THURSDAY, NOVEMBER 12, 1885

THE INTERNATIONAL SANITARY CONFERENCE OF ROME, 1885

THE first volume of the Proceedings of the International Sanitary Conference of Rome has been issued just at the time when the question of the re-assembling of the Conference is a matter of diplomatic discussion. The Roman Conference of this year was brought together by the Italian Government because it was felt that, after the cholera experience of 1883 in Egypt and of 1884 in Southern Europe, advance might be made in determining the bases of an International Code as to quarantine or other preventive measures. The previous Conference had been held at Vienna in 1874, and the conclusions then arrived at had indicated substantial progress since the preceding meeting at Constantinople in 1866. Under these circumstances nearly all civilised Governments responded to the appeal of Italy, and five delegates were deputed to represent this country. Two of these, Sir W. Guyer Hunter and Dr. Thorne Thorne, acted with the British Ambassador at Rome for Great Britain, and Sir Joseph Fayrer with Dr. Timothy Lewis went as representatives of our Indian Empire. Soon after the opening proceedings, a Technical Commission, consisting of the medical delegates, was formed, and it is essentially with the proceedings of that Commission that the volume referred to has to do.

With the ready assent of Dr. Koch, the Commission decided at the onset not to discuss scientific questions bearing upon etiology or otherwise, and the series of resolutions arrived at deal almost exclusively with the measures which are deemed necessary to prevent the spread of cholera in Europe. Perusal of the proceedings at once shows that the Powers bordering on the Mediterranean had one principal object in view. They were convinced that shipping passing from India *viâ* the Suez Canal constituted the great source of danger to ports on the basin of the Mediterranean; they knew that the sanitary state of the majority of those ports could not withstand the importation of infection; hence, cost what it might to other nations, they were determined to place restrictions upon shipping passing through the canal. It is true that the utter failure of quarantine measures had once more been abundantly shown during the 1884 epidemic, and for this reason the Commission decided to drop the word quarantine altogether; and they proposed, instead of the ten days' quarantine which had been sanctioned at Vienna, to require a detention of five days for the purposes of "observation." But, as was pointed out by the English delegates, this was quarantine pure and simple, for it involved the disembarkation of all on board vessels which might be regarded as infected by some internationally appointed officer, and the detention of men, women, and children in the filthy lazarets of the Red Sea shores for as many consecutive periods of five days as the officer in question might choose to dictate, so long as he could regard any one amongst the persons thus isolated as having suffered from symptoms which in his opinion resembled cholera. As regards European protection, it was also contended that such a measure was unnecessary in the case of British ships, and the Commission were twice challenged to give a single instance in which cholera had been brought into the continent of Europe by means of a British ship coming from India. And if it was unnecessary, it was contended that, provided British ships touched at no ports on their way home, they should be allowed the free passage of the Suez Canal as of an ordinary arm of the sea.

But quarantine restrictions were not only held to be unnecessary, they were also shown to be distinctly mischievous in so far as they led the inhabitants of threatened countries to rely on Government measures of that description instead of adopting measures of sanitation which constituted the true remedy against cholera spread. And here the experience of England was shown to be strikingly opposed to quarantine. It is now some ten years since England, adopting one of the alternative measures sanctioned at Vienna, decided that since quarantine must always fail, the country would place its trust in an inspection of in-coming vessels, together with the immediate isolation of the sick in hospital, and in securing such improvement in the sanitary state of the country as would tend to remove the conditions favourable to the diffusion of cholera if imported. And Dr. Thorne Thorne, whilst pointing out in detail that during that period of ten years our sanitary authorities had spent some 27,250,000*l.* in large public health works and that this had in truth been a remunerative expenditure by reason of the saving of life which had followed it, asked what country had shown a greater proof of the value it set on human life than England had, and contended that it would be an unfortunate day if we were to replace such a system by the imposition of a five days' quarantine. Indian statistics proving similar results were also brought forward by Sir Joseph Fayrer, and they must be regarded as unanswerable.

In short, the English delegates contended that we must look, above all, to improved sanitation in order to get rid of the danger of cholera; that countries which are taught to rely on the false security of quarantine measures and sanitary cordons will not at the same time spend their money on sanitation; and that the very countries which had fitted themselves to resist cholera by making real and substantial progress as regards sanitary improvements, and had thus effected a saving in life from infectious diseases, were those which had determined to place little or no trust in measures of quarantine.

Compared with the resolutions of the Vienna Conference, the conclusions arrived at in Rome do in many respects admittedly afford evidence of considerable advance, but they are vitiated by the initial error of trusting to modified quarantine restrictions, instead of boldly facing the need for improved sanitation. As yet these conclusions are those of the Technical Commission only, and it remains to be seen whether, since the English delegates are opposed to their colleagues on a matter of such vital principle, any object will be gained by the re-assembling of the Plenary Conference, to discuss the recommendations made by the Commission.

"EVOLUTION WITHOUT NATURAL SELECTION"

Evolution without Natural Selection; or, The Segregation of Species without the Aid of the Darwinian Hypothesis. By Charles Dixon. (London: R. H. Porter, 1885.)

THE title of this little book is misleading. Far from offering any account of evolution without natural selection, the author habitually ascribes to natural selection the lion's share of the work, only reserving a few odds and ends of small detail as results ascribed by him to other agencies. Such odds and ends have reference almost exclusively to minute differences of coloration in allied species of birds—the argument being that these differences are too minute to count for anything in the struggle for existence, and therefore cannot have been due to survival of the fittest. Now, although Mr. Dixon has presented in a brief and very readable form a considerable number of most interesting facts upon this head, they cannot be said to have any bearing upon the Darwinian hypothesis. For even if it were conceded, for the sake of argument, that all the cases given of slight variation in allied species are without utilitarian significance (although this would be a large concession), we should still be well within the four corners of Darwinism. It is the very essence of the Darwinian hypothesis that it only seeks to explain the apparently purposive variations, or variations of an adaptive kind; and, therefore, if any variations are taken to be non-adaptive, *ex hypothesi* they cannot have been due to natural selection. But as such variations are, even upon the showing of our author himself, for the most part rare and always trivial, they may be freely presented to the anti-Darwinians without any loss to Darwinism. Indeed, Mr. Darwin himself has clearly recognised the occurrence of such trivial specific characters, and observes that if they are "really of no considerable importance in the struggle for life, they could not be modified or formed through natural selection." But it is no part of the theory of natural selection that it should necessarily occupy the whole field of possible causation in the genesis of species. It is surely enough if it be taken to explain all cases of *adaptation;* and this, if we understand him aright, Mr. Dixon is prepared to allow. Thus, for example, he says:—"We can therefore understand how the modifications which many species have undergone, through climatic and other causes, have been taken advantage of *when they began to be of service;* although at the time the modifications took place they were not of the slightest use!" The note of admiration here seems to imply, in accordance with the whole tone of his book, that the writer considers this view to be in some way an important emendation of Darwinism. But, in point of fact, it is Darwinism pure and simple. For Darwin is most express in affirming that natural selection cannot be supposed the original cause of variation, being only called into play when the variations, as Mr. Dixon says, begin to be of service. What these original causes of variation may be is a distinct question, and one which it remains for the future to answer. For, as we shall immediately proceed to show, Mr. Dixon has not been successful in furthering the solution.

The influence on which he chiefly relies is that of isolation, and he has gathered a number of interesting facts whereby to justify his opinion. It is needless to say that this opinion also is quite in harmony with Darwinian teaching; for when a section of a species is geographically isolated, the constituent members of it are virtually confined to a world of their own whereon to begin a new course of history, and being thus cut off from interbreeding with the main stock, there is nothing remarkable in the fact that, under such circumstances and in some cases, the history of the isolated section should not run perfectly parallel with that of the main stock. This, indeed, is Mr. Dixon's own view, and we should have no criticism to offer upon it, if, on the one hand, he did not present it as anti-Darwinian, and if on the other hand he had been more clear in distinguishing between a condition and a cause. He everywhere speaks of isolation as the cause of minute specific characters; whereas it is obvious that at best it can only be the condition to the operation of causes, the nature of which it apparently does not occur to him to suggest.

Another agency invoked by the writer as a direct cause of variation is climate. But here again his views cannot be said to be anti-Darwinian, save in so far as they appear to err on the side of exaggeration. For even Mr. Spencer—who, by the way, ought to have been mentioned by Mr. Dixon as having long ago argued in favour of such direct causes of variation—would scarcely go so far as to attribute to climatic influences variations of a protective kind. This, however, is done by Mr. Dixon; but he maintains a judicious silence upon the closely-allied topic of mimicry. Yet such remarks as the following apply with even more force to the facts of mimicry than to those of protection:—"If the colour was donned from protective motives, to escape some special enemy, it seems impossible not to believe that the species would have become exterminated long before the protective colour reached a beneficial degree of development." Does Mr. Dixon believe that the exquisite details of form and colour whereby an insect is made to resemble a leaf can reasonably be ascribed to climatic influences? If not, what becomes of his argument touching the much less remarkable cases of protective colouring?

There still remains one other criticism of a general kind which it seems impossible to avoid making. On p. 7 it is said: "Natural Selection is probably the most potent agent in the evolution of new species only at such times when the earth is undergoing violent changes. . . . We can conceive how, as soon as violent changes once more pervade the world, the struggle for life will be infinitely greater than it is now. Then species will be matched against species, race against parent form, or race against race; all Nature will be thrown into a kind of chaos; and then Natural Selection will adjust the disordered balance," &c., &c.

Now, this passage, which appears to be intended as conciliatory to Darwinism, is the only really anti-Darwinian passage in the essay. For not only are the views expressed by it in direct contradiction to the now universally-accepted teaching of uniformitarianism, but they equally run counter to the emphatic contention of Darwin, that the great merit of his theory consists in its agreement with that teaching. Not in chaos or in

cataclysm is the influence of natural selection to be sought, but in forest and in field, in river, lake, and sea, where all may seem most orderly and eloquent of peace.

But although we are thus unable to commend Mr. Dixon's philosophical views on topics connected with natural history, we should be sorry to take leave of his work without explicitly stating what has already been implied—namely, that his facts are better than his theories. On this account we consider that his essay well repays perusal, and therefore recommend it to the notice of zoologists.

GEORGE J. ROMANES

FORESTRY IN POLAND

Forests and Forestry in Poland, Lithuania, the Ukraine, and the Baltic Provinces of Russia. With Notices of the Export of Timber from Memel, Dantzig, and Riga. Compiled by John Croumbie Brown, LL.D., &c. (Edinburgh; Oliver and Boyd. London: Simpkin, Marshall, and Co., and William Rider and Son, 1885.)

THIS is another contribution of Dr. Brown's to the subject of forestry and to the furtherance of the formation of the Museum and School of Forestry in Edinburgh, which, it was thought, might be the outcome of the Forestry Exhibition held in the Scotch capital last year. The consideration of the establishment of a forest school has since occupied a wider range of thought, consequent upon the action of Sir John Lubbock in the House of Commons, and in connection with this Dr. Brown's latest volume will probably be of some interest in showing what is effected in forest matters in countries somewhat beyond the track of the ordinary English traveller, notwithstanding that Dr. Brown has given us similar books to the present on the forests of Norway, Northern Russia, the Ural Mountains, &c.

The present book commences with a very readable comparison of the facilities of travelling in Poland, Lithuania, Courland, Estonia, and Livonia some forty years since and at the present time.

In the first chapter the character of the country along the railway for some 200 miles from St. Petersburg towards Poland is described as a dead level of marshes and bogs; such dry land as there is being to some extent covered with trees probably of no great age, "apparently," Dr. Brown says, "the scraggy representatives of extensive forests of a former day." Nowhere are such forests as may be seen in travelling in the Governments of Olonetz and Archangel in Northern Russia, and of Moscow, Orel, and others in Central Russia.

Entering Poland at Kovna, about 200 miles from Dunsburg, and advancing through the eastern portion of that country, Dr. Brown says the traveller remarks that agriculture appears to be carried on with a more scientific character than in the lands through which he has been passing. Agriculture seems also to be more remunerative; the crops are thicker. The fields are sown with wheat, whereas to the north of Kovna barley, oats, and flax alone are cultivated. All the more valuable cereals seem to flourish in Poland, and in passing through this district there is produced an impression that the soil is more productive than it is further to the north; that the climate must be more equable; and the superficial aspect of the land being more undulating, and at the same time more thickly wooded; that as an agricultural district it must be at least 50 per cent. superior to the Governments of St. Petersburg and of Pskoff. In Poland both wheat and wool are raised for exportation. Large crops of potatoes are grown for the production of spirits by distillation, and beetroot for the manufacture of sugar; and wood for building purposes is exported largely. The Scotch fir (*Pinus sylvestris*) and the oak (*Quercus Robur*) are of very superior quality.

The trees in this district are described as being different in character from those of the region traversed in coming hither. In the earlier stages of the journey they consisted almost exclusively of firs, birches, and willows, while around Berdicheff in Poland the woods are composed in a great measure of oaks, elms, and chestnuts.

Dr. Brown's second chapter is devoted to forest exploitation, and the third chapter to the important subjects of area, distribution, management, and produce of forests. The information under these heads is, however, to some extent technical and statistical. Some interesting facts are quoted regarding what may be called bye-products of the forest, such, for instance, as honey, which is collected by the bees largely from the flowers of the lime-tree, as well as from the thyme, hyssop, and buckwheat.

Regarding the schools of forestry in Poland, the most important arrangements for the study of forest science and economy by forest officials are at Novoi Alexandria. Of these arrangements details are given, from which it seems that the institute is ranked as a college of the first class with two sections—one devoted to the study of rural economy and agriculture, the other to the study of forest science and forestry, with a farm, forest, and an extensive domain attached to it, the whole being placed under the Minister of Public Instruction at Warsaw. The staff of officials includes a director, inspector, five professors, eight tutors and three teachers, a laboratory superintendent, a mechanic, foreman of the workshop, land steward or manager of the estate, gardener and assistant, surgeon, secretary, book-keeper, and a superintendent of buildings. No professor can hold two chairs, and any of them after twenty-five years may be again and again reappointed for successive terms of five years each. A Board of Management, consisting of the director, inspector, and two professors, has the charge of expenditure to the amount of 300 roubles, to be sanctioned by the director; the expenditure of sums between 1000 and 5000 roubles requires the sanction of the Council; and the expenditure of sums above this amount that of the Ministry. The course of instruction embraces a very wide range of subjects. The instruction is given in the Russian language. Each professor and tutor is required to give six lectures a week, and teachers to spend twelve hours a week in class duties.

In the second part of Dr. Brown's book, which is devoted to Lithuania, the chapters are apportioned to considerations of the people, the aspects of the country, forests of the Dnieper, while Parts III., IV., and V. are respectively given up to the Ukraine, the timber exports of the Baltic, and the Baltic provinces of Russia.

OUR BOOK SHELF

Elementary Mechanics. By O. J. Lodge. (London and Edinburgh: Chambers, 1885.)

THIS is a revised edition of Prof. Lodge's Text-Book:—not much altered, so far as we can see even by the help of the rapid yet searching stereoscopic squinting, from the former edition. Why a writer, who begins by acknowledging his indebtedness to the really scientific works of Thomson and Tait, Clerk-Maxwell, and Clifford, should make frequent references to the merely "popular" and singularly loose *brochures* of Deschanel and Ganot, is a question more easily asked than answered. But it is totally unintelligible to us that, having begun with classical works, he should proceed to "recommend real students to read one or other" of these poor compilations. Was it not Horace Smith who said:—

> "Is there such scanty store of standard works,
> That students must be fed on foreign trash?"

But Prof. Lodge's own standard is far above that of the books to which he, unfortunately and unaccountably, refers his "real students." His work is a curious one. There is scarcely a trace of the dogmatism which is asserted to be so natural to the *genus* Professor! The author seems to place himself on the same level with his reader, and anxiously to seek for confirmation of his own statements in the assent of his pupils. This is, to say the least, unusual; but we cannot at once either commend, or find fault with, it. It is a new departure, and its value and usefulness must be judged by its success.

There are a few elementary, but important, points in Dynamics, by his treatment of which every author on the subject shows at once whether he is "sound in the faith" or not. On the whole, Prof. Lodge passes these tests with credit; and the rest of his book is of a much higher order than the run of elementary treatises.

There are, however, here and there some singular slips, which should be corrected in future editions. We note only one or two, but even these are destructive of the character for definiteness and accuracy which should be the leading feature of every scientific book. Thus, in §5 (where, unfortunately, a "statical" definition of force is introduced as well as a "kinetic" one) we are told that *change of motion* "is called" *Acceleration;* though in later sections the true meaning:—i.e. *Rate of* Change of *Velocity*:—is assigned to Acceleration. To the mere popular reader this may appear hypercriticism; but science is most careful to distinguish not only between *Change* and *Rate of Change*, but also between *Motion* and *Velocity*. Again, in § 16, serious confusion is introduced by the statement that the velocity of a point at unit distance from an axis "*is called*" the angular velocity of the rotating body. Prof. Lodge knows perfectly well that it is not so, and that none but unscientific people could confound a quantity of dimensions $[T^{-1}]$ with another of dimensions $[LT^{-1}]$; even when, as in the present case, their *numerical* values happen to be equal. We are tempted to seek an explanation of, and thus to find an excuse for, these and other similar slips, in his inexcusable partiality for the works of Deschanel and Ganot.

P. G. T.

The Ocean, &c. By W. L. Jordan. Second Edition. (London: Longmans, 1885.)

OF this elaborate work it is enough to say that it is based on "*The* New Principles of Natural Philosophy." These principles we sketched (June 21, 1883) in an article which, as his mode of acknowledgment showed, was by no means satisfactory to our Author. That *Vis Inertiæ* was entirely misunderstood by Newton, and that *unresisted* motion ultimately comes to rest, are among the chief foundations of this work! That a terrestrial globe whose frame is carried round through a portion of a curve, and then suddenly stopped, will rotate in consequence, is conceivable: but we should try to explain the fact by bad centering, or some such cause; certainly not by the assumption that, during the curvilinear motion, one part of the equator had necessarily a greater *linear* velocity than the opposite part. Our Author does not seem to be acquainted with the most elementary properties of the kind of motion called Translation! But this is merely, on his part, the most recent revival of Jelinger Symonsism:—for it assumes the fundamental tenet of that peculiar heresy; viz. that a body, which revolves round a centre, is not rotating if it turn always the same side to the centre. It is needless to say more on this melancholy waste of time, trouble, and ready money (the latter especially); on the part of an author who has been complimented by a reviewer of one of his other works as having "a familiar acquaintance with questions of finance." See *Advertisement* appended to the present volume.

P. G. T.

Spectrum Analysis. By Dr. H. Schellen. Translated from the Third German Edition by Jane and Caroline Lassell. Edited, with Notes, by Capt. Abney, R.E., F.R.S. (London: Longmans, 1885.)

