THURSDAY, DECEMBER 1, 1904.

DAI NIPPON.

Dai Nippon, the Britain of the East, a Study in National Evolution. By Henry Dyer, D.Sc., &c. Pp. xvi+450. (London: Blackie and Son, Ltd., 1904.)

THE story of how Japan jumped from what she was to what she now is will always form one of the most remarkable episodes in the history of material civilisation. Not only is it this, but it is also a remarkable illustration of the results that can be achieved by occidental education fostered by and implanted on a system of oriental ethics.

This story, under the title of "Dai Nippon," or "Great Japan," is told by Dr. Henry Dyer, who for about ten years was principal of the College of Engineering in Tokyo. From it we learn that Japan has taken from Europe and America every concrete aid to progress on which she could lay her hands, and in return for this she now offers a code of morals. When we realise that it is Japanese ethics which are at the base of Japanese character, and that these ethics led to the desire to acquire European knowledge, they commend themselves for close consideration.

We may give water to a horse, but to make him drink is another matter. In a similar manner we may cover a country with schools, but to induce people who have neither the ability nor desire to learn to take advantage of such schools is a formidable task. The Japanese had ability in a marked degree. Their extraordinary power of memorising, which the few Europeans who have noticed the same have only regarded as an abnormal curiosity, may possibly be the resultant of committing to heart the sayings of eastern sages and endless idiographs. A philosophy which had sunk into the hearts of the people while many Europeans still revelled in a feral state no doubt played its part in the suggestion that it was advisable to fall in line with western progress. The main lever, however, which forced Japan from its insular Utopia into the never-ending struggle amongst the comity of nations was the feeling that national and personal honour had been affronted. A civil war was ended, the Tokugawa party had been defeated, and the feudal barons had been united under the Emperor who still reigns. Internal dissensions had ceased, but western demands had settled like a cloud upon the nation. Treaties had been made with thirteen States, each of which had its courts of justice; Japan was powerless to fix its tariffs; Yokohama was policed by a British regiment, and legations kept their guards. In these and other directions Japan felt that, notwithstanding she possessed a culture about which the man in the street is yet profoundly ignorant, she was humiliated and looked down upon as an inferior. Buddhism and Shintoism had resulted in an extraordinary patriotism and loyalty, while the "Bushido" of the "Samurai" gave a system of moral principles "which entered more deeply into the national life of Japan than do those of the religion we profess into Western civilisation."

Among these ethical teachings those bearing upon wisdom, benevolence, and courage were preeminent. Wisdom meant intellectuality rather than mere knowledge. Benevolence resulted in social relationships, so that beggars are practically unknown, whilst State aid for the poor is seldom sought. Courage embodied the idea that it is better to die for one's country rather than yield. Commerce had always been looked down upon as a low pursuit. A nation saturated with such ethical teachings was naturally proud of her autonomy, and sought to escape from occidental restrictions. The escape she chose was by an education in western utilitarian knowledge, wisely backed by an army and a navy.

In 1868, when the present Emperor ascended the throne, he took an oath embodying five principles, the objects of which were to act as beacons in the ocean of international struggles of the world. In the fourth of these we read that "all purposeless principles and useless customs" were to be discarded, whilst the fifth directs that "knowledge and learning shall be sought after throughout the whole world, in order that the status of the Empire of Japan may be raised ever higher and higher." When this announcement was made the education of Japan chiefly consisted in memorising Chinese classics and characters, learning to reckon on the abacus, and studying history and edicts. Knowledge relating to science and its applications was almost non-existent, and we can well imagine the doubts of those who were entrusted with the administration of the imperial command as to the courses they should follow. In 1871 a department of education was created, and with it schools of various grades were established throughout the country. The children of the lower classes, including females, were admitted, while the schedules of study of preexisting schools were re-modelled. At the present time it may be said that Japan bristles with schools, and that there is not an ignorant family in the country.

A child, possibly commencing at a kindergarten, is admitted to a common school at the age of six. After four years he passes to a higher grade school, where there is also a four years' term. Above this there is a middle school with a five years' term. Graduates from this school can by competitive examination pass to one of six higher middle schools, above which stand two imperial universities, in connection with which there are colleges of literature, science, medicine, engineering, law, and agriculture. The number of elementary schools is 27,109. Usually no fees are charged, but in special cases the local governor may allow charges varying between $2\frac{1}{2}d.$ and $5d.$ per month.

In the training of children moral education takes precedence of instruction in facts of practical use in daily life. Bodily development is not neglected, but good manners and etiquette rank higher than minds stored with information.

In the secondary schools, although mathematics, natural history, physics, chemistry, and other subjects are taught, we again find—and find in institutions of all grades—that "morals" (without religious dogma) head the list. It is clear that the Japanese want good citizens, citizens who recognise the symbol of authority

rather than practical demonstrations of the same. In Japan a crowd will halt before a straw rope on which flutters a tiny paper notice. In Europe police and truncheons might be required. The good manners of the East are hardly so superficial as popularly imagined. They are the outcome of their philosophy emphasised by special training, the end of which is "to cultivate your mind that even when you are quietly seated not the roughest ruffian can dare make an attack on your person."

The higher secondary schools are preparatory to the universities, the objects of which are to teach "such arts and sciences as are required for purposes of the State." To each is attached a university hall, which is established for purposes of original research. In the six colleges forming the university the professors and assistants number 245, and the students 3121. The entrance fee is 2 yen, and the annual tuition fee is 25 yen (1 yen=2*s*.). For those who cannot proceed to the universities, industrial, agricultural, commercial, and other technical schools have been established. In 1902 there were 845 such schools, attended by 55,596 scholars. The expenditure on these in 1902 was 2,739,297 yen, of which 285,253 yen was State aid. The total annual expenditure by the Government in connection with the educational department is roughly six million yen (600,000*l*.).

In addition to the schools mentioned, Japan has its naval, military, art, and music schools. Over and above these, again, we find educations in departments of life which in Europe have received but little attention. Chess, or rather "*go*," clubs are common throughout the country, and for proficiency in the game certificates are awarded. Certificates can also be obtained in the art of flower arrangement, an art which has its terminology and canons, but which in Europe finds its perfection in "studied negligence."

In connection with education, a point which Dr. Dyer has not emphasised, but which is in strict accordance with the imperial edict of 1868, is that the Government keeps up a stream of its best educated men flowing round the world, each being a specialist, visiting countries and institutions with the object of gathering together what is valuable in his own vocation. Originally it was the Japanese student who was sent abroad; now it is the professional man. You may not know it, but often he may be able to give more information than he receives. Generally speaking, in Dr. Dyer's words, the Japanese Government finds that money spent on education is a good national investment.

The chapters devoted to industrial development, the army and navy, commerce, politics, and other subjects are as interesting and full of information as those bearing upon education.

With regard to the future of Japan, Dr. Dyer tells us that his ideas are decidedly optimistic, and he believes "that in material, intellectual and moral influence Japan will fully justify her claim to be called the Britain of the East." So far as the concrete adjuncts of civilisation are concerned, Japan might be pleased could she be on the same platform as her ally, but it is doubtful if she aspires to much more. Her 46 millions of people have smiling faces, their courtesy and politeness have attracted the attention of all travellers, they are scrupulously clean and see a bath-tub every day, to show anger is to put yourself on a level with a dog, and should two persons have an altercation, for one to dub the other as a "shaba fusagi" or an "impeder of the world's progress" would be an epithet not to be forgiven. The courage of her soldiers needs no comment, while the endurance of a "jinricksha" man, who for a week can pull a heavy European with his baggage 40 or 50 miles per day, is, from an occidental point of view, quite phenomenal.

The Japanese are temperate, frugal, modest, and happy, while the world knows that they possess artistic instincts. In many directions a Japanese is distinctly superior to the European. The nation has a soul, and if we reflect on the components which make up that soul—the soul of Ruskin—it seems that in certain directions European countries might be benefited if only they were able to raise themselves to the level of Dai Nippon. Although by the opening of the country much has been gained, there are many signs indicating that the blessings have not been unalloyed. Commerce, competition, and the accumulation of wealth have been accompanied by increasing poverty, whilst those whose vocations have been at the open ports have acquired the manners of those with whom they came in contact. So far is this marked that a Japanese who has been a servant in a European house may be handicapped in obtaining similar employment amongst his own people. To say the least, he has become too brusque. Side issues of this nature may cause a nation to regard with regret the disappearance of old conditions, but, taking all in all, Japan has gained more than she has lost. She is no longer a pupil, but a teacher.

SYLVESTER'S MATHEMATICAL PAPERS.

The Collected Mathematical Papers of James Joseph Sylvester. Vol. i., 1837–1853. Pp. xii+650. (Cambridge: University Press, 1904.) Price 18*s*. net.

THE appearance of this volume is very welcome for more reasons than one. Sylvester's papers were published in a variety of journals, and generally contained a considerable number of misprints; they will now be available in an attractive form, with their accidental blemishes removed by a very careful and competent editor. The work of preparing these papers for the press must be troublesome and tedious, and the thanks of mathematicians are due to Dr. Baker for having undertaken it. Special attention should be directed to the note at the end of the volume on Sylvester's theorems about determinants, some of which require correction.

The papers here published range in date from 1837 to 1853. The first three relate to mathematical physics; but Sylvester soon followed his natural bent, and all the rest of this volume is pure analysis, mostly algebra. Historically, the most notable results are those on elimination, canonical forms, and the theory associated with Sturm's method of locating the real

roots of equations. Moreover, there is the paper on the contacts of lines and surfaces of the second order, where the invariant factors of a matrix are recognised, and the system of two quaternary quadratics is considered in detail with reference to the simplest simultaneous reduction of the forms.

Appreciations of Sylvester's character and of the value of his mathematical work have been written by able hands, and it is unnecessary to enlarge upon them here. His egotism was obvious and often amusing, but never offensive; his enthusiasm was refreshing, and though his temper was touchy, he was very generous and kind. As a master of formal analysis he has few equals; the birth of the calculus of invariants occurred just at the right time to attract his attention, and his contributions to this subject alone are enough to make him famous. He had the instincts of an architect, and it is well, on the whole, that he did not always trouble to clear away the chips. The casual remarks scattered about his papers and the fragmentary nature of some of them, help to make the reading of them very stimulating; he takes us into his confidence, shows us how his ideas arose, and gives us hints of unexplored regions. He was eminently original, and spent little time in studying the works of his contemporaries; thus he did not even realise that his theory of reciprocants had been more than anticipated by others, especially by Lie. But any misunderstanding arising from this source must have been long since dissipated, and his place among the great mathematicians of his time is quite secure.

Sylvester's occasional notes on the theory of numbers and his lectures on partitions suggest problems to those who are interested in arithmetic. The present volume, for instance, contains three notes on cubic Diophantine equations, a subject not yet exhausted, though Sylvester's own theory of resideration throws much light upon it. The late Henry Smith once referred to this problem as being one which might be hopefully attacked with the engines of modern analysis; perhaps the appearance of this edition of Sylvester's works may lead to the discovery of a complete theory.

A good example of Sylvester's power of illuminating and drawing general conclusions from the simplest mathematical problem is the note (p. 392) on an elementary geometrical theorem for which no direct proof had been discovered. He observes that the proof may be made to depend on showing that a certain analytical equation has no real root, and suggests that in all such cases where the analytical proof consists in demonstrating the *non-existence* of roots, the geometrical proof must necessarily be indirect, while in other cases the *reductio ad absurdum* may be convenient, but is not necessary. This observation reminds us at once of Gauss's discussion of the division of the circle, and if Sylvester's conjecture is true it gives another case of the curious points of contact that exist between analysis and geometry.

It is not to be expected, or even desired, that many should share Sylvester's keen delight in the beauty of formal analysis; but it is a mistake to discourage those who are inclined to enjoy it, however unpractical parts of the subject may be. Quite apart from other reasons, the study of pure mathematics may be defended, like that of music or chess or painting, from the merely æsthetical side, and this Sylvester does in terms both vigorous and quaint. For example:—

"The fortunate proclaimer of a new outlying planet has been justly rewarded by the offer of a baronetcy and a national pension, which the writer of this wishes him long life and health to enjoy. In the meanwhile, what has been done in honour of the discoverer of a new and inexhaustible region of exquisite analysis?" the latter reference being to Cayley's discovery of the calculus of invariants. Fortunately Cayley was saved in another way from the cares of money-making, and he lived long enough to realise to the full his great reputation among those who would appreciate his work. Sylvester in his early life suffered unjustly from the current prejudice against his race; so far as it was possible this was afterwards atoned for, and it is to be hoped that no bitter feeling was left behind.

G. B. M.

MENTAL AND SOCIAL MEASUREMENTS.

An Introduction to the Theory of Mental and Social Measurements. By Edward L. Thorndike, Professor of Psychology in Teachers' College, Columbia University. Pp. xii+212. (New York: The Science Press, 1904.) Price 1.50 dollars net.

