this extract from Clarke's introduction to the first edition of his "Constants" (1873): "While engaged upon the study of some interesting points in theoretical chemistry, the compiler of the following tables had occasion to make frequent reference to the then existing lists of specific gravities. None of these, however, were complete enough. . . ."

[3] The statistics of school libraries in the United States are very meagre, the expenditures for them being included with that for apparatus. For libraries and apparatus of all common schools, both primary and secondary, the annual expenditure is set at 987,048 dollars, which is about seven-tenths of one per cent. of the total expenditure for these schools.

The library is a necessity of the laboratory. Indeed, there is much in common between what is called the laboratory method, and what might be called the library method, in college training. The educational laboratory was instituted by chemistry, first taking form under Liebig at Giessen only about fifty years ago. Experimental study has been adopted in one subject after another, until, now, the "laboratory method" is advocated in language and literature, in philosophy and law. It is to be hoped that chemistry will not fall behind in the later applications of "the new education" in which she took so early a part.

The advancement of chemical science is not confined to discovery, nor to education, nor to economic use. All of those interests it should embrace. To disparage one of them is injurious to the others. Indeed, they ought to have equal support. It would be idle to inquire into their respective advantages. This much, however, is evident enough, chemical work is extensive, and there is immediate want of it.

Various other branches of science are held back by the delay of chemistry. Many of the material resources of the world wait upon its progress. In the century just before us the demands upon the chemist are to be much greater than they have been. All the interests of life are calling for better chemical information. Men are wanting the truth. The biologist on the one hand, and the geologist on the other, are shaming us with interrogatories that ought to be answered. Philosophy lingers for the results of molecular inquiry. Moreover the people are asking direct questions about the food they are to eat, or not to eat, asking more in a day than the analyst is able to answer in a month. The nutritive sources of bodily power are not safe, in the midst of the reckless activity of commerce, unless a chemical safeguard be kept, a guard who must the better prepare himself for his duty.

Now if the people at large can but gain a more true estimation of the bearing of chemical knowledge, and of the extent of the chemical undertaking, they will more liberally supply the sinews of thorough-going toil. It must be more widely understood that achievements of science, such as have already multiplied the hands of industry, do not come by chances of invention, nor by surprises of genius. It must be learned of these things that they come by breadth of study, by patience in experiment, and by the slow accumulations of numberless workers. And it must be made to appear that the downright labour of science actually depends upon means of daily subsistence. It must be brought home to men of affairs, that laboratories of seclusion with delicate apparatus, that libraries, such has bring all workers together in effect, that these really cost something in the same dollars by which the products of industrial science are measured. Statistics of chemical industry are often used to give point to the claims of science. For instance, it can be said that this country, not making enough chemical wood pulp, has paid over a million dollars a year for its importation. That Great Britain pays twelve million dollars a year for artificial fertilizers, from without. That coal tar is no longer counted a bye-product having risen in its value to a par with coal gas. But these instances, as striking as numerous others, still tend to divert attention from the more general service of chemistry as it should be known in all the economies of civilization.

It is not for me to say what supplies are wanted for the work of chemists. These wants are stated, in quite definite terms, by a sufficient number of those who can speak for themselves. But if my voice could reach those who hold the supplies, I would plead a most considerate hearing of all chemical requisitions, and that a strong and generous policy may in all cases prevail in their behalf.

If any event of the year is able to compel the attention of the world to the interests of research, it must be the notable close of that life of fifty years of enlarged chemical labour, announced from Berlin a few months ago. When thirty years of age, August Wilhelm von Hofmann, a native of Giessen and a pupil of Liebig, was called to work in London. Taking hold of the organic derivatives of ammonia, and presently adopting the new discoveries of Wurtz, he began those masterly contributions that appear to have been so many distinct steps toward a chemistry of nitrogen, such as industry and agriculture and medicine have thriven upon. In 1850 he opened a memoir in the philosophical transactions with these words, "the light now begins to dawn upon the chaos of collected facts." Since that time the coal tar industry has risen and matured, medicine has learned to measure the treatment of disease, and agriculture to estimate the fertility of the earth. It seems impossible that so late as March of the present year, he was still sending his papers to the journals. If we could say something of what he has done we could say nothing of what he has caused others to do. And yet, let it be heard in these United States, without such a generous policy of expenditure for science as gave to Dr. Hofmann his training in Giessen, or brought him to London in 1848, or built for him laboratories in Bonn and Berlin, without such *provision by the State*, the fruits of his service would have been lost to the world. Ay, and for want of a like broad and prudent provision for research with higher education, in this country, other men of great love for science and great power of investigation every year fail of their rightful career for the service of mankind.