THIS is the second edition of a well known book: in its general arrangement there is little departure from the first, which appeared in 1872. While the German edition from which it has been translated was being prepared, the author unfortunately died; it is not to be wondered at therefore that the present reprint does not reflect the present state of our knowledge so accurately as did the former one; indeed there is evidence that the German editor has been compelled by the sad circumstances under which this task devolved upon him to take what was readiest to his hand.

Some of the material however is very valuable: thus, for instance, we have a complete and well illustrated account of Vogel and Huggins' work on the spectra of stars, much interesting information concerning Prof. Rowland's new concave gratings; while the English editor has added a full account of Abney, Festing, and Langley's work on infra-red spectra, and Abney and Schuster's discussion on the photographs taken during the eclipse of 1882. With these exceptions the English, French, or Italian work accomplished during the last ten years is but imperfectly referred to. The names of Thollon and Tacchini, to say nothing of Crookes and Hartley, not even being in the index. To the student therefore the book is worse than useless, it is misleading. The popular reader, however, who does not care too much for completeness will find much information conveyed in a pleasant form. The main branches of the science, both in its terrestrial and celestial applications, are dealt with, and the methods of work are given. Great interest also attaches to the various forms of instruments used in the new science; many of these are described, from a new form of pocket spectroscope—which we learn from the index was devised by Capt. Abney—to the more complex apparatus designed by Vogel, von Konkoly, and others.

The theoretical parts are perhaps most to be avoided. The chapter on the plurality of spectra, for instance, will help the reader very little in coming to a conclusion upon a subject of fundamental importance. Such a statement, too, as that on p. 268, "That Kirchhoff's theory has received full confirmation from the observations of solar total eclipses" is not so true as the writer evidently thought it to be.

Again, on the question of the change of refrangibility of light due to the motion of a light source towards or from the eye. The complete statement made by Fizeau in 1848 appears to be unknown to the author, who attributes the solution of the problem to Mach, of Prague, in the year 1860.

The translators have done their work throughout in a

very admirable manner, showing that they possess a perfect acquaintance with the subject.

There are, however, a few minor blunders; thus, for instance, the substitution of the word "length" for "longitude" in connection with the perihelion and node, plays havoc with the elements of a comet's orbit, given on p. 584, while the diagram on p. 387, illustrating the change of wave-length, is rendered unintelligible by the misplacement of the figures indicating miles per second.

A Practical Arithmetic on an entirely New Method. By John Jackson. (London: Blackie, 1885.)
Principles of Arithmetic. By Homersham Cox, M.A. (Cambridge: Deighton, 1885.)

As the title-pages indicate, these attack the subject from quite different sides: the former is eminently practical, and everything unpractical is carefully eschewed: the latter goes into the principles and considers all from the theoretic side, giving very little practice.

Mr. Jackson aims at giving the easiest and shortest rules he can; explanations are few, the deficiency to be met by black-board illustration. The fractional form for the solution of questions is adopted in the advanced rules; but the most noticeable feature is the exclusion of the rule of "subtraction" and the substitution of what the writer calls "incremental or complementary addition." To take an example in compound complementary addition:—A pays a bill of 15*s.* 8¾*d.* with a sovereign; the tradesman says, "15*s.* 8¾*d.* with a farthing (puts it down) make 15*s.* 9*d.*, and 3*d.* (puts it down) make 16*s.*, and 4*s.* (puts it down) make one pound." There is no new difficulty introduced here, and a beginner is taught a good practical lesson. There is a vast collection of examples, numerous examination papers, and a good store of sums worked out on the usual plan, as well as on that put forward by the writer. There are 25 pages of tables containing specific gravities, a mariner's compass, a perpetual calendar (to A.D. 1925), compound interest results, square and cube numbers, prime numbers and logarithms. Some space, as might be expected, is devoted to "mental arithmetic." We have shown, we think, that this book well merits its title of a "practical" arithmetic.

Mr. Cox at once states "the object is to give an account of the principles of arithmetic, omitting all merely mercantile applications." The author takes as his guide, in the main, Cantor's "Geschichte der Mathematik," consulting also Hankel and Nesselmann ("Algebra der Griechen"); but "the conception of the subject as a whole, and many of the details, have been taken from the mathematical portions of the works of Auguste Comte, and in especial from his last great work, the 'Synthèse subjective.'"

There is no index nor table of contents, which is a drawback to the ready use of the book. There is an introduction, and then come seven chapters. Chapter I. discusses Numeration; Chapter II. is devoted to the first four rules in four sections; Chapter III., on Properties of Numbers, is divided into four sections: (1) Theorems (the commutative, the associative, and distributive); (2) G.C.M.; (3) Prime and Composite Numbers; (4) L.C.M. Chapter IV., in four sections, treats of the four rules for fractions, and in the fifth section discusses Ratio and Proportion. Chapter V., in six sections, treats of Decimal fractions. Chapter VI., in four sections, discusses powers and roots, with geometrical illustrations and resumes (in Section IV.) the subject of Ratio and Proportion (applied to incommensurable quantities). Chapter VII., in three sections, resumes the discussion of Properties of Numbers, as regards Permutations, the Arithmetical and Geometrical Progressions, and Figurate Numbers. There are a few exercises appended to the sections. The book in parts reminds us much of De Morgan's Arithmetic: it will be valuable for teachers, even if they have read the works cited in Mr. Cox's preface. It is by no means a school-book, though senior boys may derive much interest as well as profit from its perusal.

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. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Recent Total Eclipse of the Sun

By last mail I sent you a brief account of my eclipse observations at Tahoraite on the 9th inst., and a diagram illustrating the corona. Owing to a miscalculation as to closing time of mail the account had to be very hurriedly written; there was no time to revise it or to find out the longitude and latitude of the point of observation, but this information I am now able to supply from the Trigonometrical Survey Records at Napier:—

	Longitude		Latitude
Centre of railway station at Tahoraite, Hawkesbay	176° 5′ 7″·07	...	40° 13′ 17″·22

The longitude and latitude of the nearest Trigonometrical Station, No. 83, from which the above were calculated, seems to have been originally fixed with reference to Trigonometrical Station No. 60, Lighthouse Reserve, Napier, whose latitude then, according to observations taken in January 1871, was 39° 28′ 47″·30. According to fresh observations taken in February 1885 the latitude of the same point is 39° 28′ 43″·52 ± 0° 0′ 0″·04. If both series of observations are correct, a *reduction* in latitude to the extent of about 3″·78 must have taken place since 1871.

Considering the position of New Zealand at the Antipodes of Europe, where a reduction of latitude seems to have occurred, a reduction like the one above indicated, bearing as it does on a very interesting question, has particular importance and urgently calls for confirmation. As mentioned in my last letter, the corona reminded me of an auroral display. The rays all seemed radially disposed and perfectly straight with well defined edges. The differences in length were very remarkable. All the observers I have spoken to agree as to the position of the longest ray, but not as to that of the others. The public attention was, however, fixed on the red protuberances and the other phenomena of the eclipse, and little notice was evidently taken of the corona.

N. A. GRAYDON

Hastings, Hawkesbay, New Zealand, September 25

Ophthalmologic Education in the United Kingdom

I DID not see your notice of my translation of Fuchs's "Causes and Prevention of Blindness" until to-day. I find two accusations brought against me, which I do not admit to be well founded.

(1) I am accused of "mistranslation" because I have often rendered "Augenheilkunde" by the word "ophthalmology." You state that "the treatment of diseases of the eyes' would be the correct translation. "Ophthalmic medicine," which is my alternative translation, is more correct than the translation you offer; but ophthalmology is quite sufficiently correct, and in many cases is employed by the author indifferently with "Augenheilkunde," to express the same thing. No doubt "ophthalmology," etymologically considered, is a more comprehensive word than "Augenheilkunde" or its English synonym "ophthalmic medicine;" but custom has sanctioned its employment in the limited sense of the latter word in Germany, in France, and in this country. Thus the Professor of Ophthalmic Medicine in Vienna was Professor of Ophthalmology. Fuchs constantly speaks of "ophthalmological clinics," and in many of the medical schools of this country the lecturers on what is in other schools called "ophthalmic surgery," "diseases of the eye," &c., are called lecturers on "ophthalmology" (King's College, Yorkshire College, Liverpool University College, Owens College, Catholic University School of Medicine, Dublin).

(2) I am blamed for not correcting Fuchs when he says, "As a rule no regular lectures on ophthalmology (Augenheilkunde)

are delivered in the medical schools of Great Britain and Ireland." You say: "Systematic lectures are delivered in every medical school in the United Kingdom; and it is difficult to believe that the translator could have been unacquainted with the fact." Now, I do not admit that it is the duty of a mere translator to correct all the errors of the original, and, as a matter of fact, I have, I think, only once put the author right (at p. 109); but I do not admit the author to be wrong in his assertion. Looking through the *Medical Directory* for this year, I find that eleven medical schools make no provision whatever for ophthalmological instruction, and I doubt very much if the "Ophthalmic Demonstrations," "Clinical Lectures on Diseases of the Eye," "Ophthalmic Surgery," &c., advertised at many of the other schools, would properly come under the head of Dr. Fuchs's "regular lectures," or the "systematic lectures" you speak of. As it is upwards of forty years since I was a student at a medical school, I may of course be mistaken respecting the present state of ophthalmologic education in this country; at all events, I had not any knowledge of an opposite state of things which would have enabled me to say that Dr. Fuchs was wrong in saying that "*as a rule* no regular lectures on ophthalmology are delivered" in our medical schools, and the facts I have given above seem to prove that "regular lectures" on ophthalmic medicine are still the exception in the medical schools of the United Kingdom.

R. E. DUDGEON

53, Montagu Square, November 4

[We have referred Dr. Dudgeon's letter to the writer, who replies as follows:—

Dr. Dudgeon's letter will not bear a moment's examination.

In the first place he misstates what he calls the "first accusation." He was not accused of "often" rendering "Augenheilkunde" by "Ophthalmology," but of having done so in one particular place, in which the effect of the mistranslation was to give a certain amount of colour to a statement which, in the original, was wholly untrue.

It is obvious that "Ophthalmology" is neither English, French, nor German. It is common to all three, and the forms of it differ only in termination. "Ophthalmologie" should be rendered by "ophthalmology," and *vice versâ*. Its meaning embraces everything appertaining to the eyes, and its German equivalent is "Augenlehre."

"Augenheilkunde," on the other hand, is a word of limited significance, the meaning of which embraces only the treatment of affections of the eyes. Dr. Dudgeon's suggested rendering, "Ophthalmic Medicine," is so far inadequate that it might not be understood to include surgery, and it could hardly be understood to include the use of optical appliances. "Augenheilkunde" forms part of ophthalmology, an important part indeed, but a part only.

Dr. Fuchs asserted that, "as a rule, no regular lectures on 'Augenheilkunde' were delivered in the medical schools of Great Britain and Ireland." This assertion, very possibly made in honest ignorance, is absolutely the reverse of the truth. Dr. Dudgeon altered it into the statement that "no regular lectures on ophthalmology" were so delivered. This, in a sense, is true; because the lectures, which cover the whole extent of "Augenheilkunde," neither cover, nor attempt to cover, "ophthalmology."

I do not think it is too much to expect that a translator shall correct a misstatement in the original work, especially when that misstatement is one which casts a wholly unmerited stigma upon the institutions of the translator's native country. Instead of correcting it, Dr. Dudgeon casts it into an altered form, in which it may be said to be true literally, although calculated to produce an entirely erroneous impression upon the reader.

Dr. Dudgeon must not go to the extremely condensed statements of the *Medical Directory* for complete accounts of the work done by British Schools of Medicine, but to the prospectuses of the schools themselves. There are thirteen such schools in London, and regular lectures on "Augenheilkunde" are delivered at all of them; at Bartholomew's by Messrs. Power and Vernon; at Guy's by Mr. Higgins and Dr. Brailey; at King's College by Mr. MacHardy; at the London by Mr. Waren Tay; at the Middlesex by Mr Lang; at St. George's by Mr. Brudenell Carter and Mr. Frost; at St. Mary's by Mr. Critchett; at St. Thomas's by Mr. Nettleship; at University College by Mr. Tweedy; at the Westminster by Mr. Cowell; at the West London by Mr. Vernon; at the School of Medicine for Women by Mr. Mackinlay. At Charing Cross the lectures are delivered by arrangement with the staff of the adjacent Westminster Ophthalmic Hospital. It would be tedious to enter into particulars with regard to the provincial, Scotch, and Irish schools, but similar lectures are delivered in all of them.]

The Helm Wind

THE *helm wind* of Cumberland has been the subject of much discussion in England. I wonder how the true explanation has not been found, viz. *that the helm wind is a bora, i.e.* identical in character with the extremely strong dry east and north-east winds blowing on the coasts of Istria and Dalmatia, as well as on the north part of the east coast of the Black Sea, especially at Novorossiisk. At the latter place it blows from the Varada chain, about 2000 feet high, and, as with the helm wind, it is not felt a little distance to the east. I give the translation of a passage on the bora in my book on "The Climates of the World":—

"Seamen call the bora an *air-waterfall*. There is reason to believe that it begins when the stable equilibrium between the air-strata on the mountain and the bay is disturbed, *i.e.* when the latter is more than 10° warmer than the former. The Varada chain falls in a gentle slope eastward towards the broad Adegoa valley, to the north-east of which is the Svinzovy (Lead) chain. In this walled-in valley the temperature is much lower than on the coast, especially in winter and autumn, and when the cold air fills it to overflowing there arises an unstable equilibrium towards the west, and the colder it is on the mountain in comparison to the bay, the stronger is the reaction, *i.e.* the bora."

Here also the bora may arise, not only on account of a strong local cooling of the air in the Adegoa valley, but also accompany general north-east winds to the north of the Caucasian chain. They bring cold air from afar, are sometimes prevented by the Varada chain from sinking to the sea-level, and during this time the equilibrium is disturbed and they appear as bora, even if they blow as gentle farther to the east.

I have no doubt the English helm wind is also due to a disturbed equilibrium. The east is colder than the west, and the contrast is stronger when east winds blow, *i.e.* local radiation makes the east yet colder, and in short a difference of temperature of about 14° is likely to occur between the Cross Fell Range and the Penrith valley. In summer the wind is not felt—the west being then colder than the east; and it is less frequent in winter than in November, March, and April, because the prevailing west winds and the cloudy weather which necessarily accompanies them equalise the temperature.

St. Petersburg, October 19[31] A. WOEIKOF

The Resting Position of Oysters

THE evidence adduced by Mr. Cunningham to prove that oysters rest on the right or flat valve in their natural state seems conclusive. Remembering, however, that I possessed a young oyster-shell detached from a sandstone rock years ago on the coast of Arran, I turned to it, and was surprised to find that the lower or attached valve was unmistakably the larger, overlapping the other at the hinge and all round. I have another single valve of some foreign species taken from a Haliotis shell, which furnishes similar evidence. Apparently, therefore, in the young or attached state it is the larger or convex valve which is the lower, and probably this is the evidence on which the ordinary statement in conchological books rests. It will be curious if the truth turns out to be that the oyster changes its position when it becomes unattached. Perhaps the remarkable inequalities in the shape of the convex valves may arise from the inequalities in the objects to which they are originally fixed.

W. TURNER

27, Queen's Crescent, Edinburgh

The Australian Lyre Bird

HAVING been stationed at intervals for some years on the mountains of Eastern Manaro, in the southern part of New South Wales, the habitat of the Lyre Bird or Native Pheasant (*Menura superba* or *Paradisea*), I have thought some fuller particulars regarding its habits, than are usually obtainable, might be interesting to your readers.

This range of mountains, the more sheltered sides of which form the home of these interesting birds, attains a height of over 4000 feet above sea level. The sides, sloping towards the coast at a general angle of about 45°, are heavily timbered with

eucalypti, wattle, and musk trees, and covered with a dense undergrowth of ferns and creepers, the gullies being filled with tree ferns. Generally speaking there is a noticeable absence of game, but at certain seasons the forest resounds with the varied cries of the male lyre bird. The hen builds her nest at the foot of a trunk of a tree, of twigs and bark, lining it with dried ferns and grass, and leaving an opening in the front of the top. Herein she deposits the *one* egg on which she sits to incubation (for, as an Irish friend said, "she only lays one egg at a time"), leaving the nest daily for food. The country abounds in the hills of ants, from those of the large bull-dog ant, an inch long, to those of a small black variety, and it is upon these insects and their larvæ that the lyre bird chiefly subsists. The bird is of a sooty black colour, with a body somewhat larger than that of a pigeon, but has a tail of graceful form and beautifully marked. Ordinarily, this tail is simply carried behind like a peacock's in repose, but if found upon their "dancing beds" with head erect and tail expanded over the back they are decidedly handsome. These "dancing beds" are patches of comparatively clear ground, from one to two yards in diameter, with the ferns trodden smoothly upon the surface, upon which the birds assemble, and dance and strut to their apparent great delight. The original cry or call of the lyre bird is a very simple one, but his adopted one partakes of that of every sound he hears; for he is a most wonderful mocker, not only of other birds, such as the parrot, cockatoo, yang yang, or magpie, but he will imitate, to the life, the bullock driver with his whip, the step of the teamster's horses, the rasping of the cross-cut saw, and the blows of the axe and tomahawk, and more wonderful still, more than one of these at the same time, so that the solitary explorer is led to believe he has suddenly come upon pioneers of civilisation in the heart of the forest.

The male bird is exceedingly pugnacious, and this fact is made use of by the settlers to his destruction, for his tail is worth $3. By imitating one of his prominent calls, the hunter can lure him within gun-shot, although naturally very shy; he comes to repel a fancied intruder into his domain. His flesh is very dark-coloured and coarse, and only used as food in cases of necessity. Many attempts have been made to rear the birds in captivity, and there is a report that *one* has been successful. With this exception, which I cannot authenticate, I never heard of any result but failure.

The sound of his call so alters in proportion as his tail is in full feather or indifferently ornamented, that hunters can judge from that whether or no any individual bird is worth pursuit.

My apology for asking for so much of your valuable space must be in the fact that until I set myself the task of getting the above information, I could not obtain it from published accounts.

ALFRED MORRIS

Railway Survey Camp, Manaro, New South Wales, September 1

Blackberry Blossoms in November

I HAVE this day seen blackberry blossoms in a hedge on this road, and yet the autumn has been rainy and inclement.