AMERICAN colleges seem more awake than our own to the fact that the newer methods of statistics have made it possible to deal with facts with which they are directly concerned, and to discuss them with far more completeness than was practicable a few years ago. They are making in consequence large collections of anthropometric data to serve as tests of health and development, and for comparisons between colleges. Again, there are more teachers in America than in this country who, appreciating the fact that the above methods have far wider applicability, extend the range of their measurements to psychophysical subjects. They are also eager to deal with purely psychical matters that elude direct measurement but admit of being arranged by mutual comparison into their proper class places, or to utilise a third and still more general method, which deals with such objects as can be sorted into a few distinct classes without regard to their internal arrangement. The author is fully justified in saying that

"The obscurest and most complex traits, such as morality, enthusiasm, eminence, efficiency, courage, legal ability, inventiveness, can be made material for ordinary statistical procedure, the one condition being that the general form of distribution of the trait in question shall be approximately known."

In these circumstances a system of elaborate measurements has come into vogue in many American colleges. Whether the authorities have always planned their measurements wisely, and whether they discuss them adequately and accurately, will not be considered here. The volume is written to direct and to warn, in doing which it reveals some grave blunderings. Unfortunately, it is composed chiefly for those persons who are ignorant of even simple mathematics. The

author is fully conscious of the serious embarrassments of the position he has chosen, but bravely attempts the well-nigh impossible task of overcoming them. Thus he says:—

"If this book were written by a mathematician for the mathematically minded, it would not need to be one fifth as long. If read by such a one it may well seem intolerably clumsy and inelegant."

Whether he succeeds under these difficulties in giving easily intelligible explanations may well be doubted; indeed, his language, though frequently lucid, is often quite the reverse. Still, if the volume were used as a text-book in the hands of an enthusiastic and capable teacher good results might follow, but it requires an optimistic disposition to believe that it would prove more than superficially instructive, if it were intelligible at all, to the mass of ordinary and unassisted readers. The author might, however, claim a higher rank for it than he has done on the ground that it teems with instructive illustrations by which everyone may profit, and that it presents familiar ideas from slightly new points of view, much to the advantage of even well instructed readers.

There is no science more handicapped by cumbrous and repellent terminology than that of the higher statistics. Its ideas are not always intrinsically difficult to grasp, but the phrases by which they are expressed are both ugly and unexpressive. The writer believes that a student, however mathematically minded he may be, would save himself time and annoyance if he prefaced his earliest studies by a few hours of what might be called *kindergarten* exercises with beans, acorns, or the like. By the process of sorting them into arrays and picking out the medians, quartiles, &c., then by measuring them individually and extracting from the measures the remaining statistical constants, he would soon obtain a serviceable familiarity with the more elementary technical terms and the ideas they represent. It would be easy to devise a suitable course that would prove a welcome help to students who are enthusiastic about measurements, and it is to be hoped that the next writer on popular statistics will elaborate one.

The author gives a large number of frequency polygons, derived from a wide variety of data, which are of interest. It is to be wished that attempts were more frequently made to reduce the variously shaped polygons obtained by experience into a few classified types, to append to each type the names of the objects that had been found to conform to it, and to analyse the causes of its shape in each instance. It is difficult to doubt that by so doing some desirable help would be given to the interpretation of any new polygon. It is perfectly true that almost any curve or polygon *may* be built up in various ways by different types of curve or polygons appropriately superposed, but experience alone will tell whether there is not a much greater probability of such and such a type being due to such and such combinations rather than to others. Through these means many hypothetical sources of origin might be found so rare as to be hardly worth considering, and so the field of probable interpretations would be narrowed. Speaking generally, the interpretation of results is a branch of statistics that has hitherto received less attention than it deserves. It is no doubt a great thing to be able to describe groups and to determine correlations between them with precision, but this is not all that is wanted. It is another and even more important achievement to dissect and analyse results and to discover the dominant causes that produced them, but the art of doing this seems as yet inadequately developed and to offer a promising field for research. F. G.

OUR BOOK SHELF.

Practical Chemistry, a Second Year Course. By G. H. Martin, M.A. (N.D.). Pp. 41. (Bradford: G. H. Martin, The Grammar School.) Price 1*s*.

Mr. Martin has arranged in an unpretentious form a most excellent syllabus of experiments and examples suitable for boys beginning the study of chemistry.

It is satisfactory to find that, in a school of such high standing as the Bradford Grammar School, the science master has seen the wisdom of devoting a whole year (it is to be hoped it will be extended to a second year) to teaching the simple facts which underlie important principles without recourse to tests and tables.

One suggestion may be offered. If the book is to have a wide circulation, which it certainly deserves, it will be necessary to fill in the outline of experiments, and perhaps to illustrate the results by actual examples, possibly in a companion volume.

Boys cannot be expected to work out details of apparatus in the short time allotted to science during school hours if substantial progress is to be made. No doubt the author has his apparatus set up and gives an appropriate demonstration to the class, but this will not help those teachers who wish to profit by the book unless their technical difficulties are solved for them.

J. B. C.

Retouching. By Arthur Whiting. Pp. xvi+91. (London: Dawbarn and Ward, Ltd., 1904.) Price 1*s*. net.

It very often happens that photographic negatives require a certain amount of careful manipulation owing to defects caused by photographic methods, scratches, &c. It is also desired sometimes to eliminate small defects due to slight movement of the object, or to alter or improve portions of the picture to attain a desired end. The author has endeavoured in these few pages to place before the reader the different methods and devices that are in use to cope successfully with the various defects that may be encountered. In the first instance the tools required are described, and the special objects of each explained. The reader is then shown how, in the case of portraits, to preserve the likeness but yet to eliminate the blemishes caused by optical or chemical or other action; he is here introduced in a few words to the elements of facial anatomy. The author has considered it necessary to insert a special chapter on retouching portraits of professionals, in which the main principle to be kept in view is to produce a beautiful face. To attain such an ideal, mouths are reduced, jaws cut down, ears knifed, eyes enlarged, and various other surgical operations performed. Working up draperies, retouching landscapes, preparing prints for the press, and how to make a portable retouching desk, form other topics for treatment. The book should serve as an admirable guide to amateurs, and will be found useful to those who go more especially into this class of work. Numerous illustrations accompany the text.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Average Number of Kinsfolk in each Degree.

As Dr. Galton has completely misunderstood the point of my last remark, I fear it will be necessary again to re-open a discussion which I had thought was satisfactorily closed.

My point is this: If we take a large number n of families containing in the aggregate nd sons and nd daughters, and remove on an average one child *of specified sex* from each family, we shall have a preponderance of the opposite sex in those that remain. The *average* numbers under this condition will be d and $d-1$, and not $d-\frac{1}{2}$ and $d-\frac{1}{2}$, and this was how I was originally led to my first conclusion.

If, however, we wish to test the question whether a girl has the same average number of brothers as sisters, we are only concerned with families containing at least one girl, and therefore families containing only boys must be left out of account, as I stated. When these have been removed there will be a preponderance of girls in the families that are left. It is this cause which enables us to reconcile the fact that, while the probable total numbers of girls and boys in any family may be equal, the probable numbers of brothers and sisters of a single individual of specified sex, say a girl, may still be equal. This may not be such a rigorous method as Dr. Galton employs, but it at least shows that the result is not necessarily opposed to what one would naturally infer from general considerations. G. H. BRYAN.

Compound Singularities of Curves.

THE compound singularities of algebraic curves may be divided into three *primary* species. First, *point singularities,* or multiple points, which are exclusively composed of nodes and cusps; secondly, *line singularities,* which are exclusively composed of double and stationary tangents; thirdly, *mixed singularities,* which are composed of a combination of simple point and line singularities. Amongst compound line singularities may be mentioned (α) a double tangent which osculates a curve at one of its points of contact, the constituents of which are one stationary and two *ordinary* double tangents; (β) a tangent having a contact of the fourth order with a curve, the constituents of which are three double and three stationary tangents.

The third species comprises the majority of compound singularities, and may be divided into the following subsidiary ones:—

(1) Nodes and multiple points, any tangent at which has a contact of a higher order than the first with its own branch, and does not touch the curve elsewhere. The flecnode and biflecnode are the most familiar examples of this species.

(2) Nodes, cusps, and multiple points, any tangent at which has a contact of the first or some higher order at some other point or points on the curve. For example, it is possible for each of the six nodal tangents of a trinodal quintic to touch the curve elsewhere, and it can be shown that the six points of contact lie on a conic.

(3) Two or more nodes, cusps or multiple points may have a common tangent. Thus the reciprocal of a biflecnode is a pair of cusps having a common cuspidal tangent, whilst a septimic curve may possess a node and a rhamphoid cusp having a common tangent.

(4) Singularities of the tacnode and oscnode type. When the number of constituent double points is unequal to $\frac{1}{2}n(n-1)$, where n is a positive integer, the singularity cannot be a multiple point, but must be of the tacnode type; and since the constituents of a tacnode are two nodes and two double tangents, every singularity of this species must contain double or stationary tangents, or both. When the number of double points is equal to $\frac{1}{2}n(n-1)$, the singularity *may* be a multiple point, but when it contains line as well as point singularities, it is of the same type as the oscnode, which is composed of three nodes and three double tangents.

(5) A tangent at a node or a multiple point, which has a contact of a higher order than the first with its own branch, may coincide with some other tangent at the singularity. When both tangents at a flecnode coincide, the resulting singularity is a tacnode; but the coincidence of two or more tangents at a multiple point, any of which possess this property, gives rise to a variety of peculiar singularities which do not appear to have been completely examined.

It is also possible for a mixed singularity to be formed in more than one manner; in other words, it may possess more than one penultimate form. Thus an oscnode may be formed by the union of two cusps and two stationary tangents, and additional singularities of this character are possessed by quintic and sextic curves.

To call a cissoid or a cardioid a *nodal* curve appears to me a glaring misuse of language, since both curves are *nodeless.* A. B. BASSET.

November 18.

The Origin of Life.

No doubt "Geologist" points out a literal flaw in my statement, but I thought it would be obvious that by the "potentiality of life," which would be destroyed by heat, I meant potentiality of life, appearing within the time of the experiment. Given countless ages, then, on the evolution hypothesis, the potentiality of life, as of the rest of nature as we know it, existed in the fluid mass of the uncooled earth, and I did not mean to say anything inconsistent with this. Nor, on the other hand, did I mean to say that by the heat applied the potentiality of life in the matter under test would be destroyed for all time. I meant potentiality of appearing within a given time, the time of the experiment, and I cannot help thinking this was the natural sense of my words.

In asking me to explain the introduction of life or its potentiality into this planet, "Geologist" shows that he has entirely mistaken the purport of my letter. My aim was only logical, not constructive. If I could explain how life first appeared on the earth, I should probably be able to suggest a more promising line of experiment than that hitherto followed, which I find myself unable to do. My sole object was to point out a logical error, as it seemed to me, in the view commonly taken by men of science of the results of these experiments, an error, if my memory serves me, fully shared by Huxley—in admiration for whom, I hasten to say, I yield to no one. Huxley, if I remember rightly, was so impressed with the strength of the evidence against the contemporary origination of life that he practically gave up the idea, and put the date back. In this, I am venturing to suggest, he was illogical; through having overlooked the fact that in all the experiments the agent, which was used to destroy actual life and its germs, would probably be efficacious in destroying the potentiality of life in non-living matter on the point of assuming life, if any such there were, and, consequently, the positive result having artificially been made impossible, the negative result meant nothing, and should not be allowed to influence opinion. GEORGE HOOKHAM.

Change in Colour of Moss Agates.

THE following observations may perhaps throw light on the colour changes in moss agate and flint noted by Messrs. Whitton and Simmonds in your issues of November 10 and 17. Specimens of the flints from Bournemouth referred to by Mr. Simmonds were brought to this laboratory some months ago, and, though they were not submitted to any very searching examination, it was found that the colouring matter could be removed on boiling a fragment with hydrochloric acid, while the solution gave well marked reactions for iron and phosphoric acid. Now the compound $Fe_3(PO_4)_2.8H_2O$, whether prepared in the laboratory or occurring as the mineral vivianite, is colourless when pure, but becomes oxidised to ferrosoferric orthophosphate, and turns blue, when exposed to the atmosphere. It seems probable, then, that the change of colour of these flints is due to a layer of vivianite which alters on exposure.

In considering the case of the agate penholder, it should be noted that such objects are but rarely made of agate in its natural condition, it being the practice of

the manufacturers to colour the stone artificially by chemical treatment. Thus a fine blue colour can be developed by soaking the stone first in a solution of potassium ferrocyanide and then in a solution of a ferric salt. Now as exposure to the action of alkalies, or in some cases to direct sunlight, suffices to destroy the blue colouring matter, it would seem probable that it is in this direction that an explanation of the change observed by Mr. Whitton is to be sought.

In conclusion, I may add that a very instructive series of specimens illustrative of the artificial colouring of agate is on exhibition in the mineral gallery of the British Museum (Natural History). A. HUTCHINSON.

The Mineralogical Laboratory, Cambridge, November 21.

Eocene Whales.