For the prosecution of research, in the larger questions now before us, no training within the limitations of human life can be too broad or too deep. No provision of revenue, so far as of real use to science, can be too liberal. The truest investigation is the most prudent expenditure that can be made.

In respect to the support that is wanted for work in science, I have reason for speaking with confidence. If I go beyond the subject with which I began I do not go beyond the warrant of the Association. This body has lately defined what its members may say, by creating a committee to receive endowments for the support of research.

There are men and women who have been so far rewarded, that great means of progress are in their hands, to be vigorously held for the best advantage. Strength is required to use large means, as well as to accumulate them. It is inevitable to wealth, that it shall be put to some sort of use, for without investment it dies. By scattered investment wealth loses personal force. The American Association, in the conservative interests of learning, proposes certain effective investments in science. If it be not given to every plodding worker to be a promoter of discovery, such at all events is the privilege of wealth, under the authority of this association. If it be not the good fortune of every investigator to reach knowledge that is new, there are, every year, in every section of this body, workers of whom it is clear that they would reach some discovery of merit, if only the means of work could be granted them. Whosoever supplies the means fairly deserves and will receive a share in the results. It is quite with justice that the name of Elizabeth Thompson, the first of the patrons, has been associated with some twenty-one modest determinations of merit recognized by this association.

"To procure for the labours of scientific men increased facilities" is one of the constitutional objects of this body. It is time for effectiveness towards this object. The Association has established its character for sound judgment, for good working organization, and for representave public interest. It has earned its responsibility as *the American trustee of undertakings in science.*

"To give a stronger . . . impulse . . . to scientific research" is another declaration of what we ought to do. To this end larger endowments are necessary. And it will be strange if some clear-seeing man or woman does not put ten thousand dollars, or some multiple of it, into the charge of this body for some searching experimental inquiry now waiting for the material aid. The committee upon endowment is ready for consultation upon all required details.

"To give . . . more systematic direction to scientific research" is likewise stated as one of our objects. To this intent the organization of sections affords opportunities not surpassed. The discussions upon scientific papers give rise to a concord of competent opinions as to the direction of immediate work. And arrangements providing in advance for the discussion of vital questions, as formally moved at the last meeting, will in one way or another point out to suitable persons such lines of labour as will indeed give systematic direction to research.

In conclusion, I may mention another, the most happy of the duties of the American Association. It is to give the hand of hospitable fellowship to the several societies who year by year gather with us upon the same ground. Comrades in labour and in refreshment, their efforts reinforce us, their faces brighten our way. May they join us more and more in the companionship that sweetens the severity of art. A meeting of good workers is a remembrance of pleasure, giving its zest to the aims of the year.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

1851 EXHIBITION SCIENCE SCHOLARSHIPS.—Her Majesty's Commissioners for the Exhibition of 1851, assisted by a committee of gentlemen experienced in scientific education, have made the following appointments to the science scholarships for the year 1892. The scholars have been students of science for at least three years, and have been recommended for the scholarships by the authorities of their respective Universities or Colleges, as indicating high promise of capacity for advancing science, or its applications, by original research. The scholarships are of the value of £150 a year, and are tenable for two years (subject to a satisfactory report at the end of the first year) in any University at home or abroad, or in some other institution to be approved of by the Commissioners. The scholars are to devote themselves exclusively to study and research in some branch of science, the extension of which is important to the industries of this country.

ARTHUR ELLIS, Major-General,
Secretary.

18, Victoria-street, Westminster, August, 1892.