JOSEPH JOHN MURPHY

Osborne Park, Belfast, November 10

EXPLORATIONS IN PAHANG

PAHANG is a small state in the Malay peninsula on the eastern side of the dividing range, with a coast-line on the China Sea. The territory is almost exclusively occupied by Malays, who live on the banks of the rivers; but in the unexplored forests of the interior near the mountains there are a few tribes of wild aboriginal Sakeis. Though Pekan, the capital, is not quite 200 miles from Singapore, it is rarely visited by Europeans. It is situated at the mouth of the river Pahang, and on this stream the bulk of the population is to be found. The Pahang is the main artery of communication with the interior. Its course is inaccurately laid down on the map published by the Straits Government in 1879. Quite recently, however, Mr. W. Cameron, a surveyor, has by his own efforts, unassisted by the Government, mapped the whole course of the stream, and his map, not yet published, is in the hands of the Straits branch of the Royal Asiatic Society. Recently also the river was ascended by Mr. G. Scaife. He went up by the Semanten River and one of its tributaries to the dividing range, and then, accompanied by Malays only, he crossed to Klang, in Selangor, in three days, and so reached the western coast. In May of this year Mr. Swettenham, the Government Resident in Selangor, succeeded in passing the dividing range from Perak by ascending the River Slim. Having descended on the eastern side of the mountains he reached the Lipis River, down which he came on rafts to the Pahang, and so on to Pekan. The whole journey occupied one month.

It may seem strange that a territory so near Singapore should be so little known. The reasons for this are that on the land side its jungles and forests are very inaccessible, and that for six months of the year, when the north-east monsoon is blowing, the rivers and coast-line can scarcely be approached from the sea. Pahang has always had a peculiar interest because of the large and rich gold mines said to exist within its limits. Curious specimens of nuggets are constantly reaching the British settlements from this locality.

In July last I started from Singapore with the intention of seeing some of the gold fields and generally to examine the geology of the river and some of its tributaries. I was accompanied by Mr. H. G. James and Mr. Scaife. A small steam launch had been sent on previously, and we hoped by its means to save time and the inconvenience of depending on native boatmen.

Pekan, the capital, lies about six miles above the mouth of the river. It is a small town of perhaps 1500 inhabitants. It is well laid out in rectangular grassy streets. The sides of these are formed of high bertane fences, within which, buried in tropical foliage, are the detached bungalows of the inhabitants; the houses are built high off the ground with attop roofs. There is one street of wretched Chinese shops called the market. In the midst of this is a somewhat pretentious two-story palace for the Sultan. Close by are many sheds built for games for royal diversion, amid which is a conspicuous inclosure covered in, where for many hours almost daily his Highness plays at top-spinning with his nobility and gentry.

He received us courteously at midnight (a common hour for receptions) and seemed quite pleased to have his country visited by Europeans. He gave us a letter commanding all chiefs (Datus) to give us any help we might require. He does not affect any royal splendour, but is very simple in his habits. He is a liberal-minded man, who might do much but for his indolence.

We started with a party of thirteen in a large river prahm, in case the launch should fail us, which it promptly did. Though only drawing 2 feet 8 inches we lost four days in advancing fifteen miles. At last the shallows stopped us altogether, and we had to take to the prahm. The Pahang drains an immense basin and is fed by innumerable tributaries, so that it is rather disappointing to find that unless in times of flood it is only navigable for the small prahm of the Malay. The largest of these scarcely draws two feet of water.

The channel is from 300 to 600 yards wide, interrupted continually by jungle islands and large sandbanks. On the latter pea-fowl (*Pavo javanicus*) are commonly seen. The banks are lined at intervals with small villages. They may be known at a distance by the clumps of cocoa-nut and betel palm. On our approach we frequently heard the wooden gong or drum echoing with singular clearness through the forest. It reminded one of what Stanley tells us of the River Congo, except that the Pahang natives are very peaceable. The vegetation was of the usual Malay character. The common trees were Ficus, Phyllanthus, Vitex, Castanopsis, Garcinia, Dipterocarpus, Fagræa, Hibiscus, &c., with creepers and vines innumerable, especially Bauhinia, Vitis, Ipomæa, Entada,

and Mucuna. I saw very little that was new to me, but there was no time for any search. At forty miles we came to the River Lint, which at one time had a great reputation for its gold mines. Two Europeans have started to prospect the locality. We met with them on our return. They had found traces of very extensive workings in former times, but the whole are quite abandoned. The country around is hilly, and the banks of the river are beautifully picturesque. Scarcely any natives live in the vicinity.

We passed many small tributaries to the right and left, and at ninety-one miles, or eight days, from Pekan passed the Semanten, a large affluent coming from the west. Our course had been west hitherto, but now turned to the north-west. Our progress was but slow. We had hired a second boat, and both had to be urged against a strong current by means of long poles—the usual mode of up-stream progress in the Malaysia. One seldom averages more than a mile an hour in this way.

At about 130 miles we passed the Tomoleng, a large stream to the right. It was up this, I believe, that Baron Maclay passed in 1875. The river to the left is called the Jelis or Jelai. Between the two there is a very small stream which is called the Pahang. In Cameron's map the Jelai is marked as the Pahang, but the natives do not call it so. The Jelis is still a fine river, with fewer sandbanks, and I think a deeper bed. Fifty miles further we reached the Lipis. Where we left the Jelis it was still an important stream at least 200 yards wide. The Lipis is also a good stream, half the width of the former. We only went about ten miles up it, and at that distance or less came to Punjom, a large village, the second in importance to Pekan. We found that the cholera had just visited the place, and carried off half the inhabitants, and we found subsequently that several other villages had been visited, or were actually suffering from this terrible epidemic.

About three miles from Punjom is a celebrated gold mine at a village called Jelai, which has been worked for centuries. The formation is just like what is seen in the auriferous districts of Australia—that is to say, highly inclined slate schists and sandstones with quartz lodes containing the gold. The mines, I am told, have been worked in succession by Siamese, Malays, and Chinese. At present about thirty Chinese are employed, with a few Malays, who wash the sands for gold dust. The locality is very curious, from the evident antiquity of the workings. An enormous quantity of material has been quarried away, and shafts have been sunk in the solid rock. Subsequently the rock has been removed, leaving traces of the shafts on the faces of the quarries. It seems as if the miners had found gold in the alluvium, and then had removed the rock in searching for more. The lodes were scarcely touched, probably being too hard. But just beside the lodes the casing with some pockets of pyrites have been taken out in small quantities and are still worked. Doubtless these ores are rich, but a small quantity of free gold dust is all that these miners get.

The ground for acres around is covered with refuse heaps, and after each rainfall the native women and children may be seen searching for specks of gold in the sand. There is a good deal of iron pyrites in the heaps, and as this gradually decomposes, the gold is liberated in the form of fine dust. The mine is about to be worked by a European company.

I returned from Punjom down the Pahang as far as the Semanten, and ascended that river almost due west for about 50 miles. It then forks into the Karau (W.N.W.) and the Brentong (S.W.). As the latter was a series of rapids we changed our boats for small canoes. The water is very deep in places, but shallow at the rapids, where it falls over barriers of beautiful black marble with white veins, or over slate rocks, highly inclined and much jointed. It took us a whole day to ascend about 15 miles, as there was a fresh in the stream. This made the work of poling up the rapids difficult and exciting. After the first few miles we saw no habitations, but we met small bamboo rafts carrying down ingots of tin from the village of Brentong. The river flows in a channel about 50 yards wide, through a dense forest echoing with the cry of the large black siamang or gibbon monkey (*Hylobates syndactylus ?*). Occasionally we heard the peculiar warning shriek, as I may call it, of the wild aboriginal Sakei.

We left our canoes at the junction of a mountain torrent called the Dua. Here we camped one night, and then crossed to the sources of the stream, passing over several high mountain spurs from the main divide. In the mountains we found a few Malays washing stream tin from a shallow, coarse gravel. This consisted of broken Palæozoic slates and sandstones. We visited two or three mines of this kind in various places in the ranges. Travelling was very difficult, because of the undergrowth amid a fine forest of Dipterocarpus, oak, chestnut figs, Dammar, Fagræa, &c., with much Bertam palm (Huguessonia). Traces of tigers and elephants numerous. Game plentiful. In the river a very large barbel and a smaller one abundant (*Barbus burmanicus* and *Kolus ?*), both tasteless fishes and full of bones. We found also an eel-like voracious fish, which I took to be *Ophiocephalus micropeltes*, excellent eating, but uncommon. I have found the same fishes in all the mountain rivers of the Malay peninsula.

We returned direct to Pekau from the Sungei Dua, having spent about five weeks in the boats. Throughout we found the people affable and courteous, not timid of strangers, though some of them had never previously seen white men. Their only medium of exchange is a tin coinage, shaped for the most part like an old-fashioned square inkstand. They objected to receive the smaller silver coin of the Straits Settlements, but would take an empty bottle or a meat or biscuit tin in exchange for a fowl, and fruit such as bananas, cocoa-nuts, mangostems, and papaws, besides tapioca, maize, and brinjals.

We saw a few slaves, who seemed to be Sakeis or Africans. The whole population of the State can scarcely be 50,000, of which probably not 500 are Chinese.

About half way between the dividing range and the sea there is a belt of detached conical steep mountains 1500 to 2000 feet high. From the specimens of rock abutting on the River Pahang I judge these hills to be volcanic, and to consist of trachytic and felspathic rocks. I also found in the bed of the stream isolated patches of andesite, felsite, molaphyre, and limestone. In respect to the volcanic rocks the eastern side of the Malay peninsula differs much from the western. J. E. TENISON-WOOD

Singapore, August 28

P.S.—I have just seen in a number of NATURE, published in the early part of this year, a letter from Mr. L. Wray, jun., correcting what he considers certain mistakes of mine. It is due to your readers to state that I do not accept any of these corrections. During the long period that I have spent in exploring in these regions, Mr. Wray travelled with me for about a fortnight. I should like to repeat that I have never seen on the Malay peninsula any sign of upheaval or subsidence. The instance Mr. Wray refers to at Matang obviously admits of a very different interpretation.

THE CRETACEOUS FLORAS OF CANADA[1]

Geological Relations of the Floras

IN a memoir published in the first volume of the *Transactions* of this Society I have given a table of the Cretaceous formations of the western North-

[1] By Sir William Dawson, F.R.S., &c. From advance sheets of a memoir to appear in the *Transactions* of the Royal Society of Canada.

West Territories of Canada, prepared by Dr. G. M. Dawson, and have fully stated the geological position of the plants at that time described. The new facts detailed now require us to intercalate in our table three distinct plant-horizons not previously recognised in the western territories of Canada. One of these, the Kootanie series, should probably be placed at the base of the table as a representative of the Urgonian or Neocomian, or, at the very least, should be held as not newer than the Shasta group of the United States Geologists, and the Lower Sandstones and Shales of the Queen Charlotte Islands. It would seem to correspond in the character of its fossil plants with the oldest Cretaceous floras recognised in Europe and Asia, and with that of the Komé formation in Greenland, as described by Heer. No similar flora seems yet to have been distinctly recognised in the United States, except, perhaps, that of the beds in Maryland, holding cycads, and which were referred many years ago by Tyson to the Wealden.

The second of these plant-horizons separated, according to Dr. G. M. Dawson, by a considerable thickness of strata, is that which he has called the Mill Creek series, and which corresponds very closely with that of the Dakota group, as described by Lesquereux, and that of the Atané and Patoot formations in Greenland, as described by Heer. This fills a gap, indicated only conjecturally in the table of 1883. Along with the plants from the Dunvegan group of Peace River, described in 1883, it would seem to represent the flora of the Cenomanian and Turonian divisions of the Cretaceous in Europe.

Above this we have also to intercalate a third sub-flora, that of the Belly River series at the base of the Fort Pierre group. This, though separated from the Laramie proper by the marine beds of the Pierre and Fox Hill groups, more than 1700 feet in thickness, introduces the Laramie or Danian flora, which continues to the top of the Cretaceous, and probably into the Eocene, and includes several species still surviving on the American continent, or represented by forms so close that they may be varietal merely.

Lastly, the subdivision of the Laramie group, in the last Report of Dr. G. M. Dawson, into the three members known respectively as the Lower or St. Mary River series, the Middle or Willow Creek series, and the Upper or Porcupine Hill series, in connection with the fact that the fossil plants occur chiefly in the lower and upper members, enables us now to divide the Laramie flora proper into two sub-floras—an older, closely allied to that of the Belly River series below; and a newer, identical with that of Souris River, described as Laramie in Dr. G. M. Dawson's Report on the 49th Parallel, 1876, and in the Report of the Geological Survey of Canada for 1879, and which appears to agree with that known in the United States as the Fort Union group, and in part at least with the so-called Miocene of Heer from Greenland.

From the animal fossils and the character of the flora it would seem probable that the rich flora of the Cretaceous coal-fields of Vancouver Island is nearly synchronous with that of the coal-bearing Belly River series of the western plains.

It will thus be seen that the explorations already made in Canadian territory have revealed a very complete series of Cretaceous plants, admitting, no doubt, of large additions to the number of species by future discoveries, and also of the establishment of connecting links between the different members, but giving a satisfactory basis for the knowledge of the succession of plants and for the determination of the ages of formations by their vegetable fossils.

The successive series may be tabulated as follows, with references for details to the fuller table in my memoir of 1883:—

Successive Floras and Sub-Floras of the Cretaceous in Canada (in Descending Order)

Periods	Floras and Sub-Floras	References
Transition Eocene to Cretaceous	Upper Laramie or Porcupine Hill Series ...	Platanus beds of Souris River and Calgary. Report Geol. Survey of Canada for 1879, and memoir of 1885.
Upper Cretaceous (Danian and Senonian)	Middle Laramie or Willow Creek Series.	
	Lower Laramie or St. Mary River Series ...	Lemna and Pistia beds of bad lands of 49th Parallel, Red Deer River, &c., with Lignites. Report 49th Parallel and memoir of 1885.
	Fox Hill Series	Marine.
	Fort Pierre Series	Marine.
	Belly River Series. (See note.)	Sequoia and Brasenia beds of S. Saskatchewan, Belly River, &c., with Lignites. Memoir of 1885.
	Coal Measures of Nanaimo, B.C., probably here ...	Memoir of 1883. Many Dicotyledons, Palms, &c.
Middle Cretaceous (Turonian and Cenomanian)	Dunvegan Series of Peace River. (See note.) ...	Memoir of 1883. Many Dicotyledons, Cycads, &c.
	Mill Creek Series of Rocky Mountains	Dicotyledonous leaves, similar to Dakota Group of the U.S. Memoir of 1885.
Lower Cretaceous (Neocomian, &c.)	Suskwa River and Queen Charlotte Island Series. Intermediate Series of Rocky Mountains ...	Cycads, Pines, a few Dicotyledons. Report Geol. Survey. Memoir of 1885.
	Kootanie Series of Rocky Mountains	Cycads, Pines, and Ferns. Memoir of 1885.

NOTE.—Though the flora of the Belly River Series very closely resembles that of the Lower Laramie, showing tha similar plants existed throughout the Senonian and Danian periods in North America, yet it is to be anticipated that specific differences will develop themselves in the progress of discovery. In the meantime it scarcely seems possible to distinguish by fossil plants alone the Lower Laramie beds from those of Belly River, and if these are really separated by 1700 feet of marine strata, as is now believed on stratigraphical grounds, the flora must have been remarkably persistent. The Dunvegan series of Peace River probably corresponds in time with the marine Niobrara and Benton groups farther south, and the Mill Creek with the Dakota group

Physical Conditions and Climate indicated by the Cretaceous Floras.—In the Jurassic and earliest Cretaceous periods the prevalence, over the whole of the Northern Hemisphere, and for a long time, of a monotonous assemblage of Gymnospermous and Acrogenous plants, implies an uniform and mild climate and facility for intercommunication in the north. Towards the end of the Jurassic and beginning of the Cretaceous, the land of the Northern Hemisphere was assuming greater dimensions, and the climate probably becoming a little less uniform. Before the close of the Lower Cretaceous period, the dicotyledonous flora seems to have been introduced, under geographical conditions which permitted a warm-temperate climate to extend as far north as Greenland.

In the Cenomanian we find the Northern Hemisphere tenanted with dicotyledonous trees closely allied to those of modern times, though still indicating a climate much warmer than that which at present prevails. In this age extensive but gradual submergence of land is indicated by the prevalence of chalk and marine limestones over the surface of both continents; but a circumpolar belt of land seems to have been maintained, protecting the Atlantic and Pacific basins from floating ice, and permitting a temperate flora of great richness to prevail far to the north, and especially along the southern margins and extensions of the circumpolar land. These seem to have been the physical conditions which terminated the existence of the old Mesozoic flora and introduced that of the Middle Cretaceous.

As time advanced, the quantity of land gradually increased, and the extension of new plains along the older ridges of land was coincident with the deposition of the great Laramie series and with the origination of its peculiar flora, which indicates a mild climate and considerable variety of station in mountain, plain, and swamp, as well as in great sheets of shallow and weedy fresh water.

In the Eocene and Miocene periods the continent gradually assumed its present form, and the vegetation became still more modern in aspect. In that period of the Eocene, however, in which the great nummulitic limestones were deposited, a submergence of land occurred on the eastern continent which must have assimilated its physical conditions to those of the Middle Cretaceous. This great change, affecting materially the flora of Europe, was not equally great in America, which also by the north and south extension of its mountain chains permitted movements of migration not possible in the Old World. From the Eocene downwards, the remains of land animals and plants are found only in lake basins occupying the existing depressions of the land, though more extensive than those now remaining. It must also be borne in mind that the great foldings and fractures of the crust of the earth which occurred at the close of the Eocene, and to which the final elevation of such ranges as the Alps and the Rocky Mountains belongs, permanently modified and moulded the forms of the continents.

These statements raise, however, questions as to the precise equivalence in time of similar floras found in different latitudes. However equable the climate, there must have been some appreciable difference in proceeding from north to south. If, therefore, as seems in every way probable, the new species of plants originated on the Arctic land and spread themselves southward, this latter process would occur most naturally in times of gradual refrigeration or of the access of a more extreme climate, that is, in times of the elevation of land in the temperate latitudes, or conversely, of local depression of land in the Arctic, leading to invasions of northern ice. Hence the times of the prevalence of particular types of plants in the far north would precede those of their extension to the south, and a flora found fossil in Greenland might be supposed to be somewhat older than a similar flora when found farther south. It would seem, however, that the time required for the extension of a new flora to its extreme geographical limit, is so small in comparison with the duration of an entire geological period, that practically, this difference is of little moment, or at least does not amount to antedating the Arctic flora of a particular type by a whole period, but only by a fraction of such period.

It does not appear that during the whole of the Cretaceous and Eocene periods there is any evidence of such refrigeration as seriously to interfere with the flora, but perhaps the times of most considerable warmth are those of the Dunvegan group in the Middle Cretaceous and those of the later Laramie and oldest Eocene.

It would appear that no cause for the mild temperature of the Cretaceous needs to be invoked other than those mutations of land and water which the geological deposits themselves indicate. A condition, for example, of the Atlantic basin in which the high land of Greenland should be reduced in elevation and at the same time the northern inlets of the Atlantic closed against the invasion of Arctic ice, would at once restore climatic conditions allowing of the growth of a temperate flora in Greenland. As Dr. Brown has shown ("Florula Discoana"), and as I have elsewhere argued, the absence of light in the Arctic winter is no disadvantage, since, during the winter, the growth of deciduous trees is in any case suspended, while the constant continuance of light in the summer is, on the contrary, a very great stimulus and advantage.