IN NATURE for September 29 (p. 543) "R. L." reviews Dr. Fraas's paper on the Egyptian zeuglodonts, dissenting from the conclusions that the zeuglodonts are not whales, and that the ancestors of the whales are at present unknown. I trust "R. L." will pardon me for in turn dissenting from these assertions, and for agreeing entirely with Dr. Fraas. So long ago as 1900, in discussing the pelvic girdle of Basilosaurus, I pointed out that the vestigial femur suggested that of a creodont, while later, in *Science* for March 11, I recorded my utter disbelief in any relationship between Basilosaurus and existing whales. Consequently, while greatly pleased at the results of Dr. Fraas's study of the small zeuglodonts, I was not at all surprised. It seems to me that our knowledge of Eocene mammals is really very small, and that it will be many years before we will be able to trace the line of descent of many existing forms with any degree of certainty. This is most emphatically true of the whales, the ancestry of which is still obscure. At the same time I have pointed out (*Science*, March 11) that the Eocene deposits of the southern United States contain remains of a large cetacean that is at present known to us by a few caudals alone. This form is undescribed, because it seemed to me best to await the discovery of better material than caudals. So while the ancestors of whales are still unknown, we have a hint that they may be discovered any day. F. A. LUCAS.

Brooklyn Institute Museum, November 4.

The Discovery of Argon.

IN reference to the slip indicated in the last issue of NATURE by Prof. G. H. Darwin, permit me to mention that the slip was mine—not Mendeléeff's. In Mendeléeff's text it stands: "As to argon and its congeners—helium, neon, krypton and xenon—these simple gases discovered *mainly* (*preimuschestvenno*) by Ramsay. . . ." I am sorry to see that I had omitted the word "mainly."

In reality, my manuscript (which I enclose) contained, as you see, the words "discovered chiefly by Ramsay," but as "chiefly" was not the proper word it was struck out, probably by myself, in the proof. THE TRANSLATOR.

The Leonids, 1904.

WATCHING was begun on November 14, when between 18h. 10m. and 18h. 40m., in a sky rapidly brightening with approaching sunrise, one certain Leonid, of magnitude excelling that of Sirius, shot from Cancer into Gemini.

November 15.—Watch from 12h. 5m. to 12h. 40m., and 14h. 5m. to 15h. 45m. The heavens were very clear at the start. I had just commenced looking out when a beautiful tailed Leonid, of mag. 3, shot from 85½°+2½° to 74°−2°. At 12h. 17m. thin, broken clouds began to pass over, the sky becoming completely covered at 12h. 40m. At 12h. 38m. a huge-headed Leonid, outrivalling Venus in brilliancy, was seen travelling behind small, broken clouds from 129°+35½° to 107°+43° in three-quarters of a second. The path here given is probably a little too long. About 13h. 30m. the sky began to clear again, and was pretty good by the time of the commencement of the second watch. There were many thin clouds, but the interspaces were large and very clear. At 15h. 25m. the heavens became quite unclouded. In this last look-out Leonids were more numerous, six being between 14h. 45m. and 15h. 38m. The increase in frequency of meteors of the dominant shower at this period was not due to improvement of seeing conditions.

In the latter watch three shooting stars coming from 160°+48½° were mapped. The radiant point of the Leonids of November 15, as determined from eight tracks, was at 151°+20°. The meteors were swift, and mostly left streaks. There was a decided tendency towards green in their colouring.

Below are particulars of some of the most interesting Leonids, other than those mentioned above:—

November 15.

G.M.T.	From	To	Mag.	Duration	Length	Remarks
h. m.	° °	° °		secs.	°	
14 46	181½+28	186 +28½	>1	¼	4	Swift. Greenish-yellow. Directed from 1° N. γ Leonis.
15 6	71 − 9½	64 −11	>1		7½	Very swift. White, tinged blue.
15 26	101 +16½	88 +12½	<S	1	14	Green-yellow.
15 38	172 +34½	179½+37½	S−½		7	White, tinged green. Streak.

Sheffield, November 24. ALPHONSO KING.

Intelligence in Animals.

HAVING recently seen in NATURE some accounts of the sagacity of cats, I trust that the following facts, for which I can personally vouch, may also be interesting to your readers.

We have a cat, an ordinary tabby, which, when out and anxious to gain admittance into the house, not only lifts the weather-board of either our front or back hall-doors three or four times in succession, thereby causing a loud knock each time, but has also instructed her young kitten to perform the same feat.

Both mother and daughter now regularly knock in this manner in order to be let in. J. E. A. T.

MY room opens by a door to a hall; when our fox-terrier wants to come into my room from the hall he *scratches* at my door. When he finds himself in the hall and wants to go out by another door to the garden or back-hall, he *whines* for me, and, going out, I find him by the door he wants opened. This—my leisure regrets—is of daily occurrence.

F. C. CONSTABLE.

Wick Court, near Bristol, November 27.

PATAGONIA.[1]

THE dispute between the Argentine Republic and Chile with regard to the boundary line of their Patagonian possessions threatened at one time to result in a prolonged and sanguinary struggle. Happily this misfortune was averted by the decision, honourable to both nations, to refer the differences that had arisen to the arbitration of our Sovereign. A British Commission was accordingly appointed to examine the geographical features of the country and judge how far they could be reconciled with the terms of the treaties the interpretation of which was in question. As the head of this commission was chosen Sir Thomas Holdich, who had served his country as boundary commissioner in the wild inaccessible lands that lie to the north and west of our Indian possessions, and this selection was abundantly justified by the tact and skill with which a frontier more than 800 miles in length was traced in such a manner as to accomplish the almost unprecedented feat of satisfying both parties.

In the present volume Sir Thomas Holdich has given us his impressions of the progressive republics of Chile and the Argentine, and of the scene of his

[1] "The Countries of the King's Award." By Sir Thomas Holdich K.C.M.G. Pp. xv+420. (London: Hurst and Blackett, Ltd., 1904. Price 16*s.* net.

labours in Patagonia—impressions all the more valuable because they are those of a distinguished soldier and man of science who has spent the greater part of his life in the East, and whose principal achievements have been amongst the great mountain masses and plateaux of Central Asia, which find their only parallel in the Andes. Again and again he dwells on the likeness and on the contrasts between the new lands that he was visiting and those with which he had long been familiar.

We have only space to quote one passage (p. 149):—"One could not see the stiff rows of poplars streaking the stony slopes of the eastern Andes near Mendoza without being forcibly reminded of the Indian frontiers; and the plains of Chile round about Santiago might be the plains of Afghanistan round about Kabul. Standing on the slopes of the hills near Kabul, where Baber's tomb overlooks the Chardeh valley and the flat range of the Hindu Kush fills up the western horizon, where interlacing lines of poplars chequering the purple and yellow fields mark the course of the irrigation channels, an impression once drifted in upon my mind of a land of promise set in the midst of barren hills, specially designed to illustrate man's ingenuity in making green things to grow where no green thing had been before. It was the wealth of the poplars and the willows which produced the impression, contrasted with the sterility of the mountains which formed their background and which were only faintly visible through the summer haze, with just the glint of snowpatch here and there. The impression was reproduced with the first view of the plains stretching from the foot hills of the Andes outwards to the Pacific. For twenty-five years Time might have stood still, and Chardeh, Maidan, and the road to Ghazni were all back again before me."

It is, however, the pages that describe the author's experiences in Patagonia that will appeal most strongly to the scientific reader. The international differences have borne at least some good fruit. In the hope of finding evidence to support one view or the other the interior of Patagonia has been so energetically explored that there are few countries of which there has been so rapid an increase of our geographical knowledge in recent years. Comparatively little of the tract examined by Sir Thomas Holdich had been trodden by the foot of civilised man a dozen years before his visit.

We follow with absorbing interest the author in his rapid journey through the varied scenery of the central depression between the Andes on the one hand and the pampas on the other—a fertile land of hill and valley, with here and there great lakes that occupy the deeper hollows and overflow, some to the Atlantic and others through deep breaks in the mountains to the Pacific. Everywhere there are evidences of important changes in the still recent past—the shrinkage or complete disappearance of lakes, the diversion of the drainage from the Atlantic to the Pacific, and the retrocession of the glaciers.

FIG. 1.—Corcovado Valley. From "The Countries of the King's Award."

Elsewhere we read of cruises amid the channels and inlets of the Pacific coast, which form the submerged continuations of the central valley of Chile, and of the glens of the rivers that traverse the Andean chain. Further inland these latter are filled with alluvium overgrown with impenetrable jungle. On this side, too, of the Andes there is evidence of recent changes, for—as Darwin was the first to point out—high above the sea-level are raised beaches and deposits containing shells of forms that still live in the neighbouring ocean.

But although the axis of the Cordillera and the outer

chain of islands appear to be rising from a position of depression, the line of the great Chilian valley is probably still sinking, for near the head of the Gulf of Penas, and south of the isthmus of Ofqui, that connects the peninsula of Taitao with the mainland, are found forests so recently submerged as to render it necessary to be cautious in steering amongst the tree tops. Future generations of mankind, the author thinks, may see the isthmus submerged beneath the ocean, above which it is even now but slightly raised.

Part of this isthmus is occupied by Lake San Rafael, which is remarkable as the "terminus of an enormous glacier that scatters huge icebergs about its waters." "Is there any other glacier," the author asks, "descending to sea level in latitude 47° either N. or S.?" We know of none; but however that may be there are several that reach the sea between this point and the Straits of Magellan; and yet southern Patagonia is a land of luxuriant vegetation, at least on its western coasts. "Forest was everywhere about us, dense, shadowy, dark and generally dripping. The long lines of the higher sierra were thick with it up to the point where the granite cliffs polished and smoothed by ice-cap and glacier gave foothold to vegetation only on their flat ledges. The little islets that seemed to chase one another through the streaky grey sea were rounded and packed with it." In the Ultima Esperanza district in latitude 52° there are grazing grounds where the sheep fatten quickly on the tufted grass of the country, and are left to find their own shelter, while in the neighbouring woods the puma waits his opportunity as he does in the tropical forests of Brazil. And over the whole country, mountains, valleys, and pampas alike, blow untiringly the strenuous western winds, for the most part in blustering gales that succeed one another in quick succession. "In no country in the world," remarks our author, "must 'weather' and climate be so differentiated as in Patagonia. The weather is bad as bad can be—wild and boisterous, bursting into fury, breaking into sunshine, freezing the blood in one's veins with a biting blizzard, or suffocating the system with the still steady glare of a noonday sun, and it may do all this and more in the course of a few hours' interval; but whether storming or shining, tearing one's tent to rags or bathing the landscape in sunshine, who can describe the life-giving, purifying, sweetening, strengthening effects of the climate."

Such is Patagonia, a land that seems destined to nourish a hardy race woven of many strands, among which the sturdy Welsh colonists of the 16th of October Valley, of whom the author has much to tell us, will not be least important. To the man of science it is a land of striking illustrations of long established principles and of problems that will require many years of research to solve, for of the story of its making scarcely the first chapter—a chapter of which Darwin wrote the opening pages—is yet complete.

J. W. E.

LORD KELVIN AND GLASGOW UNIVERSITY.

THE installation of Lord Kelvin as Chancellor of Glasgow University, which took place in the Bute Hall on Tuesday, is an event which has few, if, indeed, it has any, precedents in the recent annals of our universities. The Chancellor is the head of the whole university, but in practice he is rarely present except on ceremonial occasions, and a great part of the work which he has had to do officially is done for him in Scotland, as it is at Oxford, Cambridge, London, or in the newer English universities, by the Vice-Chancellor. Many occasions arise, however, when it is of importance to the universities concerned that statesmen, such as the Prime Minister, who is Chancellor of Edinburgh, Mr. Chamberlain, who is Chancellor of Birmingham, Lord Rosebery, who is Chancellor of London, and Lord Spencer, who is Chancellor of Manchester, should represent their universities in Parliament or elsewhere, and such men have usually been elected not so much on account of their own connection with the universities they preside over as of the eminent place they have taken in the State, and the weight which must on all occasions be attached to their considered opinions. Lord Kelvin has been connected with the University of Glasgow since his early boyhood, he has spent his life within her walls, and he built up his enduring fame during the fifty-three years when he was professor of natural philosophy in the university.

Lord Kelvin's father was a north of Ireland man, preparing for the ministry of the Presbyterian Church. In his day, and until the foundation of the Queen's Colleges in Ireland, Glasgow was the university to which many north of Ireland men resorted, and Lord Kelvin's father was a distinguished student in Glasgow, gaining prizes in many classes more than ninety years since. About eighty years ago he gave up his studies for the ministry and became professor of mathematics in the Belfast Academical Institution. Eight years later—in 1832—he was elected to the chair of mathematics in Glasgow, which he filled for sixteen years with eminent success. There were no better text-books anywhere than those which he published on the subjects of his chair, and the small number of his students who remember him can testify that they never met a clearer or better teacher of mathematics. Prof. James Thomson had a genius for teaching other things besides mathematics, and both Lord Kelvin and his elder brother, who was professor of engineering first in Belfast and afterwards in Glasgow, owed the best of their education to their father. Lord Kelvin was only twenty-two years old when the university had the courage to elect him to the chair of natural philosophy, on the strength of his quite exceptional brilliancy as a student first in Glasgow and afterwards in Cambridge. How he has discharged the duties of his chair and how wide and fruitful have been his conception of its duties is known to the whole world of science.

On Tuesday, after Lord Kelvin had been formally installed as Chancellor of the University, he proceeded to confer the following honorary degrees of LL.D. on the recommendation of the Senate.