University of Edinburgh.—Mr. Andrew John Herbertson.
,, Glasgow.—Mr. James Blacklock Henderson.
,, Aberdeen.—Mr. John Macdonald.
Mason Science College, Birmingham.—Mr. Lionel Simeon Marks.
University College, Bristol.—Mr. George Lester Thomas.
Yorkshire College, Leeds.—Mr. Harold Hart Mann.
University College, Liverpool.—Mr. James Terence Conroy.
Owens College, Manchester.—Mr. Thornton Charles Lamb.
University College, Nottingham.—Mr. Edward Arnold Medley.
Firth College, Sheffield.—Mr. William Henry Oates.
University College of North Wales.—Mr. Edward Taylor Jones (*conditionally*).
Queen's College, Cork.—Mr. George Ryce.
,, ,, Galway.—Mr. William Gannon.
University of Toronto.—Mr. Frederick J. Smale.
,, Adelaide.—Mr. James Bernard Allen.
,, New Zealand.—Mr. David Hamilton Jackson.
,, Sydney (*postponed from* 1891).—Mr. Samuel Henry Barraclough.

ROYAL COLLEGE OF SCIENCE, LONDON (SESSION 1891-92).—List of Scholarships, Prizes, and Associateships, awarded July 1892:—

First Year's Scholarships	Spencer, Bernard E.; West, George S.; Gray, Charles J.; Verney, Harry.	
Second Year's Scholarships	Allan, William.; Melton, George R.	
"Edward Forbes" Medal and Prize of Books for Biology	West, William; Vanstone, John H.	2 Medals and Prize divided.
"Murchison" Medal and Prize of Books for Geology	Starling, Sydney E.	
"Tyndall" Prize of Books for Physics Course I	Spencer, Bernard E.	
"De la Beche" Medal for Mining	Cooke, Lewis H.	
"Bessemer" Medal and Prize of Books for Metallurgy	Jeans, Harold.	
"Frank Hatton" Prize of Books for Chemistry	Perry, George H.	

Prizes of Books given by the Department of Science and Art.

Mechanics	Longbottom, John G.
Astronomical Physics	Bruce, James.
Practical Chemistry	Perry, George H.
Mining	Cooke, Lewis H.
Principles of Agriculture	Jones, Thomas.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 16.—M. Duchartre in the chair.—Theory of a condenser introduced into the secondary circuit of a transformer, by M. Désiré Korda.—Vaporization in boilers, by M. de Swarte.—On some new combinations of piperidine, by M. Raoul Varet.—On an application of chemical analysis for fixing the age of prehistoric human remains, by M. Adolphe Carnot. This determination is based upon the drogressive diminution of fluorine contained in the fossil bones of the various geological ages. If the quantity contained in the most ancient remains be designated by 1, we shall have 0·64 for Tertiary remains, 0·35 for "Quaternary," and 0·05 or 0·06 for the recent ones. This fact was utilized in fixing the age of a human tibia found in the sandy layers of Billancourt (Seine) in the neighbourhood of some remains of undoubted Quaternary origin. The ratio of the quantity of fluorine contained in the animal fragments to that in the human tibia was found to be 0·469 or 0·578 to 0·066. This establishes the more recent origin of the tibia.—On a new genus of permio-carboniferous stems, the *G. Retinodendron Rigolloti*, by M. B. Renault. The specimen upon which this new genus has been founded was discovered by M. Rigollot in the silicified layers of Autun. It represents a stem 12 mm. thick, 3 mm. of which belong to the wood and 9 mm. to the bark. The latter is composed of several eccentric zones of gum or resin canals, and of cells with sclerified walls in regular alternation. The canals are arranged in continuous circular lines; their cavities enclose a brown substance which is sometimes granular. The structure of the wood indicates that the new genus belongs to the gymnosperms; its density and the small thickness of the ligneous cellular rays distinguish it from the ordinary cycads, while their composite nature makes it impossible to class them with the conifers. Hence it belonged to a family of gymnosperms which is actually extinct. It may be concluded that at no other epoch have the plants secreting gums, resins, tannin, &c., been more abundant, and that the carbonization of these products is the origin of the yellow or brown substances found not only in the bituminous schists, forming bands or small lenticular patches, but also in pitcoal, impregnating more or less the preserved tissues, and in cannel-coal, enclosing a large number of recognizable vegetable fragments.—Pancreatic diabetes, by MM. Lancereaux and A. Thiroloix. Further experiments show that there exists a diabetes actually consequent upon the destruction of the pancreas; this diabetes is not, however, caused by the absence of the external glandular secretion, but simply by the absence of the liquid secreted internally by the gland and absorbed by the blood-vessels and the lymphatics.—On a new treatment of the glanders, by MM. Claudius Nourri and C. Michel. This is identical with that applied recently to human tuberculosis, with which it has much in common.

CONTENTS. PAGE