It is a remarkable phenomenon in the history of genera of plants in the later Mesozoic and Tertiary, that the older genera appear at once in a great number of specific types, which become reduced as well as limited in range down to the modern. This is no doubt connected with the greater differentiation of local conditions in the modern; but it indicates also a law of rapid multiplication of species in the early life of genera. The distribution of the species of *Salisburia*, *Sequoia*, *Platanus*, *Sassafras*, *Liriodendron*, *Magnolia*, and many other genera, affords remarkable proofs of this.

Gray, Saporta, Heer, Newberry, Lesquereux, and Starkie Gardner, have all ably discussed these points; but the continual increase of our knowledge of the several floras, and the removal of error as to the dates of their appearance must greatly conduce to clearer and more definite ideas. In particular, the prevailing opinion that the Miocene was a period of the greatest extension of warmth and of a temperate flora into the Arctic, must be abandoned in favour of the later Cretaceous and Eocene; and if I mistake not, this will be found to accord better with the evidence of general geology and of animal fossils.

NOTE.—While this memoir was passing through the press, the Report of Mr. Whiteaves, F.G.S., Palæontologist to the Canadian Survey, on the invertebrate fossils of the Laramie and Cretaceous of the Bow and Belly River districts appeared ("Contributions to Canadian Palæontology," vol. i. part 1, 89 pp. and 11 plates). This valuable Report constitutes an independent testimony, based on animal fossils, to the age of the beds in question, and accords in the main very closely with the conclusions above derived from fossil plants. Unfortunately, however, no animal remains have yet been found in the Kootanie series, and the only fossil recorded from the Mill Creek beds is a species of *Inoceramus* characteristic in the United States of the Niobrara and Benton groups, a position a little higher than that deduced from the plants.

RADIANT LIGHT AND HEAT[1]

IV.

Radiation and Absorption—Celestial Applications.

THE continuous emission of light and heat from the sun and stars through long periods, consisting of millions of years, cannot fail to strike us with amazement, more especially if we regard the great intensity of this radiation. It has been conjectured that the amount of solar heat received by the earth in one year would liquefy a layer of ice 100 feet thick, covering the whole surface of the earth. Now if we bear in mind that the solar heat reaching the earth at any time is only $\frac{1}{2300000000}$ of that which leaves the sun, we may obtain some conception of the enormous radiation from our luminary. It has been calculated by Sir William Thomson that if the sun were a hot solid body, such as carbon, its surface would cool in a few minutes of time. It therefore becomes an object of great scientific interest and importance to discover what is the nature of the peculiar machinery which enables the sun to continue, without interruption, discharging, as it does, into space such enormous quantities of radiant energy. The reply to this question can best be given by a detailed study of the surface of the sun. Whether viewed telescopically or spectroscopically, this

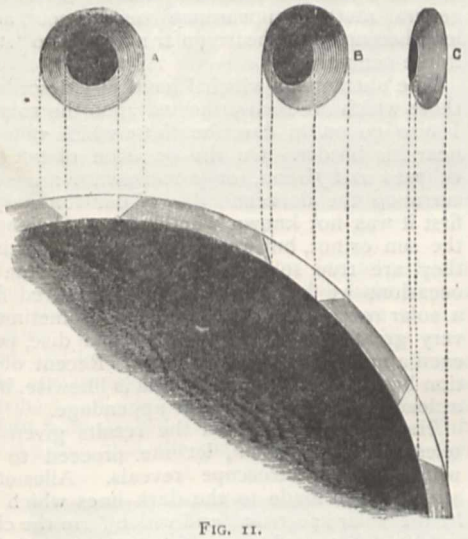

FIG. 11.

surface is by no means that of a globe of uniformly luminous heated matter. Let us begin by examining this surface telescopically.

Shortly after the invention of the telescope Galileo and Scheiner showed that the disc of the sun is far from being uniformly luminous, since it frequently presents the appearance of having large *spots* on its surface. This is a fact which had been previously known to the Chinese. Further research showed that these black spots exhibit at least two degrees of darkness, consisting of a central intensely dark *umbra*, surrounded by a *penumbra*, or semi-dark border. We know now that even the umbra is not absolutely black, but consists of matter at a temperature comparatively low as regards the sun, but comparatively high as regards the earth. It was likewise found in the course of telescopic research that there are patches which are brighter, not darker than the average solar surface or *photosphere*, and these bright patches have been termed *faculæ*.

Thus we have on the solar surface things with three degrees of brightness, consisting of the normal solar surface or photosphere, of the spots which are darker than it, and of the faculæ, which are the brightest of all. The faculæ are more especially to be found in the neighbourhood of spots.

These are the phenomena which may generally be viewed on the sun's surface on any occasion by means of an ordinary telescope. Nevertheless, there are occasions on which we shall find no spots. Schwabe, a German observer, after forty years' patient study of the sun's surface, was successful in detecting a periodicity of these phenomena. There are certain years of maximum and other years of minimum sun-spot frequency, and the average distance from one maximum to the next, or from one minimum to the next, is about eleven years.

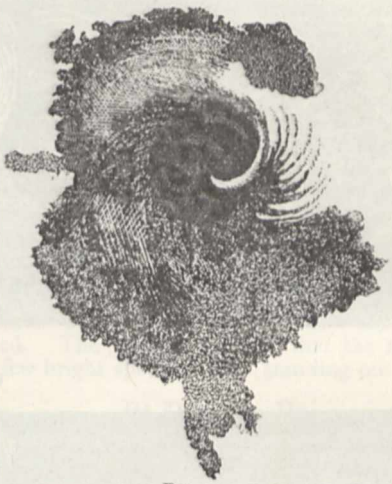

FIG. 12.

I have said nothing hitherto about the rotation of the sun, which was discovered by means of the apparent motion of the sun spots over the solar disc. This rotation takes place in about twenty-six days, and its plane is not far removed from the ecliptic, or that in which the earth moves around the sun, the two motions being likewise in the same direction. It has been discovered by Carrington that, as a rule, spots are confined to the regions around the solar equator, never by any chance appearing at the poles.

The nature of these spots has been a subject of much

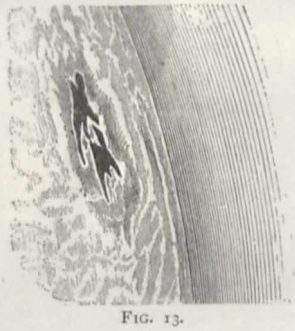

FIG. 13.

discussion. Professor Wilson, of Glasgow, was the first to bring forward evidence indicating that they are below the general level of the solar surface—pits, in fact, the bottoms of which are intensely black, while the sloping sides are less so. This evidence consisted in the fact that when near the sun's border that portion of the penumbra of a spot which is next the visual centre is hidden from our view, a behaviour which is illustrated in Fig. 11. Again, it has been pointed out by the Kew observers that the bottom of a spot is blacker because it is colder than the general surface, and they have likewise brought forward evidence to show that this diminution of temperature has

[1] Continued from vol. xxxii. p. 551.

probably been produced by the downrush of comparatively cold matter from above, a conclusion which has since been abundantly verified by spectroscopic observations.

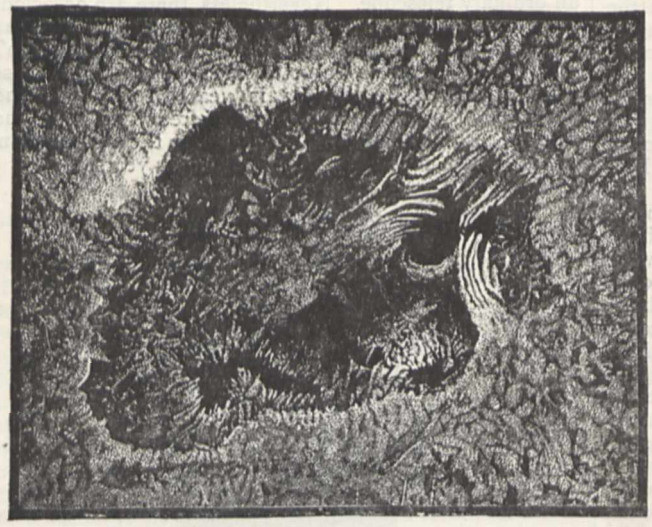

FIG. 14.

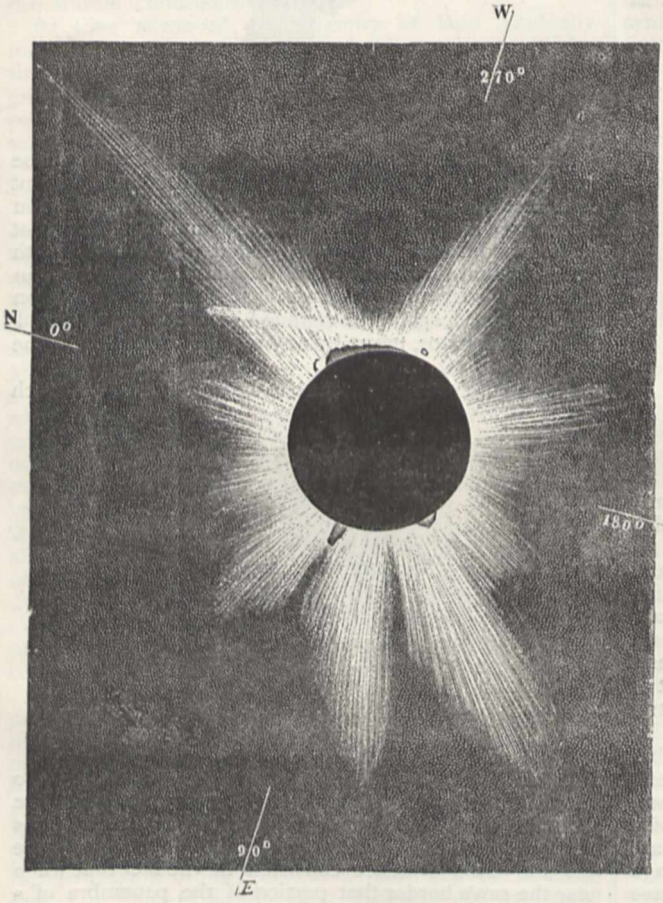

FIG. 15.

In fine, these phenomena attest the existence or an extensive and extremely active solar atmosphere, which grows quickly colder as we ascend from the sun's surface, and a spot with its accompanying faculæ may perhaps be looked upon in the light of a celestial hurricane or hail-storm.

We have in the spot the downrush of a vast quantity of comparatively cold matter from above, and in the faculæ the necessary re-action of this, or the uprush of comparatively hot matter from below, the scale of the operation being occasionally of such a vast magnitude that thirty or forty of our earths might be buried in the pit which represents a spot.

What we have on a large scale in spots and faculæ we have on a small scale all over the sun's disc. When viewed with a powerful telescope the brightness of his disc is found to be far from uniform, the whole surface being made up of bright and dark patches existing side by side. This mottled appearance was first noticed by the elder Herschel, who considered the pores, as he termed them, to be small spots—a conclusion which has since been abundantly verified by the spectroscope. Quite recently M. Janssen, the well-known French observer, has obtained admirable photographs of the sun, exhibiting this mottled appearance on a very large scale. In Fig. 12 we have a picture of a cyclonic sun spot, while in Fig. 13 we have one of faculæ surrounding a spot seen near the sun's edge. Fig. 14 again is a picture by Secchi exhibiting the general mottled appearance round a spot, and the lengthening out of the irregular masses into "straws" in the penumbra.

The phenomena which I have just described are those which are seen projected upon the solar disc. I now go on to describe those which take place near his border. On the occasion of total solar eclipses *red flames*, or *prominences*, are seen to surround the darkened disc of our luminary. At first it was not known whether these belonged to the sun or not, but we are now quite certain that they are true solar appendages. On the same occasions we have, in addition to the red flames, a solar *corona*, or glory, extending sometimes to a very great distance around the solar disc, perhaps even a million of miles or more. Recent observation has proved that this corona is likewise, in part, at least, an undoubted solar appendage.

Having now described the results given us by telescopic observation, let me proceed to those which the spectroscope reveals. Allusion has already been made to the dark lines which occur in the solar spectrum, and which form the characteristic difference betwixt his spectrum and that of the electric light. We have also mentioned the fact that the double solar line D corresponds quite exactly in spectral position with the bright lines given out by incandescent sodium, and that Prof. Stokes conjectured from this coincidence that sodium must exist in the solar atmosphere at a comparatively low temperature.

Professors Bunsen and Kirchhoff in their spectroscopic researches greatly extended this branch of inquiry, showing that many of the dark lines of the solar spectrum are coincident in spectral position with bright lines seen in terrestrial spectra, and concluding that the gaseous substances which afford these spectra must occur in a comparatively cold state in the atmosphere of the sun. The following substances have thus been found to occur in the atmosphere of our luminary—hydrogen, magnesium, calcium, sodium, iron, nickel, manganese, chromium, cobalt, barium, copper, zinc, titanium, aluminium.

The spectroscope has been applied with equal success to the border or limb of our luminary. It was a subject of some surprise that the red flames seen at the time of a total eclipse should be invisible on other occasions; and

this perhaps induced observers to imagine that they were not true solar appendages. Independently and nearly simultaneously Janssen and Lockyer showed that these red flames may be rendered visible on ordinary occasions by means of the spectroscope, and they are now the daily study of solar observers. It has been shown that they consist chiefly of incandescent hydrogen, and the reason is very obvious why we cannot see them without the spectroscope. The glare of light around the sun's disc

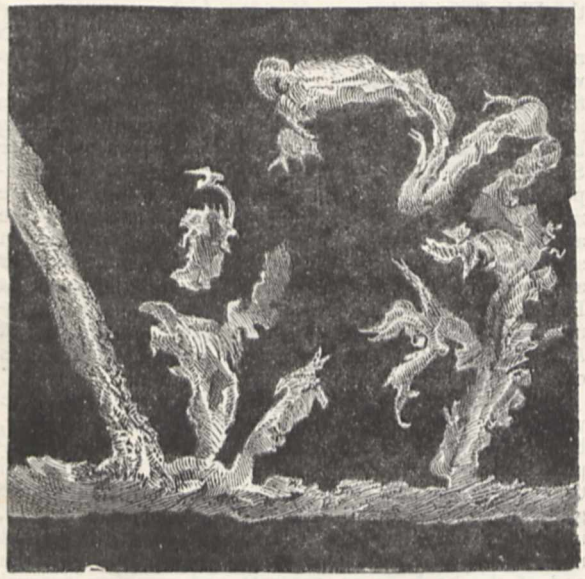

FIG. 16.

(a strictly terrestrial phenomenon due to reflexion) is in general so strong compared to the light from the red flames, that it is impossible for the eye to distinguish the latter. Now during a total eclipse this glare is removed, and hence the eye can see the red flames. But in the spectroscope we have a means not so much of removing as of diluting the glare, while at the same time the light from the red flames is not diluted. This arises from the fact that the glare is ordinary sun-light, consisting of rays of a great many refrangibilities which are spread out into a long ribbon by the spectroscope, and consequently diluted. On the other hand, that from the red flames consists only of one or two widely-separated

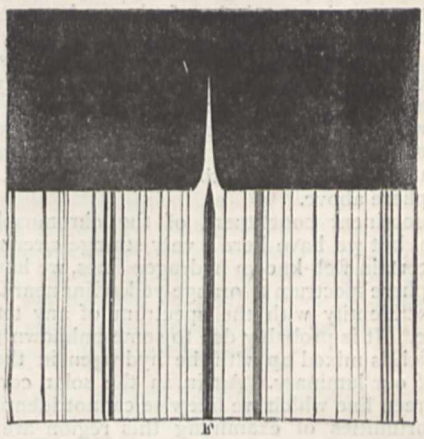

FIG 17

refrangibilities which are not spread out, and therefore not diluted. The consequence is that the red flames give us a few bright spectral lines standing out in a solar

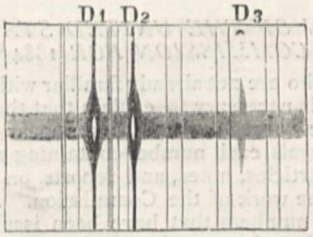

FIG. 18.

spectrum so diluted as to be almost invisible. In Fig. 1 we have a representation of the eclipsed sun showing the red flames near the sun, and the corona extending to a great distance around his disc; while in Fig. 16 we have

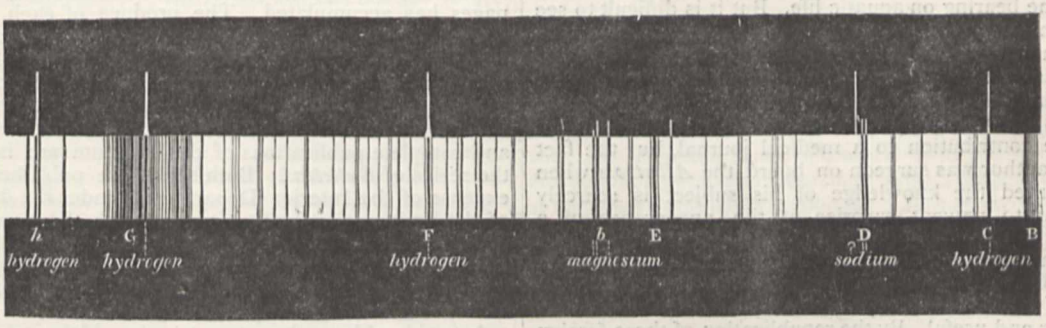

FIG. 19.—Exhibiting the spectrum of the chromosphere above and that of the photosphere below.

an enlarged view of one of the red flames, showing the curious shapes which these phenomena frequently assume.

The application of the spectroscope by Lockyer and others to selected portions of the solar disc and its surroundings has been most fruitful in its consequences.

One of the first results obtained by Lockyer was the arrow-shaped appearance of the bright line F of the sun's atmosphere, when the slit of the spectroscope is made to form a continuation outwards of the solar radius; that is to say, is perpendicular to the rim of the sun.

This is shown in Fig. 17, and the explanation is very simple. It will be remembered that the line F of hydrogen is one which is very susceptible to an increase of pressure. It is therefore much wider at the bottom of the solar atmosphere than at the top, thus presenting the appearance seen in the figure. When the same observer applied the spectroscope to a sun-spot there was found to be a thickening of various absorption lines in the region of the spot, thus indicating an increase of pressure, and proving that a spot is a phenomenon that occurs below

the general surface of the photosphere. In Fig. 18 we have the spectrum of a sun-spot as given by Young, exhibiting this thickening in the double line D, a line which, like F, is eminently susceptible to variations of pressure.