Princess Louise (Duchess of Argyll), who was president of Queen Margaret College until the college was incorporated with the university in 1893. The Marquess of Ailsa, who has taken a great interest in naval architecture, and in its practical application to the building of yachts and other vessels. Dr. J. T. Bottomley, F.R.S.; Dr. James Donaldson, principal of the University of St. Andrews; Admiral Sir John Charles Dalrymple Hay, G.C.B., F.R.S.; Dr. J. M. Lang, principal of the University of Aberdeen; Mr. G. Marconi; Mr. Andrew Graham Murray, M.P., Secretary for Scotland; the Hon. C. A. Parsons, F.R.S.; and the Lord Provost of Glasgow, Sir John Ure Primrose, Bart.

After conferring these degrees Lord Kelvin delivered an address, in the course of which he spoke as follows:—

To be Chancellor of one of the universities of our country is indeed a distinguished honour. For me to be Chancellor of this my beloved University of Glasgow is more than an honour. I am a child of the University of Glasgow. I lived in it sixty-seven years (1832 to 1899). But my veneration for the ancient Scottish university, then practically

the university for Ulster, began earlier than that happy part of my life. My father, born in County Down, was for four years (1810 to 1814) a student of the University of Glasgow, and in his Irish home, first as professor of mathematics in the newly-founded Royal Belfast Academical Institution, his children were taught to venerate the University of Glasgow. One of my earliest memories of those old Belfast days is of 1829, when the joyful intelligence came that the Senate of the University of Glasgow had conferred the honorary degree of Doctor of Laws on my father. Two years later came the announcement that the faculty of Glasgow College had elected him to the professorship of mathematics.

In 1834, two years after my father was promoted from Belfast to the Glasgow professorship of mathematics, I became a matriculated member of the University of Glasgow. To this day I look back to Prof. William Ramsay's lectures on Roman antiquities and readings of Juvenal and Plautus as more interesting than many a good stage play that I have seen in the theatre. Happy it is for our university, and happy for myself, that his name, and a kindred spirit, are with us still in my old friend and colleague, our senior professor, George Ramsay. Greek, under Sir Daniel Sandford and Lushington, logic under Robert Buchanan, moral philosophy under William Fleming, natural philosophy and astronomy under John Pringle Nichol, chemistry under Thomas Thomson (a very advanced teacher and investigator), natural history (zoology and geology) under William Couper, were, as I can testify by my own experience, all made interesting and valuable to the students of Glasgow University in the 'thirties and 'forties of the nineteenth century. Sandford, in teaching his junior class the Greek alphabet and a few characteristic Greek words, and the Scottish pronunciation of Greek, gave ideas, and something touching on philology, to very young students, which remains on their minds after the heavier grammar and syntax which followed have vanished from their knowledge. Logic was delightfully unlike the Collegium Logicum described by Goethe to the young German student through the lips of Mephistopheles. Even the dry bones of predicate and syllogism were made by Prof. Buchanan very lively for six weeks among the students of logic and rhetoric in Glasgow College sixty-seven years ago; and the delicious scholastic gibberish of "Barbara, Celarent" remains with them an amusing recollection. A happy and instructive illustration of the inductive logic was taken from Wells's "Theory of Dew," then twenty years old. My predecessor in the natural philosophy chair, Dr. Meikleham, taught his students reverence for the great French mathematicians, Legendre, Lagrange, Laplace. His immediate successor in the teaching of the natural philosophy class, Dr. Nichol, added Fresnel and Fourier to this list of scientific nobles; and by his own inspiring enthusiasm for the great French school of mathematical physics, continually manifested in his experimental and theoretical teaching of the wave theory of light and of practical astronomy, he largely promoted scientific study and thorough appreciation of science in the University of Glasgow. In this hall you see side by side two memorial windows presented to the university to mark permanently its admiration of three men of genius, John Caird, John Pringle Nichol, and his son, John Nichol, who lived in it, and worked for it and for the world, in the two departments of activity for which universities exist, the humanities and science. As far back as 1818 to 1830 Thomas Thomson, the first professor of chemistry in the University of Glasgow, began the systematic teaching of practical chemistry to students, and by aid of the faculty of Glasgow College, which gave the site and the money for the building, realised a well equipped laboratory, which preceded, I believe, by some years Liebig's famous laboratory of Giessen, and was, I believe, the first of all the laboratories in the world for chemical research and the practical instruction of university students in chemistry. That was at a time when an imperfectly informed public used to regard the University of Glasgow as a stagnant survival of mediævalism and to call its professors the Monks of the Molendinar!

The university of Adam Smith, James Watt, and Thomas Reid was never stagnant. For two centuries and a quarter it has been very progressive. Nearly two centuries ago it had a laboratory of human anatomy. Seventy-five years ago it had the first chemical students' laboratory. Sixty-five years ago it had the first professorship of engineering of the British Empire. Fifty years ago it had the first physical students' laboratory,—a deserted wine cellar of an old professorial house, enlarged a few years later by the annexation of a deserted examination room. Thirty-four years ago, when it migrated from its four hundred years old site off the High Street of Glasgow to this brighter and airier hill-top, it acquired laboratories of physiology and zoology, too small and too meagrely equipped. And now every university in the world has, or desires to have, laboratories of human anatomy, of chemistry, of physics, of physiology, of zoology. Within the last thirty years laboratories of engineering, of botany, and of public health have been added to some of the universities of the British Empire, with highly beneficent results for our country and the world. All these the University of Glasgow now has. During the last fifty years our university has grown in material greatness and in working power to an extent that its most ardent well-wishers in the first half of the nineteenth century could scarcely have imagined possible. Two successive legislative commissions (1858 and 1889) have re-formed its constitution and broadened its foundations, and added to its financial resources, and admitted women to its membership, with all the privileges of students and graduates. Splendidly liberal subscriptions by the people of Glasgow and by a world-wide public outside, backed by powerful aid from the National Treasury, enabled the university, on leaving its ancient site, to enter into the grand group of buildings on Gilmorehill, in which it has happily lived ever since. A few years later the generous gift of 45,000*l.* by the late Marquis of Bute built the hall called after his name, in which we are now met. At the same time the adjoining Randolph Hall and staircase were built by a portion of the legacy left to the university by the late Mr. Randolph. The Queen Margaret College and grounds were presented to the university by Mrs. Elder, who also added largely to the endowment of the engineering professorship, and founded the professorship of naval architecture. Other generous donors have given an engineering laboratory with lecture-rooms, and botanical buildings, and great and much needed extensions in the anatomical department. The Carnegie Trust and the principal's university equipment scheme are at present providing two new buildings; one of these is for extensions in the medical school. The other, in which I naturally take the most personal interest, is for the natural philosophy department, including lecture-rooms and a physical laboratory, all designed and at present being realised under the able direction of my successor in the natural philosophy chair, Prof. Andrew Gray.

In the province of the humanities the working power of the university for instruction and research has been largely augmented during the last fifty years by the foundation of new professorships, conveyancing, English language and literature, Biblical criticism, clinical surgery, clinical medicine, history (in my opinion the most important of all in the literary department), pathology, political economy. In mathematics and in the science of dead matter, professorships of naval architecture and geology; lectureships of electricity, of physics, and of physical chemistry; and demonstratorships and official assistantships in all departments have most usefully extended the range of study, and largely strengthened the working corps for research and instruction. I venture to congratulate the city of Glasgow on having for her god-daughter a university so splendidly equipped and so admirably provided with workers.

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE report of the council of the Royal Society was presented at the anniversary meeting held yesterday, November 30, and the president, Sir William Huggins, K.C.B., F.R.S., delivered the annual address.

The council refers to the second general assembly of the International Association of Academies last Whitsuntide as one of the chief events of the year. At the

close of the meeting, Vienna was chosen by a unanimous vote as the place of meeting of the next general assembly. A complete protocol of the proceedings of the assembly has been drawn up, and will be issued before the end of this year. Other matters referred to in the report are the African geodetic arc, the international congress of aëronautics held at St. Petersburg in August, the international laboratory of physiology on Monte Rosa, the Royal Society "Catalogue of Scientific Papers," the "International Catalogue of Scientific Literature," the Government grant for scientific investigations, and the expenses of special Government inquiries.

The Royal Society is frequently requested by various departments of the Government to advise upon, or in some cases to undertake the supervision and control of, and in others the entire responsibility for, scientific investigations of national importance, but no provision has been made by Government to meet expenses to which the Society has been put in acceding to these requests. As the result of pointing out this unsatisfactory position, H.M. Treasury has approved of an alteration in the regulations for administering the Government grant of 4000*l.* for scientific purposes which will permit a sum to be set aside out of the reserve fund of the grant for printing and office expenditure incurred "in undertaking, controlling, supervising or advising upon matters which the President and Council may, at the request of the Government, undertake, control, supervise or advise upon." That is to say, the Royal Society is graciously permitted by the Treasury to use a part of the annual Government grant for scientific investigations to meet expenses incurred in answering Government inquiries.

Mention is also made in the report of the radium research grant of the Goldsmiths' Company, the Treasury inquiry into the Meteorological Office, and the letter on scientific education sent by the council to all British universities last January. The following extracts from other parts of the report of the council are of interest:—

Sleeping Sickness.

The investigation of this disease in Uganda was continued after Colonel Bruce's return to England by Dr. Nabarro and Captain Greig, of the Indian Medical Service. A further report (No. 4) by Colonel Bruce has been published, and its general conclusions, briefly stated in the last report of the council—namely, that the sleeping sickness is caused by the entrance into the blood and thence into the cerebro-spinal fluid of a species of Trypanosoma (*T. gambiense*), and that these trypanosomes are transmitted from the sick to the healthy by a species of tsetse fly (*Glossina palpalis*)—have been confirmed by subsequent observations. The efforts of the observers are now being directed to the attempt to discover a means of eliminating the trypanosomes from the blood and tissues of the infected in the early stages, and before severe damage has been done to the nervous centres. In the meantime the Royal Society Committee has advised the Government to adopt such preventive measures as are found practicable for protecting a non-infected area where the carrier fly is found from the incursion of emigrants from the infected areas.

Antarctic Expedition and Investigation.

The Antarctic ship *Discovery*, accompanied by the relief ships *Morning* and *Terra Nova*, returned safely in March last to Lyttelton, and a "Summary of Proceedings" was forwarded thence by Captain Scott by post to the presidents of the Royal and Royal Geographical Societies. The *Discovery* arrived in England at the beginning of September, when a joint letter of welcome from the president and the president of the Royal Geographical Society was dispatched to Captain Scott.

The natural history specimens and notes and drawings have been sent to the British Museum (Natural History Department), to be preserved there as part of the national collection, the trustees of the museum having agreed to organise and undertake the publication of these results of the expedition, under the editorship of the director of the museum.

The laborious duty of arranging for the reduction and publication of the magnetic and meteorological observations made by the expedition has been undertaken by the Royal Society. Two special expert committees have been appointed, and are already dealing with these two classes of material.

As regards the magnetic observations, the Hydrographic Department of the Admiralty has undertaken the reduction of about one-third of the material, and the remaining two-thirds, consisting of the slow-run magnetograms, remain to be dealt with. The committee for magnetism have accordingly arranged that these observations shall be reduced, under the superintendence of Dr. Chree, their secretary, in the observatory department of the National Physical Laboratory; and the Royal Society has undertaken responsibility for the cost of these reductions, to the extent of 400*l.*, by an advance from the donation fund, in the full hope that this expenditure will be refunded out of the proceeds of the sale of the *Discovery*.

Committees have been arranged for dealing with other observations. The reduction of the meteorological observations has been undertaken by the Meteorological Council with the aid of a sum of 500*l.* guaranteed by the Royal Geographical Society in anticipation of the sale of the *Discovery*. It is hoped that the publication of these results will be undertaken by H.M. Stationery Office.

The committees are working as far as possible in concert with the authorities engaged in the reduction of the observations of the German and Scottish Antarctic Expeditions, which in part covered the same period of time.

It is proposed that the special scientific results of the expedition shall be published in a uniform series of volumes similar to the published records of the *Challenger* Expedition.

Mediterranean Fever.

In February last a letter was received from the Colonial Office asking whether the Royal Society would be willing to appoint an advisory board in this country for the purpose of supervising investigations into Mediterranean fever, to be carried out by a commission representing the Navy, the Army, and the Civil Government of Malta.

The matter was referred to the tropical diseases committee of the society, which had superintended the investigations into malaria and sleeping sickness, and upon their advice the council decided to accede to the request of the Colonial Office, provided that the appointment of investigators rested with the Royal Society, and that all expenses in connection with the investigation were borne by the Government. These conditions were accepted by the Government with a modification, which the council acceded to at the particular request of H.M. Treasury, viz. that the Royal Society should participate by defraying (out of the Government Grant Reserve Fund) the cost of scientific equipment to an amount not exceeding 200*l.* The advisory board was constituted as a subcommittee of the tropical diseases committee, with Colonel Bruce, F.R.S., as chairman. Members of the commission of investigation were nominated, with the approval of this committee, by the Navy, the Army, and the Civil Government of Malta, and Colonel Bruce himself went out to Malta on behalf of the committee to start the inquiry, which is now in active progress.

National Physical Laboratory.

The National Physical Laboratory has continued its work with success during the year, the last of the five for which the original annual grant of 4000*l.* was made by the Treasury.

This fact has been prominently before the committee at its various meetings. In reply to an inquiry by the chairman, a letter was received from Sir E. W. Hamilton to the effect that while there was no idea of stopping the grant, the question before H.M. Treasury was whether there should be an increase in its amount, and suggesting that the committee should formulate "constructive proposals" with detailed estimates of the expenditure, both capital and recurring, required to put the laboratory on a satisfactory footing. Accordingly this was done, and a memorandum on the future organisation and expenditure of the labor-

atory, which was drawn up by the executive committee on February 19, was sent to the Treasury by the president and council, who strongly supported the proposals of the committee.

The main recommendations of the memorandum were (1) that a sum of nearly 30,000*l.* was required for capital expenditure, and (2) that the annual grant should be raised in the course of four years to 10,000*l.*; while, with a view to supporting these proposals, a request was made for an official inquiry into the work and organisation of the laboratory.

To this request the Financial Secretary of the Treasury replied, stating that the question of the increase must stand over until the estimates for 1905–6 were under consideration, and suggesting that meanwhile the executive committee should consider which of the new works were of the most pressing importance, and make application accordingly.

In answer, a further memorandum was prepared, pointing out that the question at issue was whether the laboratory is to be allowed to remain undeveloped in its present condition, with its limited powers and opportunities, or whether it is to be adequately developed, and ultimately placed on a footing similar to that of the corresponding institutions in other countries, and asking that the First Lord of the Treasury would receive a deputation to support the request already made, "That an inquiry might be instituted into the work and organisation of the National Physical Laboratory with a view to laying down the lines that ought to be followed in its future development."

In consequence of this request, a conference took place early in August at the House of Commons between the Prime Minister, the Chancellor of the Exchequer, and the President of the Board of Trade on the one hand, and Lord Rayleigh, Sir F. Hopwood, the treasurer and senior secretary of the Royal Society, with the director, representing the laboratory, at which the matter was discussed.

The donations and subscriptions promised to the laboratory, in most cases for five years, have increased, and now reach a total of about 2000*l.*

While the report is one of progress, the committee of the laboratory feel that with adequate financial support they might do much more. It is not yet sufficiently recognised how substantial is the assistance the laboratory can render to commerce and manufactures. The grant made by the Government is treated by them as one in aid of science itself, although it is applied under the highest scientific direction to facilitate the applications of science to manufacture. This distinction is an important one, which needs to be emphasised; when it is fully grasped the progress of the laboratory, as an aid to national industry, will be much more rapid.

In his anniversary address the president referred at first to the scientific careers of the thirteen fellows of the Society lost by death since the previous anniversary. He then gave a sketch of the work the society has done and is doing for the nation, and showed how the generous intentions of the founder, Charles II., were never fulfilled. From this survey of the history of the society, we have taken the following extracts, with the descriptions of the scientific work of this year's medallists:—

During the last few years a very large amount, increasing each year, of work outside the reading, discussion, and printing of papers, of a more or less public character, has been thrown upon the Royal Society—so large indeed as at present to tax the society's powers to the utmost. A not inconsiderable part of this work has come from the initiation by the society itself of new undertakings, but mainly it has consisted of assistance freely given, at their request, to different departments of the Government on questions which require expert scientific knowledge, and which involve no small amount of labour on the part of the officers and staff, and much free sacrifice of time and energy from fellows, in most cases living at a distance.

There is little doubt that this largely-increased amount of public work has arisen, in part naturally from the greater scientific activity of the present day, but also, and to a greater extent, from the fuller recognition by the Government and the public of the need for scientific advice and direction in connection with many matters of national concern.

It may not be inopportune, therefore, for me to say a few words on the advisory relation in which the society has come to stand to the Government, and to review very briefly the great work which the society has done, and is doing, for the nation.

Among academies and learned societies the position of the Royal Society is, in some respects, an exceptional one. In the British dominions it holds a unique position, not only as the earliest chartered scientific society, but in its own right, on account of the number of eminent men included in its fellowship, and the close connection in which it stands, though remaining a private institution, with the Government. The Royal Society is a private learned body, consisting of a voluntary and independent association of students of science united for the promotion of natural knowledge at their own cost.

The Royal Society, while remaining a purely private institution for the promotion of natural knowledge, has been regarded by the Government as the acknowledged national scientific body, the advice of which is of the highest authority on all scientific questions, and the more to be trusted on account of the society's financial independence; a body, which, through its intimate relations with the learned societies of the Colonies, has now become the centre of British science. The society's historical position and the scientific eminence of its fellows have made it naturally the body which the scientific authorities of foreign countries regard as representing the science of the Empire, and with which they are anxious to consult and to cooperate, from time to time, on scientific questions of international importance.

On their part, the fellows of the Royal Society, remembering that the promotion of natural knowledge is the great object for which it was founded and still exists, and that all undertakings in the home and in the State, since they are concerned with nature, can be wisely directed and carried on with the highest efficiency only as they are based upon a knowledge of nature, have always recognised the fundamental importance of the society's work to national as well as to individual success and prosperity, and their own responsibility as the depositories of such knowledge. They have always been willing, even at great personal cost, ungrudgingly to afford any assistance in their power to the Government on all questions referred to them which depend upon technical knowledge, or which require the employment of scientific methods. In particular the society has naturally always been eager to help forward, and even to initiate, such national undertakings as voyages of observation or of discovery of any kind, or for the investigation of the incidence of disease, which have for their express object the increase of natural knowledge.

At the same time, as the society is dependent upon the voluntary help of its fellows, whose time is fully occupied with their own work, the society may reasonably expect the Government not to ask for assistance on any matters of mere administration that could be otherwise efficiently provided for. The hope may be expressed that in the near future, with increased official provision in connection with the recognition of science, the position of the society to the Government may not extend beyond that of a purely advisory body, so that the heavy responsibilities now resting upon it, in respect of the carrying out of many public undertakings on which its advice has been asked, may no longer press unduly, as they certainly do at present, upon the time and energy of the officers and members of committees. The society regards this outside work, important as it is, as extraneous, and therefore as subordinate, and would not be justified in permitting such work to interfere with the strict prosecution of pure natural science as the primary purpose of the society's existence, upon which, indeed, the society's importance as an advisory body ultimately depends.

The society has accepted heavy responsibilities at the instance of the Government in respect of the control of scientific observations and research in our vast Indian Empire. In 1899, the India Office inquired whether the Royal Society would be willing to meet the wishes of the Indian Government by exercising a general control over the scientific researches which it might be thought desirable to

institute in that country. A standing committee was appointed in consequence by the council for the purpose of giving advice on matters connected with scientific inquiry, probably mainly biological, in India, which should be supplementary to the standing observatories committee which was already established at the request of the Government as an advisory body on astronomical, solar, magnetic, and meteorological observations in that part of the Empire.

An investigation, onerous indeed, but of the highest scientific interest and of very great practical importance, has been carried on by a series of committees successively appointed at the request of the Government for the consideration of some of the strangely mysterious and deadly diseases of tropical countries. In 1896 a committee was appointed at the request of the Colonial Secretary to investigate the subject of the tsetse-fly disease in South Africa. Two years later Mr. Chamberlain, Secretary of State for the Colonies, requested the society to appoint a committee to make a thorough investigation into the origin, the transmission, and the possible preventives and remedies of tropical diseases, and especially of the malarial and "blackwater" fevers prevalent in Africa, promising assistance, both on the part of the Colonial Office and of the Colonies concerned. A committee was appointed, and, under its auspices, skilled investigators were sent out to Africa and to India. In the case of the third committee the society itself took the initiative. An outbreak in Uganda of the disease, appalling in its inexorable deadliness, known as "sleeping sickness" having been brought to the knowledge of the society, a deputation waited upon Lord Lansdowne at the Foreign Office, asking him to consider favourably the dispatch of a small commission to Uganda to investigate the disease. He gave his approval, and a commission of three experts, appointed on the recommendation of the committee, was sent out to Uganda, 600*l.* being voted out of the Government grant towards the expenses of the commission.

The investigations in tropical diseases, promoted and directed by these committees, have largely increased our knowledge of the true nature of these diseases, and, what is of the highest practical importance, they have shown that their propagation depends upon conditions which it is in the power of man so far to modify, or guard against, as to afford a reasonable expectation that it may be possible for Europeans to live and carry on their work in parts of the earth where hitherto the sacrifice of health, and even of life, has been fearfully great. A general summary of the work already done on malaria, especially in regard to its prevention, and also on the nature of "blackwater" fever, has been published in a Parliamentary paper, which records Mr. Chamberlain's acknowledgment to the Royal Society for its cooperation in the work undertaken by the Colonial Office. The reports on sleeping sickness up to this time form four whole numbers of the *Proceedings*, giving evidence in support of the view that this deadly disease is caused by the entrance into the blood, and thence into the cerebro-spinal fluid, of a species of Trypanosoma, and that these organisms are transmitted from the sick to the healthy by a kind of tsetse fly, and by it alone; sleeping sickness is, in short, a human tsetse-fly disease.

In 1897, the council was requested to assist the Board of Trade in drawing up schedules for the establishment of the relations between the metric and the imperial units of weights and measures. A committee was appointed, which, after devoting much time and attention to the matter, drew up schedules which were accepted by the Board of Trade and incorporated in the Orders of Council.

Soon after the reports were received of the appalling volcanic eruptions and the loss of life which took place in the West Indies in 1902, the council received a letter from Mr. Chamberlain to ask if the society would be willing to undertake an investigation of the phenomena connected with the eruptions. The council, considering that such an investigation fell well within the scope of the objects of the society, organised a small commission of two experts, who left England for the scene of the eruption eleven days only after the receipt of Mr. Chamberlain's letter, the expenses being met by a grant of 300*l.* from the Government Grant Committee. Six weeks were spent in the islands, including Martinique, by the commission, which was successful in securing results of great scientific interest. A preliminary report was published at the time, and a full report has since appeared in the *Transactions*.

Time forbids me to do more than mention the successive expeditions sent out by the society, conjointly with the Royal Astronomical Society, for the observation of total solar eclipses; and the onerous work thrown upon the society for several years in connection with the National Antarctic Expedition, undertaken jointly with the Royal Geographical Society, which has this year returned home crowned with success; but the society's labours are not at an end, for the prolonged and responsible task of the discussion and publication of the scientific results of the expedition is still before them.

To the Royal Society is entrusted the responsible task of administrating the annual Government grant of 4000*l.* for the purpose of scientific research, and a grant of 1000*l.* in aid of the publication of scientific papers.

In addition to these permanent responsibilities, which are always with the society, its advice and aid are sought from time to time both by the Government and by scientific institutions at home and abroad, in favour of independent objects of a more or less temporary character, of which, as examples, may be taken the recent action of the society for the purpose of obtaining Government aid for the continuation through Egypt of the African arc of meridian, and for the intervention of the Government to assist in securing the fulfilment of the part undertaken by Great Britain in the International Astrographic Catalogue and Chart.

Upon the present fellows falls the glorious inheritance of unbounded free labour ungrudgingly given during two centuries and a half for the public service, as well as of the strenuous prosecution at the same time of the primary object of the society, as set forth in the words of the Charter: "the promotion of Natural Knowledge." The successive generations of fellows have unsparingly contributed of their time to the introduction and promotion, whenever the opportunity was afforded them, of scientific knowledge and methods into the management of public concerns by departments of the Government. The financial independence of the Royal Society, neither receiving, nor wishing to accept, State aid for its own private purposes, has enabled the society to give advice and assistance which, both with the Government and with Parliament, have the weight and finality of a wholly disinterested opinion. I may quote here the words of a recent letter from H.M. Treasury:—"Their Lordships have deemed themselves in the past very fortunate in being able to rely, in dealing with scientific questions, upon the aid of the Royal Society, which commands not only the confidence of the scientific world, but also of Parliament."

In the past the Royal Society has been not infrequently greatly hampered in giving its advice by the knowledge that the funds absolutely needed for the carrying out of the matters in question in accordance with our present scientific knowledge would not be forthcoming. Though I am now speaking on my own responsibility, I am sure that the society is with me, if I say that the expenditure by the Government on scientific research and scientific institutions, on which its commercial and industrial prosperity so largely depend, is wholly inadequate in view of the present state of international competition. I throw no blame on the individual members of the present or former Governments; they are necessarily the representatives of public opinion, and cannot go beyond it. The cause is deeper, it lies in the absence in the leaders of public opinion, and indeed throughout the more influential classes of society, of a sufficiently intelligent appreciation of the supreme importance of scientific knowledge and scientific methods in all industrial enterprises, and indeed in all national undertakings. The evidence of this grave state of the public mind is strikingly shown by the very small response that follows any appeal that is made for scientific objects in this country, in contrast with the large donations and liberal endowments from private benefaction for scientific purposes and scientific institutions which are always at once forthcoming in the United States. In my opinion, the scientific deadness of the nation is mainly due to the too exclusively mediæval and classical methods of our higher public schools, and can only be slowly removed by making in future the teaching of science, not from text-books for passing an examination, but, as far as may be possible, from the study

of the phenomena of nature by direct observation and experiment, an integral and essential part of all education in this country.

I proceed to the award of the medals.

Copley Medal.