It is, however, erroneous to suppose that the solar atmosphere consists entirely of the red prominences already mentioned. These denote merely (as their name indeed implies) the most violently agitated portions of an atmosphere surrounding the whole sun. Lockyer has named this atmosphere the *chromosphere*, and it extends to an average height of about 4000 miles above the surface of the sun. In Fig. 19 we have a picture of the spectrum of the sun's photosphere below and of the chromosphere above.

One prominent constituent of the chromosphere is hydrogen, but we have here a very strange circumstance. Besides certain well-known hydrogen lines, we have in the chromosphere spectrum an orange-yellow line near D, which we cannot identify with the spectrum of any terrestrial substance. It is probably due to some unknown gaseous body which is mixed up with the hydrogen in the atmosphere of our luminary. Again, in the solar corona, we have a green line which we likewise cannot identify; but our opportunities of examining this region are so few and so transient that any conclusion we may come to with respect to its lines must be regarded as provisional.

BALFOUR STEWART

(*To be continued.*)

BULLETIN OF THE UNITED STATES FISH COMMISSION FOR 1884[1]

TO those who are not already familiar with this publication, it is necessary to explain that the bulletin is a journal whose successive numbers appear at short but irregular intervals, each number containing a small collection of brief articles, notes, and reports, on subjects connected with the work of the Commission. At the end of each year the numbers that have been issued during its course are collected into a single volume and republished.

Some of the notes and articles in the volume for 1884 have but a very remote connection with fish or fisheries, broad as is the interpretation given to those terms by the American Commission. In most cases it may be conceded that the information given has some relation to the supply of human food derived from aquatic organisms, or at any rate some bearing on aquatic life. But it is difficult to see the connection between a report on the sanitary condition of the inhabitants of Old Providence Island and the subject of aquiculture. The Report referred to contains many interesting facts concerning the fecundity, education, and diseases of the people mentioned; it would form a valuable contribution to a medical journal, but the fact that its author was surgeon on board the *Albatross* when he acquired the knowledge of his subject is scarcely sufficient to prevent surprise at the appearance of a sanitary report in the Fish Commission Bulletin.

A considerable proportion of the volume is occupied with reprints and translations from journals and publications of other countries, and nearly all of these are interesting and useful. By the republication of these foreign papers the Bulletin becomes a guide to the knowledge of what is being done in aquicultural enterprise in all parts of the world. Among the reprints are several from British journals—for example, the articles which appeared last year in NATURE on the capture of fish larvæ by Utricularia, and an article on the sea-serpent by Richard A. Proctor, which is taken from the *Newcastle Weekly Chronicle*.

Dr. P. Brecchi's Report on the condition of oyster-culture in France in 1881, originally published in the *Journal Officiel*, is given in full; and there are also several other useful articles on the subject of oyster-culture. Mr. John A. Ryder contributes a description with illustrations of a new sand-diaphragm to be used in the cultivation of oysters in marine ponds, and a report on the condition of the oyster fishery at St. Jerome Creek. Lieutenant Francis Winslow reports on some experiments made in 1883 on the rearing of oyster larvæ. The experiments were not completely successful, and the problem of establishing a working system of oyster-culture on the east coast of America still affords scope for the energies of the Fish Commission.

Several articles and reports contain data from which may be ascertained the extent and success of the efforts which are being made to acclimatise various species of fish in waters far distant from their native homes. The introduction of American fish into French streams has been in many cases successfully accomplished by the Société Nationale d'Acclimatisation. Details of the experiments are given in an article compiled from the monthly bulletin of the Society. Pisciculture and the acclimatisation of new species in Germany is treated in several articles by Max. von dem Borne, who is the founder and owner of a large piscicultural establishment at Berneuchen. The bare record of the successful transmission of whitefish eggs to Nelson, New Zealand, and of American black bass to the river Nene in England, is contained in letters which are reprinted.

Reference to any particular article or subject in the volume, in spite of its extremely heterogeneous character, has been made perfectly easy by the number and completeness of the indexes with which it is provided. In the table of contents the names of all the contributors are given in alphabetical order. A topical synopsis follows, in which the various subjects treated in the articles and notes are given under five headings. Finally, at the end of the book, is an accurate and complete general index.

The *Proceedings* of the United States National Museum is published on the same plan as the *Bulletin* of the U.S. Fish Commission. In the "advertisement" to the volume before us (vol. vii. 1884, Washington, 1885) we are told that the series was commenced in 1878 to provide a means for the prompt publication of descriptions of the new and interesting material which was being sent to the Museum by the activity of the collectors employed in its interest. The articles are published in signatures, one of which is issued whenever printed material to the extent of sixteen pages has accumulated. The produce of each year is issued as an annual volume. The articles consist of papers by members of the scientific corps of the Museum, of papers by others founded on the collections in the Museum, and of interesting extracts from the correspondence of the Smithsonian Institution. The more extensive and complete publications of the Museum are issued in the series of *Bulletins*. Both series are published at the expense of the Interior Department, under the direction of the Smithsonian Institution, and with the supervision of Mr. Spencer F. Baird, director of the National Museum. The present volume, containing a large proportion of articles on fishes, has been edited by Dr. Tarleton H. Bean, curator of the Department of Fishes.

A considerable number of new species of fish are described in this volume. Dr. Bean describes a new species of Coregonus from Alaska, two new species obtained by the Fish Commission, and two from Jamaica. Mr. David Jordan contributes notes on a collection of fishes from Pensacola, Florida, with two new species, one of Exocœtus; and nine other short papers on collections of fishes from Mexico, Florida, and the Mississippi. The same naturalist, in collaboration with Ch. H. Gilbert, gives four, with Seth E. Meek two, and with Joseph Swain six, notes on fishes. The volume contains several additions to the natural history of the Commander Islands in the Behring Sea. One of these is a refutation, by Leonhard Stejneger,

[1] *Proc.* of the U.S. National Museum, vol. vii. 1884. (Washington, 1885.)

of the story reported by Nordenskiöld, that a sea-cow (*Rhytina gigas*) had been seen alive in 1854. There are two plates: one of the Saccopharyngoid *Ophiognathus ampullaceus*, the other of some new shells from Alaska. The index is as complete as usual in American books of this class.

NOTES

THE following is a list of the names which the President and Council of the Royal Society will recommend to the Society at their forthcoming Anniversary Meeting on the 30th inst. for election into the Council for the ensuing year:—President, Prof. George Gabriel Stokes, M.A., D.C.L., LL.D. Treasurer, John Evans, D.C.L., LL.D. Secretaries: Prof. Michael Foster, M.A., M.D., The Lord Rayleigh, D.C.L. Foreign Secretary, Prof. Alexander William Williamson, LL.D. Other Members of the Council: Prof. Robert B. Clifton, M.A., Prof. James Dewar, M.A., Prof. William Henry Flower, LL.D., Archibald Geikie, LL.D., Sir Joseph D. Hooker, K.C.S.I., Prof. Thomas Henry Huxley, LL.D., Admiral Sir A. Cooper Key, G.C.B., J. Norman Lockyer, F.R.A.S., Prof. Henry N. Moseley, M.A., F.L.S., Prof. Bartholomew Price, M.A., Prof. Pritchard, F.R.A.S., William James Russell, Ph.D., Prof. J. S. Burdon Sanderson, LL.D., Prof. Arthur Schuster, Ph.D., Lieut.-Gen. R. Strachey, R.E., C.S.I., General James Thomas Walker, C.B.

WE greatly regret to announce the death, on Tuesday, of Dr. W. B. Carpenter, at the age of seventy-three years. His death, it would seem, was the result of an accident a few hours before. The funeral will take place to-morrow (Friday) at Highgate Cemetery. We hope next week to refer at length to the scientific work of Dr. Carpenter.

A VERY remarkable article appears in the *Nation* of October 29, on "The Private Endowment of Research," remarkable as appearing in a paper like the *Nation*, published in a "practical" country like America. "Society," the *Nation* says, "may not be prepared to interfere with the breeding of great men, but when they have once been sporadically produced there is no reason why it should not concern itself with their careful preservation. In a state of nature there is a sure process for securing the supremacy of the most perfect individuals of a race, but the qualities which make the human being great are not always qualities which fit him for taking part in the vulgar struggle for existence. . . . Huxley has well said that any country would find it greatly to its profit to spend a hundred thousand dollars in first finding a Faraday, and then putting him in a position in which he could do the greatest possible amount of work." To expose a man of genius, according to the *Nation*, "to the same harsh treatment which is good for the hod-carrier and the bricklayer, is to indulge in a reckless waste of the means of a country's greatness. But instead of the rarely-gifted being treated more favourably by the present highly scientific generation, they actually receive less consideration than they have done in many past ages of the world. . . .The waste of water-power at Niagara (the article concludes) is as nothing compared with the waste of brain-power which results from compelling a man of exceptional qualifications to earn his own living. The owner of a great estate admits that the important charities of his town have a well-founded claim upon his purse; it would not require a very great change of heart for him to feel a vivid sense of shame if a few scholars are not carrying on their researches at his expense."

THE following papers (among others) will be read at the Society of Arts during the present Session:—Apparatus for the Automatic Extinction of Fires, by Prof. Silvanus P. Thompson; The Load Line of Ships, by Prof. Francis Elgar, F.R.S.E.; Technical Art Teaching, by F. Edward Hulme, F.L.S.; The Treatment of Sewage, by Dr. C. Meymott Tidy; Calculating Machines, by C. V. Boys; The History and Manufacture of Playing Cards, by George Clulow; Domestic Electric Lighting, by W. H. Preece, F.R.S.; The Scientific Development of the Coal Tar Industry, by Prof. R. Meldola, F.C.S. The First Course of Cantor Lectures will be on "The Microscope," by John Mayall, Jun., on November 23, 30, December 7, 14, 21; the Second Course will be on "Friction," by Prof. H. S. Hele Shaw, on January 18, 25, February 1, 8; the Third Course will be on "Science Teaching," by Prof. F. Guthrie, F.R.S., on February 15, 22, March 1; the Fourth Course will be on "Petroleum and its Products," by Boverton Redwood, F.C.S., on March 8, 15, 22, 29; the Fifth Course will be on "The Arts of Tapestry-Making and Embroidery," by Alan S. Cole, on April 5, 12, 19; and the Sixth and concluding Course will be on "Animal Mechanics," by B. W. Richardson, M.D., F.R.S., on May 3, 10, 17, 24, 31. The two Juvenile Lectures on "Waves" will be given by Prof. Silvanus P. Thompson on Wednesday evenings, December 30, 1885, and January 6, 1886, for which special tickets will be issued.

Science contains accounts by Profs. Mendenhall and Paul of the attempts made to obtain records of earth tremors from the explosion at Flood Rock at the entrance to New York harbour. Arrangements to secure observations were made by the Geological Survey, together with representatives from the Naval Observatory and Signal Service. The apparatus used by the Naval Observatory party was that usual in mercury observations, and three seismoscopes, one chronograph, and a number of chronometers. Unfortunately the firing of the mine was delayed for fourteen minutes, and this prevented good observations being taken at many places. The reports so far received indicate that out of seventeen stations (three occupied by geological survey parties and fourteen co-operating with them) five watched till the disturbance came, and got more or less satisfactory observations. At one of these the rock was directly in sight, and the others were so near that the observers felt sure that it had not escaped them. Four observed and timed some slight disturbances between 11h. 3m. and 11h. 7m., and, attributing them to the explosion, ceased watching for more, and either missed it entirely or were taken by surprise; two heard nothing at all up to about 11h. 10m., and so ceased observing and missed it, and six were yet to be heard from. It will thus be perceived that the results with regard to earth-tremors, which there was every reason to expect from this colossal explosion, have been greatly diminished by the long delay in firing the mine.

PART II. of the Report of the Trinity House Committee on the recent experiments with electricity, gas, and oil as light-house illuminants at South Foreland, which is now issued, contains some interesting details in connection with the trials. The first portion is devoted to illustrations of the arrangements made at the South Foreland for exhibiting, observing, and measuring the lights. The second section consists of the report of Prof. W. Grylls Adams, F.R.S., of King's College, London, on the electric light apparatus employed in the production of the light shown from A tower. Following upon Prof. Adams's report is a detailed description by Baron A. de Méritens of the magneto-electric machines supplied by him for the experiments. This communication shows the principles of construction of the machines and the mechanical disposition of the magnets. Section IV. is a detailed record of the photometric observations made by Mr. Harold Dixon, of Balliol College, Oxford, and referred to by him in his report in Part I. The record consists principally of tables showing the work done on each night. Following this are some remarks upon the pentane standard devised by Mr. Vernon Harcourt, and adopted as the basis of measurement throughout the trials. Some interesting experiments to ascertain

the effect of different atmospheric pressures upon this flame are described, in connection with which Mr. Harcourt and Mr. Dixon went to the summit of Ben Nevis. They found that the variation in the burning of the pentane flame due to variation in atmospheric pressure was less than had been anticipated, and that consequently no correction for such variation was necessary for the photometric results obtained at the South Foreland. Sections V., VI., and VII. deal with a very important question. A tabular statement is given illustrating the range of temperature within the gas and oil lanterns during the working of the higher power of these illuminants. In the gas lantern three of the four lens panels used to illustrate a fixed light have been seriously damaged, as shown by copies of photographs published. The lowest panel has not suffered. In the oil and electric lanterns the lenses are uninjured. The inference is that the damage has been caused by the direct or indirect action of heat. Section VIII. consists merely of a reproduction of a table from Mr. Thomas Stevenson's work on lighthouse construction and illumination in reference to the penetrating power of lights in relation to the increase of their intensity. Section IX. gives the result of observations made to ascertain the suitability of the respective illuminants for the exhibition of coloured sectors of light. The question of duration of flashes is dealt with in Section X. Under the heading "Divergence of Beam" Section XI. deals further with this question of the size of the beam. Section XII. consists of reports of experiments with sky-flashing lights, the object being to illuminate the clouds with sudden beams of light. In Section XIII. are given some memoranda for consideration in estimating the expenses of first cost and maintenance for light-houses illuminated by gas. Section XIV. consists of a table showing the duration of fog at lighthouse and light-vessel stations on the English coasts, compiled from four years' records. Section XV. is a summarised journal of the lights shown each night during the year of the experiments.

IT is stated that in order to make adequate provision for medical education in Japan, the Government intends dividing the country into six medical divisions, and to establish a medical college in each, in which the future surgeons and physicians will be trained.

ON the 20th ult. Prof. Terrien de Lacouperie delivered the first of a series of lectures at University College, Gower Street, on the Science of Language and its recent progress, in connection with the languages of Indo-China. These languages, the lecturer said, are a new field of research in comparative philology which may lead to the reconsideration of several vital problems in the science of language. They offer a more satisfactory solution of these problems, and one more in accordance with the known facts of language past and present, but their influence has hitherto been injurious to the progress of linguistic science. The classification of languages into monosyllabic, agglutinative, and inflectional, is, he said, now recognised to be inadequate, and was based on a hypothesis of a primitive monosyllabic stage in the history of human speech which has never existed. The languages of Thibet, Burmah, Pegu, Siam, Annam, China, are generally called monosyllabic, and are still erroneously supposed by many to be living illustrations of the imaginary primitive language of monosyllabic roots. Such monosyllabism does not and never did exist. There are, the Professor said, three sorts of monosyllabism only—one of decay, one of writing, and one of elocution. It is to the last that the tongues of South-Eastern Asia belong, while the monosyllabism of English belongs to that of decay. The languages of the Far East, according to Prof. Lacouperie, belong to two great stocks—the Turanian and Himalayan—besides a residuum of Negrito and Papuan dialects. Turanian is represented by the great Kuenlunic branch, including (*a*) the Chinese family, (*b*) Tibeto-Burman group, (*c*) Yao-Karen group, (*d*) Dravidian family. Himalayan includes two great branches: (1) Indian, for the Kolarian languages, &c.; (2) Indo-Pacific, with four divisions—(*a*) Môn-Taïc, subdivided into two families—(1) Môn-Annam, (2) Taï Shan—(*b*) Malayan, (*c*) Polynesian, (*d*) Micronesian. The second lecture, on the formation, evolution, and influence of Chinese, will be delivered on the 17th instant.

AT a recent meeting of the Manchester Literary and Philosophical Society the special thanks of the Society were offered to Mr. Henry Wilde for the great liberality recently displayed by him in connection with the changes recently made in the building belonging to the Society, and in which it holds its meetings. When it was determined that new libraries should be erected to accommodate the rapidly increasing number of the Society's books, Mr. Wilde contributed the sum of 500*l.* to the building fund. The difference between the elegance of the new rooms and the dilapidated condition of the old ones offended Mr. Wilde's eye, and he resolved that he would, at his own expense, undertake their renovation. This he has now done at an additional cost to himself of 1100*l.* But the contribution of that money is only a part of what Mr. Wilde has done. He has personally superintended all the details of the work, rarely missing a day, during the last three months, in devoting several hours to that purpose. The results obtained evince at once the taste Mr. Wilde has displayed in regulating the style and character of the decorations.

WE learn from a communication in *Naturen* that apatite has been found by Herr Enoksen, within the last few months, in certain parts of Norway where its presence had not previously been detected. The importance of this discovery to local industry is all the greater, owing to the fact that the Bamle beds, which have hitherto been the principal source from which this valuable mineral has been derived, are in the hands of a French company, which purchased them some years ago for 350,000 kroner, and still monopolises the trade. The demand for the mineral is, moreover, very considerable in Norway, one Norwegian factory, the chemical works of Stavanger, taking from the Company about 1000 tons annually, at a cost of 100 kroner per ton. According to the well-known geologist, Herr Hans Reusch, there is every reason to expect that apatite will be found with tolerable frequency in Norway when working engineers have learnt to distinguish it from the numerous valueless minerals, to which its variability of colour gives it some resemblance—for the geological formation in which it has now for the first time been detected near Stavanger, is not of uncommon occurrence in Norway. The little island of Hille, lying about five miles to the north-east of Stavanger, where Herr Enoksen has been so fortunate as to find true apatite, exhibits no products of eruption, but has extensive deposits of mica schist, largely intermixed with hornblende, and finely granulated gneiss. Here apatite is found near titanic iron in isolated masses, varying in size from a man's head to that of a nut. It occurs in various parts of the island, but its true character was not detected till Herr Enoksen showed that a piece of a stone not uncommon in the Hille schists, which had been sent to him as a scapolite, was in reality a fragment of genuine apatite. This unexpected discovery has given great impetus to the further search for this valuable mineral, which, as we learn from recent reports, has also been found in the hornblende schists of the Egersund.