The Copley Medal is awarded to Sir William Crookes, F.R.S., for his experimental researches in chemistry and physics, extending over more than fifty years. Ever since his discovery of the element thallium in the early days of spectrum analysis, he has been in the front rank as regards the refined application of that weapon of research in chemical investigation. Later, the discrepancies which he found in an attempt to improve weighings, by conducting the operation in high vacua, were tracked out by him to a repulsion arising from radiation, which was ultimately ascribed by theory to the action of the residual gas. This phenomenon, illustrated by the radiometer, opened up a new and fascinating chapter in the dynamical theory of rarefied gases, which the genius of Maxwell, O. Reynolds, and others, has left still incomplete. The improvements in vacua embodied in the Crookes tube led him to a detailed and brilliant experimental analysis of the phenomena of the electric discharge across exhausted spaces; in this, backed by the authority of Stokes, he adduced long ago powerful cumulative evidence that the now familiar kathode rays, previously described by C. F. Varley, must consist of projected streams of some kind of material substance. His simple but minutely careful experiments on the progress of the ultimate falling off in the viscosity of rarefied gases, from the predicted constant value of Maxwell, at very high exhaustions, gave, in Stokes's hands, an exact account of the trend of this theoretically interesting phenomenon, which had already been approached in the investigations of Kundt and Warburg, using Maxwell's original method of vibrating discs.

These examples, not to mention recent work with radium, convey an idea of the acute observation, experimental skill, and persistent effort, which have enabled Sir William Crookes to enrich physical science in many departments.

Rumford Medal.

The Rumford Medal is awarded to Prof. Ernest Rutherford, F.R.S., on account of his researches on the properties of radio-active matter, in particular for his capital discovery of the active gaseous emanations emitted by such matter, and his detailed investigation of their transformations. The idea of radiations producing ionisation, of the type originally discovered by Röntgen, and the idea of electrified particles, like the kathode rays of vacuum tubes, projected from radio-active bodies, had gradually become familiar through the work of a succession of recent investigators, when Rutherford's announcement of a very active substance, diffusing like a gas with a definite atomic mass, emitted by compound of thorium, opened up yet another avenue of research with reference to these remarkable bodies. The precise interpretation of the new phenomena, so promptly perceived by Rutherford, was quickly verified, for radium and other substances, by various observers, and is now universally accepted. The modes of degradation, and the enormous concomitant radio-activity, of these emanations, have been investigated mainly by Rutherford himself, with results embodied in his treatise on radio-activity and his recent Bakerian lecture on the same subject. It perhaps still remains a task for the future to verify or revise the details of these remarkable transformations of material substances, resulting apparently in the appearance of chemical elements not before present; but, however that may issue, by the detection and description of radio-active emanations and their transformations, Prof. Rutherford has added an unexpected domain of transcendent theoretical interest to physical science.

Royal Medal.

A Royal Medal is awarded to Prof. W. Burnside, F.R.S., on the ground of the number, originality, and importance of his contributions to mathematical science. The section of our "Catalogue of Scientific Papers" for the period 1883–1900 enumerates fifty-three papers by Prof. Burnside, the first dated 1885, and the "International Catalogue of Scientific Literature" thirteen more. His mathematical work has consisted largely of papers on the theory of groups, to which he has made most valuable additions. In 1897 he published a volume "On the Theory of Groups of Finite Order," which is a standard authority on that subject. Two recent papers on the same theory, published in 1903, may be specially mentioned. In one of these he succeeded in establishing by direct methods, distinguished by great conciseness of treatment, the important subsidiary theory of group-characteristics, which had been originally arrived at by very indirect and lengthy processes. In the other he proved quite shortly the important result that all groups of which the order is the product of powers of two primes are soluble.

Besides the treatise and papers relating to group theory, Prof. Burnside has published work on various branches of pure and applied mathematics. His work on automorphic functions dealt with an important and difficult special case which was not included in the theory of these functions as previously worked out. The paper on Green's function for a system of non-intersecting spheres was perhaps the first work by any writer in which the notions of automorphic functions and of the theory of groups were applied to a physical problem. He has also made important contributions to the theory of functions, non-Euclidean geometry, and the theory of waves on liquids. His work is distinguished by great acuteness and power, as well as by unusual elegance and most admirable brevity.

Royal Medal.

The other Royal Medal is awarded to Colonel David Bruce, F.R.S., who, since 1884, has been engaged in prosecuting to a successful issue researches into the causation of a number of important diseases affecting man and animals. When he went to Malta in 1884 the exact nature of the widely prevalent "Malta," "Rock," or "Mediterranean" fever was entirely unknown. After some years' work at the etiology of this disease, he discovered in 1887 the organism causing it, and succeeded in cultivating the *Micrococcus melitensis* outside the body. This discovery has been confirmed by many other workers, and is one of great importance from all points of view, and perhaps more especially as, thanks to it, Malta fever can now be separated from other diseases, *e.g.* typhoid, remittent, and malarious fevers, with which it had hitherto been confounded.

During the next few years he was engaged in researches of value on cholera, and on methods of immunisation against this disease. He also carried out some work on the leucocytes in the blood, published in the *Proceedings* of the Royal Society, 1894.

In 1894 he was requested by the Governor of Natal to investigate the supposed distinct diseases of "nagana" and the tsetse-fly disease. In the short time of two months he made the most important discovery that these two diseases were one and the same, and dependent upon the presence of a protozoan organism in the blood, known as a trypanosome. Some six months later Bruce was enabled to return to Zululand, and remained there two years, studying the disease and making the discovery that the tsetse fly acted as the carrier of the organism which caused it. He was thus the first to show that an insect might carry a protozoan parasite that was pathogenic. This observation was made in 1895.

Bruce not only determined the nature and course of "nagana," but in addition he studied the disease in a large number of domestic animals, and also observed the malady in a latent form in the wild animals of South Africa. Subsequent observers have found but little to add to Bruce's work on this subject.

In 1900 Bruce was ordered to join a commission investigating the outbreak of dysentery in the Army in South Africa, and a great part of the laboratory work performed by this commission was carried out by him.

In 1903 Colonel Bruce went, at the request of the Royal Society, to Uganda, to investigate further the nature of sleeping sickness. It was very largely, if not entirely, owing to him that the work of the Royal Society's commission was brought to a successful issue. At the time when he arrived a trypanosome had been observed by Castellani in a small number of cases of this disease; thanks to Bruce's energy and scientific insight, these observations were rapidly extended, and the most conclusive evidence obtained, that in all cases of the disease the trypanosome

was present. He showed further that a certain tsetse fly, the *Glossina palpalis*, acted as the carrier of the trypanosome, and obtained evidence showing that the distribution of the disease and of the fly were strikingly similar.

Bruce has therefore been instrumental in discovering and establishing the exact nature and cause of three widespread diseases of man and of animals, and in two of these, nagana and Malta fever, he discovered the causal organism. In the third, sleeping sickness, he was not the first to see the organism, but he was quick to grasp and work out the discovery, and he made the interesting discovery of the carrier of the pathogenic organism, and thus discovered the mode of infection and of spread of the malady, matters of the highest importance as regards all measures directed to arrest the spreading of the disease.

All this research work has been done whilst serving in the Royal Army Medical Corps, and engaged in the routine work of the Service.

Davy Medal.

The Davy Medal is awarded to Prof. W. H. Perkin, jun., F.R.S., for his masterly and fruitful researches in the domain of synthetic organic chemistry, on which he has been continuously engaged during the past twenty-five years.

Dr. Perkin's name is identified with the great advances which have been made during the past quarter of a century in our knowledge of the ring or cyclic compounds of carbon. Thus, in the year 1880, the cyclic carbon compounds known to chemists were chiefly restricted to the unsaturated groupings of six carbon atoms met with in benzene and its derivatives, whilst the number of compounds in which saturated carbon rings had been recognised was very limited, and it was indeed considered very doubtful whether compounds containing carbon rings with more or less than six atoms of carbon were capable of existence.

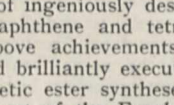
The starting point for Dr. Perkin's researches in this field of inquiry was his investigation of the behaviour of the di-halogen derivatives of various organic radicals with the sodium compounds of malonic, aceto-acetic, and benzoyl-acetic esters, which led to the synthesis of the cyclic polymethylene compounds up to those of hexamethylene, whilst heptamethylene derivatives were obtained by an adaptation of the well known reduction of ketonic bodies leading to pinacones. The reactions thus introduced by Perkin are now classical, having proved themselves of the highest importance for synthetical purposes, and having been instrumental in stimulating the further investigation of the cyclic compounds of carbon.

Dr. Perkin also extended the same methods to the synthetical formation of carbon rings of the aromatic series, obtaining by means of ingeniously designed reactions derivatives of hydrindonaphthene and tetrahydronaphthalene.

But whilst the above achievements depend mainly on happily conceived and brilliantly executed extensions of the malonic and aceto-acetic ester syntheses, Perkin has, by a remarkable development of the Frankland and Duppa reaction for the synthesis of hydroxyacids, been successful in building up the important camphoronic acid in such a manner as to place its constitution beyond doubt (1897).

Dr. Perkin has further devoted much attention to the important subject of the constitution of camphor, towards the elucidation of which he has contributed valuable experimental evidence embodied in a most important and elaborate paper, containing the results of many years' work in conjunction with numerous pupils, entitled "Sulphocamphylic Acid and Isolauronolic Acid, with Remarks on the Constitution of Camphor and Some of its Derivatives" (1898). Bearing on the same subject are later communications on camphoric acid and isocamphoronic acid.

About the year 1900, Perkin, in prosecuting his researches on the constitution of camphor compounds, succeeded in devising synthetical methods for the production of what he has termed "bridged rings," of which a simple example is furnished by the hydrocarbon dicyclopentane



The universal admiration of organic chemists has been called forth by these investigations; they reveal, indeed, a wonderful capacity for devising reactions which coerce carbon atoms to fall into the desired groupings.

Of other publications displaying not only extraordinary experimental skill but close reasoning and the power of interpreting results, mention may be made of Dr. Perkin's memorable researches on the constitution of dehydracetic acid, berberine, brasilin, and hæmatoxylin respectively.

During the present year (1904), Dr. Perkin has made perhaps the most remarkable addition to the long list of his achievements by successfully synthesising terpin, inactive terpineol, and dipentene, substances which had previously engaged the attention of some of the greatest masters of organic chemistry.

In conclusion it may be stated that Prof. Perkin is not only the author of the above and numerous other important researches which are outside the scope of this brief summary, but that he has also created a school of research in organic chemistry, which stands in the very highest rank.

Darwin Medal.

The Darwin Medal is awarded to Mr. William Bateson, F.R.S., for his researches on heredity and variation.

Mr. Bateson began his scientific career as a morphologist, and distinguished himself by researches on the structure and development of Balanoglossus, which have had a far-reaching influence on morphological science, and which established to the satisfaction of most anatomists the affinity of the Enteropneusta to the Chordate phylum. Dissatisfied, however, with the methods of morphological research as a means of advancing the study of evolution, he set himself resolutely to the task of finding a new method of attacking the species problem. Recognising the fact that variation was the basis upon which the theory of evolution rested, he turned his attention to the study of that subject, and entered upon a series of researches which culminated in the publication in 1894 of his well-known work, entitled "Materials for the Study of Variation, &c." This book broke new ground. Not only was it the first systematic work which had been published on variation, and, with the exception of Darwin's "Variation of Animals and Plants under Domestication," the only extensive work dealing with it; but it was the first serious attempt to establish the importance of the principle of discontinuity in variation in its fundamental bearing upon the problem of evolution, a principle which he constantly and successfully urged when the weight of authority was against it. In this work he collected and systematised a great number of examples of discontinuous variation, and by his broad and masterly handling of them he paved the way for those remarkable advances in the study of heredity which have taken place in the last few years, and to which he has himself so largely contributed. He was the first in this country to recognise the importance of the work of Mendel, which, published in 1864, and for a long time completely overlooked by naturalists, contained a clue to the labyrinth of facts which had resulted from the labours of his predecessors. He has brought these results prominently forward in England in his important reports to the Evolution Committee of the Royal Society, and in papers before the Royal and other societies, and also before horticulturists and breeders of animals. He has gathered about him a distinguished body of workers, and has devoted himself with great energy and with all his available resources to following out lines of work similar to those of Mendel. The result has been the supporting of Mendel's conclusions and the bringing to light of a much wider range of facts in general harmony with them. It is not too much to say that Mr. Bateson has developed a school of research to which many biologists are now looking as the source from which the next great advance in our knowledge of organic evolution will come.

Sylvester Medal.

The Sylvester Medal is awarded to Georg Cantor, professor in the University of Halle, on account of his researches in pure mathematics. His work shows originality of the highest order, and is of the most far-reaching importance. He has not only created a new field of mathematical investigation, but his ideas, in their application to analysis, and in some measure to geometry, furnish a weapon of the utmost power and precision for dealing with the foundations of mathematics, and for formulating the necessary limitations to which many results of mathematics are subject.

In 1870 he succeeded in solving a question which was then attracting much attention—the question of the uniqueness of the representation of a function by Fourier's series. The extension of the result to cases in which the convergence of the series fails, at an infinite number of suitably distributed points, led him to construct a theory of irrational numbers, which has since become classical. From the same starting point he developed, in a series of masterly memoirs, an entirely new branch of mathematics—the theory of sets of points.