AN attempt has been recently made by Herr Liznar, of the Austrian Meteorological Society, to determine the daily course of cloudiness over different parts of the earth's surface. In most places there are two maxima and two minima in the day. He distinguishes four types, viz.:—(1) A maximum about midday, a minimum in the evening; this occurs, *e.g.* at Madrid (the maximum in summer becomes as late as 4 p.m.). (2) A maximum

in the morning, and a minimum at midday ; this is found at Los Angeles on the plateau of the Rocky Mountains. (3) Two maxima and two minima : the chief maximum in the morning, and the chief minimum in the evening ; this type being met with in Vienna in winter and autumn, and in Bombay. (4) Two maxima and minima, but the chief maximum about midday and the chief minimum in the evening ; this is the case at Vienna in summer and spring. The greatest amplitude of cloudiness appears at the stations on the Rocky Mountains plateaux ; the sky being sometimes quite covered with clouds in the morning, and quite clear a few hours later. It is curious that the Sherman Station has a cloudiness exactly opposite in its course to that of Los Angeles. This meteorological element perhaps deserves more consideration than it has hitherto received.

A CORRESPONDENT of the *North China Herald* calls attention to a strange instance of Chinese belief and practice with regard to the human soul, which lately came under his notice. Lying awake at 3 a.m. he heard in the street close to his house two strange answering voices. Evidently two persons were engaged in this weird dramatic performance, one representing a departing soul, the other acting as the friends and relatives deprecating the departure. The first actor gave a low, prolonged cry, which was answered by a loud and earnest "Come, come." After a pause, the cry and the answering call were repeated ; this went on for about ten minutes, when suddenly the inarticulate cry ceased. The second actor, in an agony of distress at the departure into the unseen of the soul he had been entreating to stay, shouted loudly in a voice, which he no doubt hoped would reach to the confines of the spirit world, "Return, return—come," at the same time calling by name. Then there was another pause, presently the low cry was heard as at a distance. "Come, come," eagerly responded the actor ; and now the cry and the answer followed one another more rapidly till the cry seemed close to the caller, and in a smothered chorus as of welcome, the performance, which was probably directed by a Taoist necromancer, ceased. It is described as being strangely impressive in the stillness of the night, notwithstanding the grotesqueness of the superstition ; but of course it was not known whether there was actual death in this case, within twelve hours of which the Chinese call for the soul to return, or whether it was only a case of serious illness, fainting, or collapse. This peculiar custom, it appears, varies in different parts of China. Up the Yangtsze it is usual for two women to perform the office. When a man dies suddenly the women walk through the streets, one calling out the name of the deceased, and the other responding "I am coming," the idea being to prevail on the wandering spirit of the deceased to return to its material abode, which, it is presumed, it has temporarily abandoned.

A NEW course of lectures has been established at the Collège de France on the mechanical theory of heat, magnetism, and electricity. The course will be given by M. Bouty.

ON October 22, at about 6 p.m., a slight shock of earthquake was felt at Ramsjö, in Sweden. It went from east to west, and lasted only a few seconds.

A LARGE consignment of Chinese and Japanese fish has lately reached this country, including the variegated goldfish, the nigger goldfish, the veil or fantail, the fringetail, and the nymphi. Some specimens have been on view at the Inventions Exhibition Aquarium, as well as some Russian loach and Hungarian beardfish. A large conger eel weighing 30 lbs., which had been in the tank for a long period, has just died.

MR. JOSEPH D. REDDING, a California Fish Commissioner, writes to Prof. Baird stating that he has invited investigation into the question of the devastation caused by sea-lions in the bays and seas of San Francisco, where they abound in very large numbers. They are very voracious, and it is alleged that they destroy hundreds of thousands of pounds of edible fish daily ; whilst fishermen declare that their business is rapidly declining in consequence. Mr. Redding intends to present an exhaustive report to the California Legislature and to the United States Fish Commission.

THE observations that are to be undertaken by the National Fish Culture Association with a view to discovering the effect of certain influences upon marine fishes will be commenced this month. The stations from which observations will be made in the first instance are the Seven-Stones, the Royal Sovereign, and the Outer Dowsing. Besides these, other localities will be visited from time to time by observers appointed for the purpose, who will make the most complete investigations as to surface and bottom temperatures of the sea, the density and transparency of the water, the temperature of the air, &c. The question as to the declension in the yield of certain fisheries and the development of others will form the subject of inquiry, as will also the question of restoring depleted fishing-grounds to their former fertility.

A SOCIETY for popularising the use of scientific methods has been established in France under the name of the Topographical Society. It held its festive meeting on November 8 in the large hall of the Sorbonne ; M. Ferdinand de Lesseps was in the chair.

WE understand that Messrs. Macmillan and Co. will shortly publish a book on Elementary Algebra, by Mr. Charles Smith, the author of well known and popular treatises on Conic Sections and Solid Geometry. After the severe remarks made by Prof. Chrystal at the last meeting of the British Association on the teaching of elementary algebra, a new work on this subject will be looked for with more than usual interest.

THE Belgian Technical Railway Commission has pronounced in favour of experiments on a large scale with steel railway sleepers. It is announced that the first trial will be made on 60 kilometres of line.

MR. ERIC STUART BRUCE has been carrying on experiments at Chatham for the English Government, with a view to the adoption of his system of military signalling. The official trial of his invention took place on October 17. To test the signalling apparatus the balloon was sent up four or five miles from Chatham and allowed to ascend 500 feet, when a series of sentences were flashed by the Morse system. The officers of the Royal Engineers who were deputed to inspect the apparatus have pronounced the experiments "eminently satisfactory." It has been suggested that this translucent balloon may be utilised for other military operations besides signalling—such as for a "point light," for concentrating forces by night ; and owing to the wide area which is illuminated by the balloon, it has been proposed to use it for lighting working parties.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. Montague C. Clark ; a Gannet (*Sula bassana*), British, presented by Mr. H. Archer ; a Tawny Owl (*Syrnium aluco*), British, presented by Mr. J. Hillier ; a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, presented by Mr. C. A. O. Marsham ; a Squirrel Monkey (*Chrysothrix sciurea* ♀) from Guiana, a Ruffed Lemur (*Lemur varius* ♂) from Madagascar, a Macaque Monkey (*Macacus cynomolgus* ♀) from India, a Capercaillie (*Tetrao urogallus* ♂) from Norway, deposited ; a Brazilian Tree Porcupine (*Sphingurus prehensilis*), a Naked-throated Bell-bird (*Chasmorhynchus nudicollis*) from Brazil, two Blue-winged Teal (*Querquedula cyanoptera*) from South America, five Lesser Snow Geese (*Chen albatus*) from Alaska, purchased ; five Golden-bellied Beaver Rats (*Hydromys chrysogaster*) from Australia, received in exchange.

OUR ASTRONOMICAL COLUMN

THE ROTATION PERIOD OF MARS.—The seventh volume of the *Annals* of the Leiden Observatory contains a very thorough and painstaking investigation by Prof. Bakhuyzen of the rotation period of the planet Mars. In previous determinations one of two courses has usually been adopted, either to compare drawings of Huygens or Hooke with the most recent observations attainable, or to discuss some modern series which seemed to promise to compensate for its restricted range by its greater accuracy. Prof. Bakhuyzen has, however, endeavoured to utilise the entire mass of observations at his disposal, so as to avoid the sources of error to which the other methods are liable, and he possesses a great advantage over earlier investigators, in having access not only to the numerous observations made in 1877 and 1879, but also to the great series of more than 200 drawings which Schroeter had prepared for his projected "Areographischen Beiträge," and which, becoming the property of the University of Leiden in 1876, was edited and published by Prof. Bakhuyzen in 1881. Prof. Bakhuyzen, in the reduction of these drawings, has adopted provisionally Schiaparelli's position for the pole of Mars—R.A. 317° 46'·0, Dec. 53° 25'·4, mean equinox of 1833·0—and Proctor's rotation-period—24h. 37m. 22·74s.—and deduces corrections to these elements from a comparison of the results obtained by reducing the various observations at his command with them. His first step is, from a discussion of the drawings of Kaiser, Lockyer, Lord Rosse, and Dawes, made during the oppositions of 1862 and 1864, to obtain the time of transit on January 1, 1863, of his adopted prime meridian over the Martial meridian which passes through the earth's north pole, choosing as his prime meridian the one which lies 2° to the east of the centre of Mädler's point *a*, corresponding almost exactly to Schiaparelli's *Fastigium Aryn*, or to Proctor's *Dawes Forked Bay*, he finds the time of transit over the meridian passing through the north pole of the earth on January 1, 1863, to be 20h. 27·0m. ± 4·0m, Berlin M.T. The areographic longitude of the centre of the *Oculus*, the conspicuous circular spot, called by Green the *Terby Sea*, and by Schiaparelli *Lacus Solis*, will be, with this prime meridian, 90·87°. The second section contains the determination of the areographic longitudes of ten of the most conspicuous and easily identified markings on the surface of Mars as inferred by means of the above elements from the drawings of various observers from the time of Hooke and Huygens up to 1879. For the last-named year only Schiaparelli's observations are used, but for 1877 there is an abundant supply, there being available, besides the observations of Schiaparelli, the drawings of Lohse, Green, Dreyer, and Niesten. Beer and Mädler's drawings afford material for 1830, Herschel and Schroeter give a very full series from 1777 to 1803; and Huygens and Hooke supply a few drawings from 1659 to 1683, from which the longitude of Mädler's *f*, the *Kaiser* or *Hourglass Sea*, Schiaparelli's *Syrtis Major*, can be inferred. These longitudes are discussed in the third section, and a corrected rotation period is obtained of 24h. 37m. 22·66s ± 0·0132s., a value exceedingly close to the mean of the best previous determinations, which are as follows:—

	h.	m.	s.
Kaiser, 1864	24	37	22·62
Kaiser, 1873			·591
Schmidt, 1873			·57
Proctor, 1868			·735

Proctor's value is clearly too large, a comparison of the mean longitudes obtained for the *Kaiser Sea* with his period showing a steady decrease for successive oppositions; the only observations which stand conspicuously out from the rest being those of Hooke, upon which he had based his determination. There can be no doubt that Prof. Bakhuyzen's value is a distinct improvement upon the earlier ones, and that its uncertainty lies only in the second place of the decimals. A table for computing the time of transit of the prime meridian over that meridian of Mars which passes through the earth's north pole, completes the memoir.

Prof. Bakhuyzen supplies also a short note as to changes on the surface of Mars. The most conspicuous of all the markings on the planet's surface has always been the *Kaiser Sea*; but the drawings of Schroeter and Herschel, as Dr. Terby has already pointed out, exhibit a second marking near it, nearly as conspicuous, and very similar in shape and size. There can be no doubt that the only modern representative of this spot is *Huggins Inlet*, Schiaparelli's *Cyclopum*, a narrow streak, by no means easily observed, and now entirely unlike the *Kaiser Sea* in shape. Prof. Bakhuyzen also considers that there is sufficient evidence for thinking that Schroeter on several occasions observed Schiaparelli's *Læstrygonum*—one of the most difficult objects on the planet—which could scarcely have been the case had it not been much more conspicuous than it has been of late years. These changes, Prof. Bakhuyzen thinks, lend a high degree of probability to the theory that certain districts of Mars are covered by liquid.

THE SPECTRUM OF THE GREAT NEBULA IN ANDROMEDA.—Mr. O. T. Sherman, assistant at Yale College Observatory, reports in *Science* (vol. vi. Nos. 138 and 141) the discovery of three bright lines in the spectrum of this nebula. Of these the most refrangible corresponds to Hβ, and the wave-lengths of the other two are given as 5312·5 and 5594·0. It is suggested that the second of these lines is the well-known coronal line 1474 K, and that the third is one of the feebler coronal lines which Prof. Young observed in the 1869 eclipse, viz. the one at 1250 ± of Kirchhoff's scale. The observation, if confirmed, will go far to settle the disputed question as to whether the *Nova* is really or only apparently connected with the nebula, for two bright lines, of which one is probably 1474 K, have been observed in the spectrum of the former at the Royal Observatory, Greenwich.

THE WEDGE PHOTOMETER.—Dr. Wilsing in the *Astronomische Nachrichten*, No. 2680, criticises at considerable length several points with regard to Prof. Pritchard's use of the wedge photometer at the Oxford Observatory. Dr. Wilsing considers that Prof. Pritchard's investigations as to the figure of the wedge and its selective absorption leave nothing to be desired, but that the state of our knowledge of the physiological side of the question is still very incomplete. Experiments which Dr. Wilsing has made with two wedges of his own have convinced him that the variations in the sensibility of the eye are neither slight nor unimportant, and that they occasion discordances in the observations considerably greater than Prof. Pritchard is inclined to admit. Dr. Wilsing also finds that comparisons of differently coloured stars give results not directly comparable with eye estimations. He objects to the use of the method of limiting apertures for the determination of the value of the wedge constant, and points out that the influence of the intensity of the background affects Prof. Pritchard's magnitudes of the fainter stars very perceptibly. Despite all these drawbacks, however, he regards the wedge photometer as a useful addition to our equipment.

Mr. Chandler, who must at Harvard College enjoy special facilities for making himself well acquainted with the working of different forms of photometers, has recently expressed his preference for Argelander's method. There can, however, be no doubt but that the labours of Profs. Pritchard and Pickering have greatly advanced our knowledge of the comparative brightnesses of the northern stars.

PHOTOGRAPHING THE CORONA IN FULL SUNSHINE.—Mr. W. H. Pickering, of Harvard College, made a series of attempts during the partial eclipse of last March 16, to obtain a photograph of the corona. In this he was quite unsuccessful, for, though his plates showed several corona-like markings, they were clearly not due to the true corona, as they were found in front of the moon as well as on the sun's limb. From this Mr. Pickering was evidently led to conclude that the results which Dr. Huggins had obtained were probably of a similar character, and he expressed as much in a letter to *Science*. Dr. Huggins in reply pointed out that Mr. Pickering's method was faulty and was calculated to produce such false images. The latter, therefore, somewhat modified his apparatus, without, however, altering the two points which Dr. Huggins considered most erroneous—viz. the use of an object-glass instead of a reflector, and the placing his drop-slit close in front of the object-glass instead of in its primary focus. The result has been that he has obtained photographs free from false coronæ, but showing no real ones. At the same time he has made experiments which convince him that to produce a perceptible image of a coronal rift it is necessary to be able to discriminate between degrees of illumination which do not differ from each other by more than one-tenth the intrinsic brilliancy of the full moon. He considers that the eye is more able to detect small differences of light than a photograph is, and states that the moon cannot be photographed in full daylight, even though it may be easily seen. His investigations also lead him to think that even in the clearest weather the atmospheric illumination is 300 times as

bright as it should be for it to be possible to obtain any image of the corona. To these points Dr. Huggins has replied in the *Observatory* for November. Dr. Huggins states that he has had no difficulty at all in photographing the moon in full sunshine, and that the observations of Prof. Langley and others of Mercury and Venus, which have been seen as black disks before they reach the sun, proves that the corona must have a sensible brightness as compared with the atmospheric illumination.

He also points out that Mr. Pickering fails to obtain any trace on his photographs even of the defects of his own instrument. Dr. Huggins declines further discussion, preferring to wait the result of the work now being carried on by Mr. Ray Woods at the Cape Observatory. Mr. Pickering replies in *Science* for October 23, admitting the possibility of photographing the moon in full sunshine, but contending that these very photographs of the moon supply an additional proof of his opinion that the light of the atmosphere near the sun is more than 300 times too intense for it to be possible to obtain a photograph of the corona, since the sky light near the sun was fifty times as bright as that near the moon, and coronal photographs, to be of any use, should be able to record differences of illumination of only one-tenth the brightness of the full moon.

He explains the visibility of Venus and Mercury as being caused by the refraction of the sun's light through their atmospheres, the black disk being thus surrounded by a narrow luminous ring.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, *NOVEMBER* 15-21

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on November 15

Sun rises, 7h. 21m.; souths, 11h. 44m. 48·4s.; sets, 16h. 9m.; decl. on meridian, 18° 37′ S.: Sidereal Time at Sunset, 19h. 49m.

Moon (one day after First Quarter) rises, 13h. 18m.; souths, 18h. 37m.; sets, 0h. 3m.*; decl. on meridian, 8° 43′ S.

Planet	Rises	Souths	Sets	Decl. on meridian
	h. m.	h. m.	h. m.	° ′
Mercury ...	9 6 ...	12 54 ..	16 42 ...	24 8 S.
Venus ...	11 28 ...	15 2 ...	18 36 ...	25 59 S.
Mars ...	23 40* ...	6 46 ...	13 52 ...	12 2 N.
Jupiter ...	2 14 ...	8 23 ...	14 32 ...	1 5 N.
Saturn ...	18 48* ...	2 56 ...	11 4 ...	22 20 N.

* Indicates that the rising is that of the preceding and the setting that of the following day.

Occultation of Star by the Moon

Nov.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
			h. m.	h. m.	° °
17 ...	B.A.C. 8365 ...	6½ ...	22 41 ...	23 44 ...	166 298

Phenomena of Jupiter's Satellites

Nov.	h. m.		Nov.	h. m	
15 ...	5 0	IV. occ. reap.	17 ...	4 35	II. tr. ing.
16 ...	2 45	III. ecl. disap.	20 ...	6 56	I. tr. ing.
16 ...	5 51	III. ecl. reap.	21 ...	3 16	I. ecl. disap.
16 ...	6 47	III. occ. disap.	21 ...	6 34	I. occ. reap.

The Occultations of Stars and Phenomena of Jupiter's Satellites are such as are visible at Greenwich.

GEOGRAPHICAL NOTES

THE last number of the *Izvestia* of the Russian Geographical Society (xxi. 3) contains a variety of interesting papers. M. Ivanoff describes some Turkestan antiquities: namely, the Akhyr-tash, situated at the foot of the Alexander ridge, twenty-seven miles from Aulie-ata, one of the grandest buildings of antiquity, which covers nearly 20,900 square yards, and must have been some projected immense temple or palace; it was built from immense stones, weighing about one ton each, and brought from Tash-tube. M. Ivanoff gives for the first time a plan and a detailed description of the ruins of this immense building. Stone idols on the Issyk-kul, as also a burial-ground on the shores of the same lake, are described and represented by drawings. The whole is a most valuable contribution. M. Trusman's paper on Finnish elements in the Gdov district of St. Petersburg will be welcome to Russian archæologists. Capt. Gedeonoff gives a list of forty-three places in the Transcaspian region, whose positions have been determined by means of astronomical observations, as also their heights, determined by barometrical measurements. We notice the following: Khiva (house of Mat-murat), 41° 23′ 0″·1 N. lat., 60° 22′ 18″·9 E. long., 351 feet above the sea-level; Merv (Koushut-khan-kala), 37° 35′ 37″·6 N. lat., 61° 50′ 27″·9 E. long., 565 feet; and Tchardjui, 39° 1′ 33″·8 N. lat., 63° 36′ 12″·9 E. long., 433 feet. M. Konshin's paper on the Sary-kamysh lake basin and the western basin deserves more than a short notice, as it sums up the latest researches in this region, and presents the whole question as to the bed of the Amu-daria in quite a new light. A report on cartographical work in Russia in 1884 will be summed up under a separate head, as also two letters from Col. Prjevalsky and M. Potanin. Finally, the same issue contains two most valuable maps, by Gen. Tillo. One of them, on a larger scale, gives the lines of equal magnetic intensity, full and horizontal only, for Russia in Europe, reduced to the year 1880. On this map all places where observations have been made, as also where anomalies have been observed, are marked. Two other maps, on a smaller scale, give the lines of equal secular variation, both of the horizontal and of the total magnetical intensity. All three have explanations in German. These maps thus complete the remarkable work on "Earth-Magnetism in Russia," undertaken a few years since by M. Tillo, and already mentioned in NATURE.

THE last news from M. Potanin's expedition is embodied in a letter, dated San-chuan, January 25, and published in the last issue of the St. Petersburg *Izvestia* (xxi. 3). Leaving San-chuan on November 14, M. Potanin followed the right bank of the Hoang-ho up to He-cheu. The same red sandstones and conglomerates, covered with loess, were met with; the ridge which separates the Hoang-ho from the Tao-ho, intersected by deep ravines, is all covered with cornfields and villages; the soil abounding with moisture, villages are situated as high as 2000 feet above the bottom of the valleys. Crossing the Tao-ho and next the Da-sya-ho, the little half-ruined town of He-cheu was reached. The Da-sya-ho River is formed by the junction of three rivers—the Huishu, the Tumun, and the Leu-guan—situated 70 li above the town. This last river was followed by the expedition, and its source was reached after a two days' march. Its valley is wide and well-peopled in its lower half, the upper one being a mere gorge thickly covered with brushwood, and quite unpeopled. Crossing a ridge at the sources of the Leu-guan and its tributary, Urunka, the broad valley of the Tchitai was next reached. Its banks consist also of sandstones and conglomerates, and it is thickly peopled with Salars, its upper part being occupied by Tanguts. Descending this valley, a two days' march brought the expedition to the confluence of the Tchitai with the Yellow River; and another two days' march brought them to San-chuan. On this stretch the Yellow River flows in a narrow gorge between steep crags of the red sandstones and conglomerates, and the road ascends these crags or follows their slope on narrow wooden balconies, or by flights of steps cut in the hard rock. The right bank of the river is inhabited by Salars. They have maintained their Turkish language in great purity. The men wear a Chinese dress, but the women wear broad trousers, and a broad overcoat with sleeves, and a pointed bonnet which covers the upper part of the back. They are all Mussulmans, but their mosques are of Chinese architecture, and are decorated with dragons, lions, and tigers. Above its gorge the Yellow River flows through a depression seven miles long and less than two miles wide, which has received the name of San-tchuan, or Gurban-tala, and is peopled exclusively by Mongolian Shirongols. Their central village is Ni-ja. The Shirongols seem to belong to the same stem as that described by M. Prjevalsky under the name of Dalda in the vicinity of Kuku-nor. Both are called Tu-jen by the Chinese. If this supposition is correct, they would appear to occupy the territory from the longitude of He-cheu to that of Gan-cheu. They speak Mongolian, with an addition of Chinese words, but have some words of their own which must be remains of the language they have spoken in their former territory, the Urdus. Their dress is Chinese, but the women have maintained the same trousers as the Salars, and their houses have much likeness with those of these last. They live

on agriculture and gardening. All the religions of the region are met with among them. Around He-cheu they are all Mussulmans; but families having several male children send one of them to a Lamaite monastery so as not to divide their landholdings too greatly, and so a class of Buddhist Lamas has arisen. Those who have received Chinese instruction follow the teachings of Confucius, while the remainder go indifferently to Buddhist or Chinese temples, and many have Shamanist divinities. As to M. Berezovsky, he has left the expedition and has taken another route, *viâ* Hoy-syan; he proposes to rejoin MM. Potanin and Skassi on their way to the south.

THE expedition which is reported to have been massacred in New Guinea was sent out by the Geographical Society of Australasia, founded in May 1883. The commander, Capt. Henry Charles Everill, had been selected from a number of candidates, and his staff included a naturalist, a surgeon, two sub-leaders, one on land and the other on sea, a photographer, three natural history collectors, a surveyor, an engineer, and a "general utility" volunteer. Very full instructions were drawn out for the expedition, while considerable discretion was left to the leader to adapt his operations to circumstances. The instructions included directions not only for surveying work, but for observations on the natives, on zoology, botany, and geology, with directions for the collection and preservation of specimens. The expedition was to enter the Aird River, which is probably only an east arm of the Fly River. As a matter of fact, a telegram of September 22 announced the arrival of the *Bonito* (the vessel in which the expedition sailed from Sydney) in the Fly River. It was to penetrate as far as possible into the interior. The Australasian Society contributed 500*l.* to the expedition of Mr. H. O. Forbes, who, according to latest news, was at Port Moresby preparing to penetrate into the interior. Happily the report of the massacre is discredited by the British resident on Thursday Island.

THE Geographical Society of Lisbon passed a resolution at its last meeting asking the Portuguese Government to make a money grant by way of remuneration to the explorers MM. Capello and Ivens, and to pay the cost of publishing not less than 5000 copies of the account of their journey. It was also resolved to address every commercial association throughout the country pointing out the necessity of establishing a company or society for the purpose of investigating colonial markets hitherto imperfectly known, but of which MM. Capello and Ivens are showing the importance.

AT the last meeting of the Paris Society of Commercial Geography on the 20th ult., the Burmese Envoy being present, M. Bran de Saint Pol Lias described his recent journeys in Indo-China, which appear not to have extended far beyond Saigon, Cambodia, and the delta of the Red River. Indeed, travel even in these comparatively frequented parts of the peninsula must have been difficult when the traveller was there, for the greater part of Tonquin and Cambodia was in rebellion at the time of his visit.

THE *Bulletin* (2e trimestre, 1885) of the Paris Geographical Society, just published, contains a long report on the labours of the society, and on the progress of the geographical sciences, by M. Maunoir, the secretary. The work is, as usual, well and thoroughly done. The only other paper in the number is a description of the regions of Algeria traversed by the meridian of Paris, by Commander Derrien. This is accompanied by a map, and describes in succession, and with great detail, their orography, hydrography, geology, military roads, meteorology, military and administrative divisions, and also discusses the origin of the tribes of the Jebel Amour.

THE Geographical Society of Tokio appears to be steadily pursuing its work. The recent numbers of its *Journal*, which we have before us, show much activity in regions around Japan. Amongst the papers in the sixth volume we notice the following:—The five races of the Chinese Empire, and their ancient progress, by Mr. Otori; the interior of Northern Corea, by Mr. Kaizu; travels in Siam; notes on Thibet (compiled from European sources); Formosa under the Chinese; Manchuria: recent events in Annam; travels in South-eastern Russia; the salt-tax in China; colonisation in Saghalien (a review); Formosa during the Dutch occupation; historical notes on the relations between Russia and China; notes on the aboriginal language of Formosa, with a considerable vocabulary; Candahar and the Lower Cabul Valley, with a sketch map; the mines of Central Japan, with a map, and various other minor communications. The first number of the tenth volume contains a paper by Mr. Akamatsu on the origin and condition of the Chinese emigrants to the Philippines, based apparently on the writings of Prof. Blumentritt on the subject; and one on the longitude of Japan, by Mr. Arai, the head of the meteorological bureau. The *Journal* is printed in Japanese, but a short table of contents is appended in English.

THE leading paper in the current number (Heft 3, Band viii.) of the *Deutsche Geographische Blätter*, the organ of the Geographical Society of Bremen, is one by Leonard Steineger, describing a voyage around Behring Island, off the coast of Kamchatka, in the autumn of 1882. It describes at some length the incidents of the voyage, the capabilities of the island, &c. The writer visited and describes the ruins of the hut in which Behring and his companions wintered 141 years previously, and where the traveller himself died, and was buried. Dr. von Steiner compiles from Mr. Im Thurn, an account of the Indians of Guiana. The usual geographical news concludes the number.

MR. SCOTT, of the Indian Survey Department, recently delivered a lecture at Calcutta on the transfrontier surveys of India, in which he pointed out that 20,000 square miles on the immediate north-western frontier needed exploration. Here lie the Kafila routes into Afghanistan, which he much regretted had not been used for the advance into Afghanistan instead of the hot and thirsty Bolan Pass. He suggested that the rules against British officers crossing the frontier should be relaxed, and that they should be permitted to accept invitations, with a guarantee of safety, by native officers to their homes across the border.

THE death of Col. Obligado, of the Argentine Army, on September 22 at Buenos Ayres is announced. In recent years he had made many scientific explorations on the coasts and in the interior of Patagonia. He traversed the forests in the basins of the Negro, Limay, and Nanquen rivers, which had never been explored before; and several places in these regions now bear his name. His death was due to ill-health, caused by his journeys in Patagonia.

THE last issue of the *Mittheilungen* of the Geographical Society of Vienna contains two papers on the Carolines; one by Prof. Blumentritt describing the historical relations of Spain to the archipelago. He makes more interesting quotations from books used in Spanish schools, in which the Carolines are mentioned amongst the colonies of Spain, and the usual elementary school-book information is given about them. The secretary to the Society also gives a map of the group, with much geographical and other information respecting them. Herr Jülg concludes his paper on the erosive action of the sea, and the usual current geographical information brings the number (Band xxviii., No. 10) to a conclusion.

THE SCOTTISH METEOROLOGICAL SOCIETY

AT a meeting of the Directors of the Ben Nevis Observatory held on October 30, it was intimated that during the summer Prof. Ewing, of Dundee, had visited the Observatory to make arrangements for the observations on earthquakes and earth movements which it had been resolved to carry on there. Prof. Vernon Harcourt and Mr. Harold Dickson, both of Oxford, also spent some time at the Observatory conducting experiments and observations on the intensity of light in flames, it being necessary, in connection with the important practical question of a satisfactory determination of the light-giving qualities of coal gas supplied to the public, to make experiments on such a situation as Ben Nevis, where barometric pressure is low. Mr. H. N. Dickson resided two months at the Observatory, being chiefly engaged in carrying out, under the superintendence of Prof. Tait and Mr. Buchan, a valuable series of observations and experiments on the methods of observing the temperature and humidity of the air. For this purpose the season was a singularly suitable one, on account of the extremes of temperatures and humidities the weather presented during the summer on the Ben. As regards the humidity, where there were of course abundant opportunities of studying the behaviour of the instruments in an atmosphere completely saturated through a wide range of temperature, many cases occurred of excessive and protracted dryness of the atmosphere. On one occasion, in September, no deposition of dew took place on

Prof. Chrystal's condensation hygrometer, though its temperature was lowered to 9°·0. These quite exceptional arid states of the air on Ben Nevis during the past summer are of the greatest interest, especially in their relations to the unprecedentedly severe early frosts which were so destructive to the potato and cereal crops over extensive breadths of the country during September. It was reported that since the middle of August subscriptions to the amount of about 300*l.* had been already received from the original subscribers, and it was resolved to make the claims of the Observatory more widely known. At the same meeting the Council resolved that the discussion of the observations of the temperature of the sea round Scotland be undertaken by the Scottish Marine Station at Granton chiefly with the view of constructing isothermal maps of the sea for each month round the Scottish coasts. The Secretary reported that he had during the summer inspected twenty-six of the Society's stations. The Duke of Buccleuch, and Messrs. Donald Beith, W.S.; Robert Irvine of Royston; B. N. Peach, Geological Survey; and John Horn, also of the Geological Survey, were elected members of the Society.

ON THE INTELLIGENCE OF THE DOG[1]

THE man and the dog have lived together in more or less intimate association for many thousands of years, and yet it must be confessed that they know comparatively little of one another. That the dog is a loyal, true, and affectionate friend must be gratefully admitted, but when we come to consider the psychical nature of the animal, the limits of our knowledge are almost immediately reached. I have elsewhere suggested that this arises very much from the fact that hitherto we have tried to teach animals, rather than to learn from them—to convey our ideas to them, rather than to devise any language or code of signals by means of which they might communicate theirs to us. The former may be more important from a utilitarian point of view, though even this is questionable, but psychologically it is far less interesting. Under these circumstances it occurred to me whether some such system as that followed with deaf mutes, and especially by Dr. Howe with Laura Bridgman, might not prove very instructive if adapted to the case of dogs. I have tried this in a small way with a black poodle named "Van." I took two pieces of cardboard about 10 inches by 3, and on one of them printed in large letters the word "food," leaving the other blank. I then placed two cards over two saucers, and in the one under the "food" card put a little bread and milk, which "Van," after having his attention called to the card, was allowed to eat. This was repeated over and over again till he had had enough. In about ten days he began to distinguish between the two cards. I then put them on the floor and made him bring them to me, which he did readily enough. When he brought the plain card I simply threw it back, while, when he brought the food card, I gave him a piece of bread, and in about a month he had pretty well learned to realise the difference. I then had some other cards printed with the words "out," "tea," "bone," "water," spelt phonetically, so as not to trouble him by our intricate spelling, and a certain number also with words to which I did not intend him to attach any significance, such as "nought," "plain," "ball," &c. "Van" soon learned that bringing a card was a request, and soon learned to distinguish between the plain and printed cards; it took him longer to realise the difference between words, but he gradually got to recognise several, such as "food," "out," "bone," "tea," &c. If he was asked whether he would like to go out for a walk, he would joyfully pick up the "out" card, choosing it from several others, and bring it to me, or run with it in evident triumph to the door. I need hardly say that the cards were not always put in the same places. They were varied quite indiscriminately and in a great variety of positions. Nor could the dog recognise them by scent. They were all alike, and all continually handled by us. Still I did not trust to that alone, but had a number printed for each word. When, for instance, he brought a card with "food" on it, we did not put down the same identical card, but another bearing the same word, when he had brought that a third, then a fourth, and so on. For a single meal, therefore, eighteen or twenty cards would be used, so that he evidently is not guided by scent. No one who has seen him look down a row of cards and pick up the one he wanted could, I think, doubt that in bringing a card he feels he is making a request, and that he can not only distinguish one card from another, but also associate the word and the object. This is, of course, only a beginning, but it is, I venture to think, suggestive, and might be carried further, though the limited wants and aspirations of the animal constitute a great difficulty. My wife has a very beautiful and charming collie, "Patience," to which we are much attached. This dog was often in the room when "Van" brought the food card, and was rewarded with a piece of bread. She must have seen this thousands of times, and she begged in the usual manner, but never once did it occur to her to bring a card. She did not touch or indeed even take the slightest notice of them. I then tried the following experiment:—I prepared six cards about 10 inches by three, and coloured in pairs—two yellow, two blue, and two orange. I put three of them on the floor, and then holding up one of the others, endeavoured to teach "Van" to bring me the duplicate. That is to say, that if the blue was held up, he should fetch the corresponding colour from the floor; if yellow, he should fetch the yellow, and so on. When he brought the wrong card he was made to drop it, and return for another till he brought the right one, when he was rewarded with a little food. The lessons were generally given by my assistant, Miss Wendland, and lasted half an hour, during which time he brought the right card on an average about twenty-five times. I certainly thought that he would soon have grasped what was expected of him. But no. We continued the lessons for nearly three months, but as a few days were missed, we may say for ten weeks, and yet at the end of the time I cannot say that "Van" appeared to have the least idea of what was expected of him. It seemed a matter of pure accident which card he brought. There is, I believe, no reason to doubt that dogs can distinguish colours; but as it was just possible that "Van" might be colour blind, we then repeated the same experiment, only substituting for the coloured cards others marked respectively I., II., and III. This we continued for another three months, or, say, allowing for intermissions, ten weeks, but to my surprise entirely without success. I was rather disappointed at this, as, if it had succeeded, the plan would have opened out many interesting lines of inquiry. Still in such a case one ought not to wish for one result more than another, as of course the object of all such experiments is merely to elicit the truth, and our result in the present case, though negative, is very interesting. I do not, however, regard it as by any means conclusive, and should be glad to see it repeated. If the result proved to be the same, it would certainly imply very little power of combining even extremely simple ideas. I then endeavoured to get some insight into the arithmetical condition of the dog's mind. On this subject I have been able to find but little in any of the standard works on the intelligence of animals. Considering, however, the very limited powers of savage men in this respect—that no Australian language, for instance, contains numerals even up to four, no Australian being able to count his own fingers even on one hand—we cannot be surprised if other animals have made but little progress. Still, it is surprising that so little attention should have been directed to this subject. Leroy, who, though he expresses the opinion that "the nature of the soul of animals is unimportant," was an excellent observer, mentions a case in which a man was anxious to shoot a crow. "To deceive this suspicious bird, the plan was hit upon of sending two men to the watch-house, one of whom passed on, while the other remained; but the crow counted and kept her distance. The next day three went, and again she perceived that only two retired. In fine, it was found necessary to send five or six men to the watch-house to put her out in her calculation. The crow, thinking that this number of men had passed by, lost no time in returning." From this he inferred that crows could count up to four. Lichtenberg mentions a nightingale which was said to count up to three. Every day he gave it three mealworms, one at a time; when it had finished one it returned for another, but after the third it knew that the feast was over. I do not find that any of the recent writers on the intelligence of animals, either Buchner, or Peitz, or Romanes, in either of his books, give any additional evidence on this part of the subject. There are, however, various scattered notices. For instance, there is an amusing and suggestive remark in Mr. Galton's interesting "Narrative of an Explorer in Tropical South Africa." After describing the Damara's weakness in calculations, he says:—"Once while I watched a Damara floundering hopelessly in a calculation on one side of me, I observed 'Dinah,' my spaniel, equally embarrassed on the other; she was overlooking half a dozen of her new-born puppies,

[1] Abstract of paper by Sir John Lubbock, Bart., M.P., F.R.S., read at the Aberdeen meeting of the British Association.

which had been removed two or three times from her, and her anxiety was excessive, as she tried to find out if they were all present, or if any were still missing. She kept puzzling and running her eyes over them backwards and forwards, but could not satisfy herself. She evidently had a vague notion of counting, but the figure was too large for her brain. Taking the two as they stood, dog and Damara, the comparison reflected no great honour on the man." But even if "Dinah" had been clear on this subject, it might be said that she knew each puppy personally, as collies are said to know sheep. The same remark applies generally to animals and their young. Swans, for instance, are said to know directly if one of their cygnets is missing, but it is probable that they know each young bird individually. This explanation applies with less force to the case of eggs. According to my bird-nesting recollections, which I have refreshed by more recent experience, if a nest contains four eggs, one may safely be taken; but if two are removed, the bird generally deserts. Here, then, it would seem as if we had some reason for supposing that there is sufficient intelligence to distinguish three from four. An interesting consideration arises with reference to the number of the victims allotted to each cell by the solitary wasps. One species of Ammophila considers one large caterpillar of *Noctua segetum* enough; one species of Eumenes supplies its young with 5 victims; another 10, 15, and even up to 24. The number appears to be constant in each species. How does the insect know when her task is fulfilled? Not by the cell being filled, for if some be removed she does not replace them. When she has brought her complement she considers her task accomplished, whether the victims are still there or not. How, then, does she know when she has made up the number 24? Perhaps it will be said that each species feels some mysterious and innate tendency to provide a certain number of victims. This would, under no circumstances, be any explanation; but it is not in accordance with the facts. In the genus Eumenes the males are much smaller than the females. Now, in the hive-bees, humble-bees, wasps, and other insects, where such a difference occurs, but where the young are directly fed, it is of course obvious that the quantity can be proportioned to the appetite of the grub. But in insects with the habits of Eumenes and Ammophila the case is different, because the food is stored up once for all. Now, it is evident that if a female grub was supplied with only food enough for a male she would starve to death; while if a male grub were given enough for a female it would have too much. No such waste, however, occurs. In some mysterious manner the mother knows whether the egg will produce a male or female grub, and apportions the quantity of food accordingly. She does not change the species or size of her prey; but if the egg is male she supplies 5; if female, 10 victims. Does she count? Certainly this seems very like a commencement of arithmetic. At the same time it would be very desirable to have additional evidence how far the number is really constant. Considering how much has been written on instinct, it seems surprising that so little attention has been directed to this part of the subject. One would fancy that there ought to be no great difficulty in determining how far an animal could count; and, whether, for instance, it could realise some very simple sum, such as that two and two make four. But when we come to consider how this is to be done the problem ceases to appear so simple. We tried our dogs by putting a a piece of bread before them and preventing them from touching it until we had counted seven. To prevent ourselves from unintentionally giving any indication we used a metronome (the instrument used for giving time when practising the pianoforte), and to make the beats more evident we attached a slender rod to the pendulum. It certainly seemed as if our dogs knew when the moment of permission had arrived; but their movement of taking the bread was scarcely so definite as to place the matter beyond a doubt. Moreover, dogs are so very quick in seizing any indication given them, even unintentionally, that, on the whole, the attempt was not satisfactory to my mind. I was the more discouraged from continuing the experiment in this manner by an account Mr. Huggins gave me of a very intelligent dog belonging to him. A number of cards were placed on the ground, numbered respectively 1, 2, 3, and so on up to 10. A question is then asked: the square root of 9 or 16, or such a sum as $6 \times 52 - 3$. Mr. Huggins pointed consecutively to the cards, and the dog barked when he came to the right one. Now Mr. Huggins did not consciously give the dog any sign, yet so quick was the dog in seizing the slightest indication, that he was able to give the correct answer. This observation seems to me of great interest in connection with the so-called "thought-reading." No one, I suppose, will imagine that there was in this case any "thought-reading" in the sense in which this word is used by Mr. Bishop and others. Evidently "Kepler" seized upon the slight indications unintentionally given by Mr. Huggins. The observation, however, shows the great difficulty of the subject. I have ventured to bring this question before the Section partly because I shall be so much obliged if any lady or gentleman present will favour me with any suggestions; and partly in hope of inducing others with more leisure and opportunity to carry on similar observations, which I cannot but think must lead to interesting results.