Having established the fundamental distinction between those aggregates which can be counted and those which cannot, Cantor showed that the aggregates of all rational numbers and of all algebraic numbers belong to the former class, and that the arithmetic continuum belongs to the latter class, and further, that the continuum of any number of dimensions can be represented point for point by the linear continuum. Proceeding with these researches he introduced and developed his theory of "transfinite" ordinal and cardinal numbers, thus creating an arithmetic of the infinite. His later abstract theory of the order-types of aggregates, in connection with which he has given a purely ordinal theory of the arithmetic continuum, has opened up a field of research of the greatest interest and importance.

Hughes Medal.

The Hughes Medal is awarded to Sir Joseph Wilson Swan, F.R.S., for his invention of the incandescent electric lamp, and his other inventions and improvements in the practical applications of electricity. Not as directly included in the award, his inventions in dry-plate photography, which have so much increased our powers of experimental investigation.

NOTES.

THE council of the Royal Society of Edinburgh at its recent meeting decided to award Sir James Dewar, F.R.S., the Gunning Victoria Jubilee prize for 1900–4 for his researches on the liquefaction of gases extending over the last quarter of a century, and on the chemical and physical properties of substances at low temperatures.

THE *Times* reports that a telegram by wireless telegraphy has been transmitted by Mr. Marconi from the Marconi Company's station at Poldhu, Cornwall, to a station belonging to the Italian Government at Ancona, Italy. The distance between Poldhu and Ancona, about 1000 miles, is almost entirely overland, and in order to reach their destination the ether waves had to pass over nearly the whole of France and a considerable part of Italy, including some of the highest mountains of the Alps.

THE will of the late Dr. Frank McClean, F.R.S., includes the following bequests:—5000*l.* to the University of Cambridge to be expended in improving the instrumental equipment of the Newall Observatory, 5000*l.* to the University of Birmingham (in addition to his previous subscription) to be applied in the department of physical science, 2000*l.* to the Royal Society, 2000*l.* to the Royal Institution, 2000*l.* to the Royal Astronomical Society, and to the University of Cambridge for presentation to the Fitzwilliam Museum all the testator's illuminated or other manuscripts and early printed books, and all objects of mediæval or early art which the director of the museum may select as being of permanent interest to the museum.

IN a recent letter to the *Times* Prof. T. Clifford Allbutt directs attention to the paramount importance of considering the question of diet in all schemes of physical education. It is important that there should be no hasty legislation in this matter, especially in view of the important researches which are now approaching completion. Prof. Allbutt gives in his letter a brief account of the results at which Prof. Atwater, of Middletown, Connecticut, and Prof. Chittenden, of Yale University, have arrived. Prof. Atwater has measured accurately, upon healthy persons in uniform circumstances, the intake of food, and the output of waste and work, and has endeavoured to determine the modes and rates of conversion of foods into bodily and mental energy. Much of this expenditure of energy is upon an excess of food taken beyond the needs of the individual. Such excess (or not more than 4 per cent. of it) does not escape mechanically and cheaply from the body, but is absorbed, distributed, and excreted; to this process no little energy is diverted. In this useless effort energy is chiefly wasted by the nitrogenous foods. Excessive starches and sugars are burned off in the lungs almost directly, and at far less cost. Prof. Atwater teaches that the ordinary man eats too much, and in so doing wastes energy which he might have used to profit. Prof. Chittenden comes to a like conclusion by somewhat different methods. He will publish shortly tables to show how, on a closer adjustment of kinds and quantities of food to the useful work required, not only is this much work still sustained, but, by release of energy ordinarily dissipated in the demolition of food excess, the sum of work put out is prodigiously increased, in some cases even by so much as 60 per cent. or 70 per cent. It is clear enough already that one of the chief factors of physical well-being is to know what to eat, and what quantity of it results in the production of the maximum of useful energy. Until this is known with more exactitude than is common to-day, systems of physical education must be tentative and imperfectly conceived.

PROF. S. NEWCOMB has been elected corresponding member of the Berlin Academy of Sciences.

PROF. FEHR contributes to *l'Enseignement mathématique* for November 15 a list of the principal exhibits of models and books at the mathematical congress last August. Among the publishing firms exhibiting books, Germany was represented by six, Austria by two, France by four, Italy by five, Switzerland, Belgium and Denmark each by one. This is exclusive of books exhibited by societies and individuals, under which category we find the solitary British exhibit, by the Royal Irish Academy. Among the exhibitors of models our country was represented by Prof. Greenhill.

THE Belgian Government has decided upon the construction of a turbine steamer for its Channel fleet. Gradually the 19-knot steamers on this international service will be replaced by new turbine boats, with a speed of 23 knots, so that eventually even the slowest mail boats under the Belgian flag will have a speed of 21½ knots, or 24 miles an hour. The steamer which will inaugurate this departure in the progress of the service is at the present moment on the stocks at Hoboken, near Antwerp, and it will shortly be launched. Until quite recently, all steamships in the Channel and Irish Sea services were of the paddle-wheel type, a class admirably adapted for these comparatively short journeys. Drawing little water, they were able to enter any of the shallow harbours, and, at the same time, were capable of developing a speed altogether out of proportion to their draught. Since the introduction of turbines the diminution of the diameter of the propeller and of the weight of the engines has been rendered possible, so that what was until lately considered a mechanical impossibility, namely, to construct a steamer drawing only 9¾ feet and developing 12,000 indicated horse-power, may now be taken as a problem solved. The new Dover-Ostend mail boat will be a triple-screw steamer driven by Parsons' marine steam turbines. There will be three turbines—a high-pressure one in the centre, receiving the steam direct from the boilers, and a low-pressure one on each side, driven by

the exhaust from the central engine. The Marconi system of wireless telegraphy will be installed, and remain at the service of the travelling public, as on all the Belgian mail steamers.

THE articles in the fourth part of vol. xxxii. of Gegenbaur's *Morphologisches Jahrbuch* are two in number, the one, by Dr. Böse, on variations in certain muscles of the human thorax, and the other, by Mr. A. Gierse, on the brain and cephalic nerves of the small deep-sea teleostean fish *Cyclothone acclidens*. The latter is remarkable for possessing a median cephalic sympathetic nerve-cord, apparently unknown in any other vertebrate.

ACCORDING to the report of the annual meeting held in May last, the Boston Society of Natural History (U.S.A.) is devoting attention to the display in its museum of the fauna of New England. New England palæontology is to be shown in the eastern end of the building between the rooms devoted to the palæontology of the rest of the world, while the remaining available space will be devoted to the recent birds and mammals. In the galleries will be arranged the lower vertebrates and the invertebrates. Accordingly, the local fauna, which is to be the leading feature of the museum, will occupy the most prominent and central position, from which the various portions of the general collection will diverge. This is as it should be, and when complete the museum promises to be a model for other local institutions of a similar nature.

THE first part of vol. lxxviii. of the *Zeitschrift für wissenschaftliche Zoologie* is devoted to the fourth and apparently concluding section of Dr. E. Rohde's valuable and exhaustive account of the structure of the organic cell, and to an article by Mr. D. Deineka on the constitution of the swim-bladder of fishes. In the second of these articles the author supports the view that the main function of the swim-bladder is hydrostatic; fish in which this organ has been pierced, and the whole or part of its contained gas withdrawn, or replaced by water, completely lose their balance, in some cases falling on one side, in others standing nearly perpendicular in the water with the head downwards, and in others, again, floating belly upwards. Whether, however, the swim-bladder has a double function, and acts also as a respiratory organ, is, in the author's opinion, extremely doubtful.

IN the September issue of the *Proceedings* of the Philadelphia Academy Miss A. M. Fielde records three instances of curious traits displayed by ants kept under observation in the laboratory at Woods Holl, Mass. In the first case the actions recorded suggest something akin to hypnotism, while from the third there seems a possibility that these insects may be able to remember and recognise individuals of their own kind after a separation of several years. The reactions of ants to vibrations form the subject of a second article by the same author in conjunction with Mr. G. H. Parker. In this it is urged that it is misleading to ascribe or to deny hearing to these insects. They are very sensitive to the vibrations of solids, but not to those of air, and their reactions to these might as well be described as due to touch as to hearing.

THE appearance of a bark disease among the Para rubber trees in certain districts in Ceylon during 1903 created some alarm among rubber planters, but prompt measures for its treatment were carried out under the advice of the Government mycologist. Mr. J. B. Carruthers, the officer in question, gives an account of its occurrence in his report, which forms No. 16 of vol. ii. of the *Circulars and Agricultural Journal* of the Royal Botanic Gardens, Ceylon, and states that the disease was due to a canker fungus; further details with regard to structure and treatment will form the subject of a separate circular.

THE *Journal of Botany* (November) contains the first part of a detailed description of the plants collected in Patagonia by Mr. Hesketh Prichard, of which a preliminary list was given in his book "Through the Heart of Patagonia." The identification has been undertaken by Dr. Rendle, who prefaces the list of plants with a short account of the region in which the collections were made, and the typical elements which are represented. The new species belong chiefly to characteristic temperate South American genera. To the same number Mr. A. B. Jackson contributes some notes on Leicestershire plants which summarise observations made since the year 1886, when the "Flora of Leicestershire" was published.

DR. W. E. DE KORTÉ, at a meeting of the Pathological Society of London on November 15, described what he believes to be the parasites of small-pox and vaccinia. In the lymph of the eruptive spots in both these diseases he has detected bodies measuring about 1/2500 inch in diameter, amœboid, and containing refractile granules; these he regards as amœboid protozoa. They are extremely delicate, breaking up and disappearing on all but the gentlest manipulation, and on attempts to stain or preserve. They seem to be very similar to the bodies described by Funck some years ago under the name of *Sporidium vaccinale*.

IN an article on trypanosome diseases (*Brit. Med. Journ.*, November 26) Prof. Robert Koch advances arguments in favour of the view that the trypanosomes of mammals at present known belong to about three species, viz. the rat trypanosome and the *T. Theileri* of South African cattle, both of which are distinguished morphologically and by unchanging virulence and inoculability from the other trypanosomes, *i.e.* those of nagana, surra, mal de caderas, and sleeping sickness, all of which show considerable variation in morphology, virulence, and inoculability, and are therefore regarded by Prof. Koch as being probably varieties of one type.

THE new number of the *Mitteilungen aus den deutschen Schutzgebieten* contains papers on the north-western boundary region of Togoland, by Count Zech, and on the results of an exploration of the healthy plateau region of the Kamerun, north of the Manenguba mountains, by Dr. Hans Zieman. The information in the former paper, and the map accompanying it, are of particular interest on account of the immediate proximity of the district to British territory.

THE July number of the *Bulletin* of the Italian Geographical Society contains the concluding portion of Prof. Brocherel's report on the expedition to Central Asia in 1900. Signor Carlo Rossetti writes on the political and economic conditions of Korea, and Signor Eugenio Barbarich makes an important contribution to the physical geography and geology of Albania. Another paper deals with the award of the King of Italy in the arbitration as to the boundary between Brazil and British Guiana.

PROF. PENCK'S account of the progress made during the last five years in the execution of a map of the world on a scale of 1 : 1,000,000, which was presented to the International Geographical Congress at Washington, is published in the October number of the *National Geographic Magazine*. During the last four years France, Germany,

and Britain have issued three series of maps, containing sixty-one sheets worked out on the same scale and in the same style of division of sheets. These maps cover nearly 10,000,000 square miles, and will ultimately embrace the whole of Africa, and large parts of Asia and America. It will be remembered that the congress adopted a resolution proposing to the Government of the United States the execution of a similar general map of America.

IN a recent number of the *Bulletin* of the Italian Aëronautical Society Dr. L. Palazzo, director of the Italian Meteorological Service, gives a very interesting account of the scientific experiments in Italy with unmanned balloons. The paper contains photographic illustrations of the balloons employed, of the methods of filling them, of their flight in mid-air, and of the records of the instruments. The place chosen for the aëronautical station is Pavia, principally owing to its geographical suitability and its distance from mountains and sea. The balloons used are a preparation of india-rubber, and are made by the Caoutchouc Company, of Hanover. They are sent up in tandem fashion, and are spherical and closed, and have the faculty of expanding to about seventy times their original volume, rising rapidly to an altitude of 20,000 metres and upwards, where a temperature of 60° C. below zero may be recorded. The upper balloon eventually bursts; the second balloon, which is smaller and not fully inflated, does not burst, but acts as a kind of parachute, which commences to fall rapidly at first and afterwards more gradually. It carries the registering apparatus attached to it by a line, and is intended to attract the attention of persons in the neighbourhood of its descent. The instruments generally reach the ground somewhat gently, and are seldom broken. Dr. Palazzo acknowledges the assistance he has received from Profs. Hergesell and Assmann in inaugurating these important experiments.

WE have received a reprint of a paper published by Prof. A. Righi in the *Atti dei Lincei*, vol. xiii., ii., 233, under the title of "Certain Phenomena Observed in Air which is Ionised by Radio-active Substances"; experiments are described which show the necessity that exists in making measurements of the ionising power of radio-active substances by means of the various forms of gold-leaf electroscopes to take into account the position of the leaves relatively to the walls of the electroscope, and to the direction of the ionising rays.