Dr. Flower remarked that the crowded state of the room was sufficient evidence of the interest taken in whatever of the numerous subjects Sir John Lubbock cared to enlighten them upon. Sir John Lubbock was unable to make his dog count seven, but a dog at a place where he (Dr. Flower) was living recently certainly knew when the seventh day of the week came. The dog, most eager on every other day of the week to go for a walk, betrayed no desire to go on Sunday when his master took up his hat and stick to go to church. It struck him that the method which Sir John had adopted was the only one by which they could put themselves in relation to the minds of these animals—namely, the method of kindness and encouragement. Too many had tried to do these things by a system of intimidation and cruelty, but he did not think they could really know what dogs could do, and bring out their faculties, without patience and perseverance, encouragement, and uniform kindness.

Miss Catherine Rae explained the way in which she got a dog, within three weeks, to ring a bell. She began by letting "Tiny" smell the bone of a mutton chop, and then tied the bone to the string of the bell. At first "Tiny" was in a great tremor, but, by taking her very kindly and stroking her, she found that she could induce her to pull at the bone and so to ring the bell. After that she tied a small piece of wood to the string, but the dog would not pull it. At last she pulled her gently back till the bell rang, and in this way, in the short course of three weeks, with not more than one or two lessons a day, the dog would go and ring the bell by being told—"'Tiny,' go and ring the bell." At the end of three weeks she gave an evening party, and during the evening they were all electrified by the sudden and violent ringing of the bell. "Tiny" had been neglected to be indulged with any tit-bit, and had taken this means of receiving attention.

Miss Becker said, with regard to the experiments with the crow mentioned by Sir John, to show that it could not count beyond three, that something of the same kind might happen with a person. Place three eggs upon the table, and any one could say there were three; but if there were twelve he would require to count them to be sure of the number.

Mr. C. C. Walker gave an instance of a dog being taught politics. He belonged to a family where Liberal politics prevailed, and the dog showed his sympathy by growling fearfully when the name of "Dizzy" was mentioned, and at the name of his master giving expression to unbounded delight. Similar demonstrations at public meetings, he added, were often made with as little intelligence as those of the dog.

Some other remarks were made, one gentleman suggesting that as long as the dog was ignorant of the words "one," "two," "three," "four," he would not be able to count or get beyond the mere perception of magnitude.

Sir John Lubbock thought with reference to the question of Sunday that there were so many slight indications in the household generally to distinguish the day that he had never been able to regard that as proof of a dog counting, although it was a very interesting fact in itself. As regards several of the other cases they were clever tricks, but his suggestion was to operate in exactly the opposite direction; not to teach the dog, but to enable the dog to communicate with us.

NITROGEN IN THE SOIL

EACH of the elements required for building up the frame of animals and plants is of equal importance from a scientific standpoint, but in agriculture the various salts and substances which yield food for crops or for cattle must necessarily be valued according to their cost. There are exceptions to this rule, no doubt. Gypsum is a cheap manure, but it has sometimes doubled the clover crop, and kainit salts are comparatively cheap. Yet

for some crops, especially potatoes, in cases of a deficient supply of potash in the soil, they have sometimes proved invaluable. In general, however, cost and efficiency are closely associated, and as plants and animals are almost alike in their chemical composition the same rule as to the value of their constituents holds good. You may purchase starch and the carbo-hydrates at a much lower rate than the nitrogenous substances in food. Turnips, bread fruit, and bananas, consisting chiefly of carbo-hydrates, are sold by their respective growers at a very different and much lower price than milk or peas, which are rich in albuminous elements. In every form nitrogen is always comparatively costly. The albumen in eggs, the fibrine in cereals, the casein in milk, and the legumin in peas and beans, all owe their importance and cost to this particular element, which is the source of force and vigour, of the labour of the hardest-worked cattle and men, of lean meat and muscle.

Considering the limited supply of nitrogen and the cost of obtaining it, it is not surprising that it should often be present in cultivated soils in quantities insufficient for a full crop, and that the land, when dressed with salts of nitrogen, should answer to their touch as a horse does to the spur. In the Rothamsted experiments the unmanured field yielded for years about fourteen bushels, or half a crop, till a dressing of nitrogen was given to it, when immediately the crop was doubled, nitrogen having been, as it often is in clay soils, the one thing needful to a full crop. Sir John Lawes has been sometimes asked by American farmers how to restore the exhausted fertility of their fields, so that the land, yielding fourteen bushels per acre, which is about the average of corn-exporting countries, might be induced to return twice as much. It is fortunate for English farmers that Sir John can only send advice into the far West; he cannot send nitrogen.

Some years ago the agricultural community was flattered by the immediate prospect of a never failing supply of nitrogen. The marvels of chemistry and analysis had recently been unfolded by the writings of Sir H. Davy and Baron Liebig, and the efficacy of guano had accustomed farmers to the new method of supplying nitrogen to the land in concentrated forms and from sources outside the farmyard. Then came the promise of obtaining nitrogen from the atmosphere. The agricultural classes are rarely much moved by anything but bad weather and falling prices, and the chemists had explained to them that the nitrogen of the atmosphere, existing as it does in a free state mixed with oxygen, was not available for agricultural purposes. If it could be induced, they were told, to enter into combination with hydrogen the result would be ammonia, an invaluable manure. This was understood by farmers, and a great sensation was occasioned among them when Mr. Nasmyth, the inventor of the steam hammer, proposed to control the supply of the most costly of plant constituents by knocking it out of the atmosphere. It is easy to see that if Mr. Nasmyth had succeeded in knocking nitrogen and hydrogen into combination at a moderate cost, a revolution in the price of manures and of food must have speedily occurred.

But as the plan failed and as plants still "live and move and have their being" in the midst of an element which they cannot feed on, it was certainly surprising to learn lately that nitrogenous manures had ceased to produce their accustomed effect. The phenomenon occurred at the Duke of Bedford's experimental farm at Woburn, where, according to official statements, the yield of wheat manured by the dung of animals fed on maize proved as abundant as the crop which followed from manure produced by the feeding of cotton cake, which enriches the excreta with far more nitrogen than that produced by feeding maize.

The Woburn experiments were instituted by the Royal Agricultural Society and were placed under the management of its chemist, the late Dr. Voelcker, for the purpose of testing the value of manure obtained by the consumption of different kinds of food and to compare the effects of such manures with those of artificial manures. It is evident that in such a comparison the land to which the various fertilisers were applied should have been of similar quality. But there are other disturbing causes which may vitiate experiments of this kind, and these were not at first generally recognised. The mistake occurred in some rotation experiments in which the manure derived from cotton cake containing about 40 per cent. of nitrogenous constituents was compared in its results with that obtained from maize, a cereal containing only 10 per cent. of albuminoids. The results of these experiments were known to the agricultural community before the report of Dr. John Voelcker, who has succeeded his late father as chemist to the Royal Agricultural Society, had been made, and much surprise was expressed that at the close of the second rotation the cotton cake had not shown any decided superiority over the maize. It has been recently explained in an official report on the "Objects, Plan, and Results of the Woburn Experiments," that this was "probably due to the large amount of unexhausted manure in the land." Before commencing experiments, therefore, on the comparative value of manures the land should be exhausted by repeated scourging crops, as at Rothamsted, where in some cases the deep-rooting Bokara clover has been grown for the special purpose of reducing the fertility of the soil to *nil*.

It has long since been established that nitrogen is neither absorbed by plants from the atmosphere nor conveyed into the soil to any appreciable extent in any way except by the direct application of manure: still there are some crops which collect nitrogen and leave the surface-soil richer than before. Red clover is usually grown as a preparation for wheat, and although clover hay must necessarily withdraw a great deal of plant-food from the soil, it does not prove exhaustive in practice because the deep and fleshy roots of the plant collect nitrogen from the subsoil and, in their decay, supply it to the growing wheat-crop. Under such circumstances a strong nitrogenous manure may not be required, and may perhaps prove less desirable than a weak manure containing less nitrogen. Enough has been said to show that the field experiments which are now becoming popular, and which are being instituted at many "stations" throughout the country, will require great care and the supervision of managers who possess a competent knowledge both of "practice and science."

H. E.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

LONDON.—In accordance with resolutions passed at the extraordinary meeting of the Convocation of the University of London held on July 28 last, an adjourned extraordinary meeting of the House was held on Tuesday week in the University Building, Burlington Gardens, which was very numerously attended. The Chairman of Convocation (Mr. F. J. Wood, LL.D.) presided, and in his opening address explained his ruling that under the said resolutions the business pending before the former meeting might now be proceeded with, and invited the House to resume the debate accordingly. At the time of the adjournment the House had a motion before it, made by Lord Justice Fry, for the reception and adoption of the report of the special committee appointed to consider the project of the "Association for Promoting a Teaching University for London." To this motion an amendment had been moved by Mr. J. W. Bone, seconded by Mr. Philip Magnus, omitting all the words in the original motion after the word "received." At Tuesday's meeting leave was given to Lord Justice Fry to accept the amendment, which thus became a substantive motion, to which his Lordship, however, immediately proposed to add "And that the House now consider what amendments, if any, ought to be made in the said scheme, and that such amendments, if any, be by way of instruction to a committee of revision." For Lord Justice Fry's motion 76 only voted against 122 who negatived it. Ultimately after a three hours' sitting the debate was adjourned to Tuesday, December 8.

ALDERMAN SIR R. N. FOWLER, BART., M.P., has consented to present the City and Guilds of London Institute's Scholarships, Prizes, and Certificates at a meeting to be held on Wednesday evening, December 9, at the Salters' Hall, St. Swithin's Lane, E.C. The Right Hon. the Lord Mayor will preside.

SCIENTIFIC SERIALS

Mittheilungen der Naturforschenden Gesellschaft in Bern, Nos. 1064 to 1091, 1883-4 (three parts).—Contributions to the doctrine of metal-poisoning, by J. Marti.—Terrestrial and fresh-water mollusca collected in the neighbourhood of Berne and Onterlacken, by G. Regelsperger.—An automatically-acting thermograph, by G. Hasler.—Influence of sexual excitation on the composition of cow's milk, by F. Schaffer.—Further paper on the animal world in the pile-dwellings of the Lake of Bienne, by Th. Studer.—On a parasite in the intestine of the horse, by M. Flesch.—On the nature of odorous matters and

the causes of smell, by A. Valentin.—Mathematical considerations on the structure of bees' cells, by A. Jonquière.—On the inhibitory mechanism of the heart, by A. Glause.—On the separation of manganese and nickel by means of ozone, by V. Schwarzenbach.—On determinate integrals, by J. H. Graf.

SOCIETIES AND ACADEMIES

LONDON

Zoological Society, November 3.—Prof. W. H. Flower, F.R.S., President, in the chair.—Mr. Sclater exhibited the skull of a Tapir received by the Society in May, 1878, which was then described as *Tapirus roulini*, but which had since been found, upon anatomical examination, to be merely a dark variety of *Tapirus americanus*.—A letter was read from Mr. J. Caldwell, C.M.Z.S., of Port Louis, Mauritius, announcing the finding of a new deposit of dodo-bones in a small cavern in the south-west part of the island.—An extract was read from a letter addressed to the Secretary by Dr. F. H. Bauer, C.M.Z.S., of Buitenzorg, Java, containing some notes on the Flying Lizard (*Ptychozoon homalocephalum*) of that island.—Prof. Bell exhibited and made remarks on a fine specimen of the Decapod Crustacean, *Alpheus megacheles*, obtained by Mr. Spencer at Herm, Channel Islands.—Mr. Martin Jacoby communicated the second portion of his paper on the Phytophagous Coleoptera of Japan obtained by Mr. George Lewis during his second journey, 1880–81. The present part treated of the Halticinæ and Galerucinæ of Mr. Lewis's collection.—Mr. A. G. Butler read a paper containing an account of two collections of Lepidotera recently received from Somali Land. Mr. Butler considered that the Lepidopterous fauna of Somali Land was essentially Arabian in character.—Mr. L. R. Lydekker, F.Z.S., described a last upper molar of a Mastodon, which had been obtained by Mr. A. H. Everett, C.M.Z.S., in Borneo, and referred it to a small race of *M. latidens*, previously known only from the Pliocene Siwaliks of India and Burmah. The specimen was of much interest, as increasing our knowledge of the eastern range of the Siwalik mammals.—Mr. W. T. Blanford, F.R.S., read a monograph of the genus *Paradoxurus*. After a critical examination of a large series of specimens Mr. Blanford came to the conclusion that it would be necessary to reduce the numerous so-called species of this genus to about ten well-marked forms.—Mr. W. T. Blanford, on behalf of Mr. J. A. Murray, read a paper containing the description of a new species of *Mus* from Sind, proposed to be called *Mus gleadowi*.—Mr. F. E. Beddard, F.Z.S., read an account of the specific characters and structure of some New Zealand earthworms of the genus *Acanthodrilus*.

PARIS

Academy of Sciences, November 2.—M. Bouley, President, in the chair.—The Perpetual Secretary announced the death of M. Joly, Corresponding Member of the Section for Anatomy and Zoology, who died at Toulouse on October 17, 1885.—Remarks on the subject of M. Hirn's recent experiments on the velocity of gases with a view to testing the truth of the kinetic theory of gases, by M. Faye. The author infers from the results of these experiments that the kinetic hypothesis will have to be reconsidered, if not absolutely rejected. The limit which it imposes on the velocity of gases under certain conditions of temperature and pressure is shown to be imaginary.—Fresh researches on the origin of the glandular nervous fibres and of the vaso-dilator nervous fibres which form part of the chord of the tympanum and of the glosso-pharyngian nerve, by M. Vulpian.—Remarks on M. H. Filhol's new work entitled "Recherches zoologiques, botaniques, et géologiques faites à l'île de Campbell et en Nouvelle-Zelande," by M. Alph. Milne-Edwards. The researches embodied in this work tend to show that since the Chalk or beginning of the Tertiary epoch Campbell Island can have formed no part of New Zealand or of any other Australasian region.—Solution of a question of indeterminate analysis constituting a fundamental principle in the theory of the Cremona transformations, by M. de Jonquières.—Experimental researches on the temperature observed in the mother at the moment of delivery and of the child at birth: comparison of these two temperatures, by M. Bonnal.—On the attenuation of the virus of ovine variola, by M. P. Pourquier. From his researches, continued for a period of seven or eight years on the principles established by M. Pasteur, the author concludes that it is possible to attenuate this virus, to transform it into a true vaccine, and thus avoid the serious losse hitherto incurred by inoculating sheep against the disease.—On the Cremona transformations in a plane of n order, by M. G. B. Guccia.—On the decomposition of quadratic forms, by M. Benoit.—Note on the theory of M. Helmholtz respecting the preservation of solar heat, by M. Ph. Gilbert.—Note on the doubly-refracted dispersion of quartz, by M. J. Macé de Lépinay.—On the theoric distribution of heat over the surface of the globe, by M. A. Angot.—Combination of the nitrate of silver with the alkaline nitrates (nitrates of potassa, rubidium, ammoniac, soda, and lithine), by M. A. Ditté.—On the anhydrous chloride and silicate of cerium, by M. P. Didier. Having already determined the action of hydrosulphuric acid on the anhydrous chloride of cerium, the author now communicates a process for preparing this substance, and describes some other compounds obtained by its means by the dry process.—Note on the Asteriadæ collected during the *Talisman* expedition, by M. Edm. Perrier. As many as fifty-four species, represented by nearly 200 specimens, were obtained on this occasion, some fished up from depths exceeding 4000 metres.—On the respiration of leaves in the dark: carbonic acid retained by them, second note, by MM. Dehérain and Maquenne.—Note on artificial earthy specular iron, by M. Stan. Meunier.—On the zymotic properties of charbon and septicemic blood, by M. A. Sanson.—On the transmission of virulent glanders to the pig, by MM. Cadéac and Malet.—Treatment of mildew in the vine by means of the sulphate of copper, by M. A. Müntz.—The sulphate of lye-ashes and its employment against animal and vegetable parasitic diseases, by M. Duponchel.—Account of a remarkable meteoric phenomenon observed at Pondicherry on June 13, 1885, by M. C. André.

CONTENTS