IN a paper published in the *Physikalische Zeitschrift* (No. 20), C. Liebenow calculates that the presence of 1/5000 of a milligram of radium per cubic metre distributed uniformly throughout the earth's volume would be sufficient to compensate for the loss of heat which is caused by conduction through the crust, and thus to maintain the earth's interior at a constant temperature. The concentration which is here assumed is considerably less than that actually observed by Messrs. Elster and Geitel to hold for radium in various kinds of natural earths, but it may perhaps be assumed that the proportion of radium is greater in the crust of the earth than at the interior. In any case, the need becomes apparent of making allowance in all calculations dealing with the earth's rate of cooling, for the remarkable thermal effects of radio-active substances.

IN No. 17 of the *Revue Scientifique*, Prof. R. W. Wood's recent letter to NATURE (vol. lxx. p. 530) calling into question the existence of the *n*-rays is reprinted, and in No. 18 an editorial article discusses in detail the character of the evidence on which they are alleged to exist. In No. 19 of the *Revue* the opinions of Profs. Berthelot, Bouty, Pellat, Langevin, and Abraham have been ascertained with regard to the matter. Of these expressions of opinion, that of M. Langevin is the most emphatic; after making many experiments, he concludes that in no case in which the observer is unaware of the result he is to obtain is there the slightest evidence of the existence of these rays, whilst on the other hand the experimenter can readily so dispose his mind as to see whatever he wishes to see. The general attitude which is taken up in these articles is that the observed phenomena are purely subjective, and due to suggestion; they are consequently more likely to prove of importance to the psychologist than to the physicist.

IN the October number of the *Gazzetta* G. Bruni and A. Callegari have established by means of cryoscopic measurements the remarkable fact that in many cases the nitroso-group in organic substances is isomorphous with the nitro-radical. The formation of solid solutions in such cases is also made evident by peculiar colour phenomena. Whilst, for instance, a solution of nitrosobenzene in benzene is green, but becomes colourless when frozen, a solution in nitrobenzene, which has the same colour, remains green after solidification. In the former case solid colourless nitrosobenzene has separated, whilst in the latter a solid solution of the substance in the solidified solvent is formed, which, like the liquid solution, is coloured green.

THE numerous attempts which have been made to decide by physical methods the nature of isodynamic substances such as ethyl acetoacetate and acetylacetone have given rise to widely differing opinions. Thus Brühl, for instance, has considered that the optical properties of acetylacetone between 0° C. and 100° C. prove that, between these temperatures, it exists solely in the di-enolic form

$$CH_3.C(OH) : C : C(OH).CH_3,$$

whilst Dr. W. H. Perkin, from a study of the magnetic rotatory power of the same substance, considers that at 16° C. it consists of a mixture of this form with the keto-enolic modification, and at 93° C. of a mixture of the keto-enolic and diketonic varieties. In the October number of the *Gazzetta* F. Giolitti shows that at about 70° C. a remarkable change in the expansibility of acetylacetone occurs which conforms with Perkin's view of a change of structure at a temperature between the limits 16° C. and 93° C. The variation in the expansion of ethyl acetoacetate between −10° C. and 100° C. is, however, perfectly linear, apparently indicating that at these temperatures only one form exists, or that the rate of change of one form into another is uniform between these limits.

A CORRESPONDENT points out that in NATURE of November 24 (p. 88, line 19 from top, first column) the name Sansaulito is a misspelling for a well known locality near San Francisco. The correct spelling is Saucelito, which means "little willow," from *Sauce*, willow, in Spanish.

WE have received from Messrs. F. Darton and Co., of 142 St. John Street, E.C., a well illustrated catalogue of electrical novelties. The pieces of apparatus, toys, and household devices of which particulars are given are ingenious in design, and some of them would make instructive presents for boys with a mechanical turn of mind.

MESSRS. WATTS AND CO. will issue on December 7 for the Rationalist Press Association an English translation of Prof. Haeckel's "Die Lebenswunder," under the title of "The Wonders of Life." The chief aim of Prof. Haeckel in this work is to present a mass of biological evidence for the views as to the origin and nature of life which he briefly advanced in the "Riddle of the Universe."

MESSRS. GEORGE BELL AND SONS have published a revised re-issue of "Cities and Sights of Spain," by Mrs. Aubrey Le Blond (Mrs. Main). This handbook for tourists is meant as a supplement to the ordinary guide-book, and the information supplied shows that the writer has an intimate first-hand knowledge of the country. The advice as to hotels, expenses, what to do and what not to do, is of just the kind to be of assistance to visitors to Spain, of which country the writer says, "no other part of Europe offers so varied and attractive a field to nearly every type of traveller." The appearance of this re-issue is particularly opportune just now, since astronomers and others will be visiting Spain next year to view the total eclipse of the sun, as the central line of the eclipse runs in a direction N.W. to S.E. across that country. Mrs. Le Blond's book may be commended to those scientific visitors who will have time to visit some of the beauty spots of the land in which their observations will be made.

WE have received vol. xxxvi. of the *Transactions and Proceedings* of the New Zealand Institute, which contains details of the work of the year 1903. The transactions are divided into five sections—miscellaneous, zoology, botany, geology, and chemistry and physics. The total number of papers contributed in these subjects reaches fifty. Among the contributions to the miscellaneous section may be mentioned several statistical studies by Prof. H. W. Segar and an exhaustive consideration of Maori marriage customs by Mr. Elsdon Best. The president of the institute, Captain F. W. Hutton, F.R.S., is the largest contributor to the section of zoology. He describes a new fish, two new flies, a new blow-fly from Campbell Island, and has papers on a new Weta from Chatham Islands and on the occurrence of the curlew sandpiper (*Ancylochilus sub-arquatus*) in New Zealand. Prof. Benham writes of a new species of leech (*Hirudo antipodum*) recently discovered in New Zealand, of the Oligochæta of the New Zealand lakes, and of an apparently new species of Regalecus (*R. parkeri*). Prof. Park contributes to the section of geology five papers on different aspects of New Zealand geology. Of the six papers in chemistry and physics, three are the work of Mr. J. S. S. Cooper. The proceedings, which make up the second part of the volume, provide interesting particulars of the year's work of each of the seven scientific societies affiliated to the New Zealand Institute. The volume as a whole demonstrates conclusively that the men of science in New Zealand are doing successfully their part to extend the bounds of natural knowledge.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN DECEMBER :—

Dec. 1. 10h. 9m. to 12h. 8m. Transit of Jupiter's Sat. III.
" 10h. 22m. Minimum of Algol (β Persei).
" 13h. 56m. to 14h. 8m. Moon occults η Virginis (Mag. 4·0).
4. 7h. 11m. Minimum of Algol (β Persei).
8. 13h. 43m. to 15h. 45m. Transit of Jupiter's Sat. III.
10–12. Epoch of Geminid meteoric shower (Radiant 108°+33°).
11. 12h. 0m. Saturn in conjunction with Moon (Saturn 3° 28′ S.).
12. 1h. Juno in conjunction with Moon (Juno 0° 49′ S.).
13. 10h. 19m. to 11h. 12m. Moon occults λ Aquarii (Mag. 3·9).
" 21h. 0m. Mercury at greatest elongation (20° 30′ E.).
16. 17h. Jupiter in conjunction with Moon (Jupiter 1° 47′ N.)
20. 6h. 1m. to 7h. 4m. Moon occults γ Tauri (Mag. 3.9).
" 11h. 25m. to 11h. 58m. Moon occults θ' Tauri (Mag. 3·9).
Dec. 20. 12h. 21m. to 13h. 31m. Moon occults BAC 1391 (Mag. 4·9).
" 15h. 19m. to 16h. 12m. Moon occults α Tauri (Mag. 1·1)
21. 21h. 0m. Uranus in conjunction with Sun.
24. 8h. 54m. Minimum of Algol (β Persei).
26. 9h. 2m. to 9h. 13m. Moon occults A Leonis (Mag. 4·6).
27. 5h. 43m. Minimum of Algol (β Persei).
" 21h. Venus in conjunction with Saturn (Venus 0° 48′ S.)
28. 10h. Neptune in opposition to the Sun.
29. 12h. 0m. Neptune's Satellite at max. elong. west (distance 17″).

ENCKE'S COMET (1904 *b*).—No. 3980 of the *Astronomische Nachrichten* contains the results of further observations of Encke's comet.

Prof. Millosevich, observing at the Roman College Observatory at 6h. 26m. 15s. (M.T. Rome) on November 7, determined the position of the comet to be

α (app.)=22h. 50m. 39·93s., δ (app.)=+22° 19′ 20″·1,

and recorded the object as an extraordinarily difficult one with the filar micrometer of the 39 cm. equatorial; no nucleus could be definitely seen.

On November 15 Herr Moschick, using the 6-inch telescope of the Konigstuhl Observatory, Heidelberg, found the comet to be a very faint and diffuse object with a doubtful nucleus. The position at 13h. 12m. (Konigstuhl M.T.) was α (app.)=22h. 13m. 37·6s., δ (app.)=+18° 14′ 26″.

The following is a corrected ephemeris, by M. Kaminsky, given in the November number of the *Observatory* :—

Ephemeris (*Berlin Midnight*).

1904	R.A. h. m. s.	Dec. ° ′
Nov. 29 ...	21 18 30 ...	+10 30
Dec. 3 ...	21 3 50 ...	+ 8 9
" 7 ...	20 49 20 ...	+ 5 36
" 11 ...	20 34 10 ...	+ 3 1
" 15 ...	20 16 32 ...	+ 0 17
" 19 ...	19 56 38 ...	− 2 58
" 23 ...	19 35 12 ...	− 6 31

On the last mentioned date the comet will be a little north of κ Aquilæ, and owing to its proximity to the sun in right ascension will be a difficult object to observe.

As pointed out by Dr. Smart, the comet will approach very near to Mercury in January, and it is hoped that an opportunity of testing the mass of Mercury, by observations of the comet after the approach, will therefore be available.

VARIATIONS ON THE MOON'S SURFACE.—In No. 4, vol. liii., of the Harvard College Observatory *Annals* Prof. W. H. Pickering publishes a number of photographs illustrating the changes which take place in the regions about the lunar crater Eratosthenes during the commencement, the duration, and the passing of sunlight on that region of the moon's surface.

There are sixteen figures in all, the longest interval of time between the taking of any two successive figures being 1·6 days, and it is hoped that, by publishing these together with the detailed descriptions by Prof. Pickering which accompany them, the work of other selenographists may be greatly facilitated, by the possession of the knowledge of what to look for.

The mean diameter of the crater of Eratosthenes is 37 miles, that of the floor 28 miles, and measures of the shadows cast indicate that the western wall has a height of 12,000 feet, whilst the indicated height of the eastern wall is something less than 15,000 feet.

As evidence in favour of the vegetal origin of these phenomena, Prof. Pickering suggests that although water could not exist at the low pressures obtaining on the lunar surface, yet it might be retained in the soil by capillary attraction and thence feed the vegetation, which at each return of sunlight would develop and thus cause the changes illustrated in the photographs.

CELESTIAL PHOTOGRAPHY AT HIGH ALTITUDES.—An interesting account of the work performed by Prof. Payne and Dr. H. C. Wilson during their sojourn at Midvale (Montana), illustrated by reproductions of two of the photographs

obtained, is given by the latter observer in No. 8, vol. xii., of *Popular Astronomy*.

The altitude of the observing station was 4790 feet above sea-level, and the results lead Dr. Wilson to the conclusion that the increase in altitude, from Northfield to Midvale, reduced the necessary exposures, other conditions being the same, by about one-half. The two reproductions accompanying the account show excellent photographs of the America nebula and of the region between β and γ Cygni taken with a $2\frac{1}{2}$ inch Darlot lens with exposures of three hours and of two hours respectively.

DISTRIBUTION OF STELLAR SPECTRA.—In No. 1, vol. lvi., of the Harvard College Observatory *Annals* the distribution of stellar spectra, mainly in reference to the Milky Way, is discussed.

The spectra dealt with are those examined by Mrs. Fleming for the Harvard catalogues, and the work is not yet complete, the present publication dealing only with the results already obtained.

The number and proportion of each class of spectra in definite regions of the heavens, as determined from the discussion of 276 plates containing the spectra of 32,197 stars, are given in a series of tables and shown on a number of curves.

The results indicate that the universe consists of two portions, (1) the first-type stars, which occur in all regions, but preponderate in the formation of the Milky Way; (2) the stars having second- or third-type spectra, which show, in general, a uniform distribution over the whole sky.

The proportion of first-type stars increases as fainter objects are included, but with the Orion stars the opposite seems to be the case. Stars with peculiar spectra seem to congregate in the Milky Way, whilst, contrary to expectation, those having spectra of class F appear to be relatively fewer in the galactic regions.

ABSORPTION BY WATER VAPOUR IN THE INFRA-RED SOLAR SPECTRUM.—An interesting series of experiments has been made at the Smithsonian Astrophysical Laboratory, by Mr. F. E. Fowle, jun., in order to test the correctness of Bouguer's formula for calculating the amount of solar energy received after atmospheric absorption.

The results, so far as they go, show that the selective absorption of water vapour is well represented by Bouguer's formula and seems to depend only on the amount of the absorbent present, that is to say, the amount of the absorption produced by a given quantity of water vapour is the same, whether the radiations pass through a *great* thickness of *small* density or *vice versâ*.

The absorption increases as the wave-lengths of the bands increase, and varies from about 10 per cent. near A ($0{\cdot}76\mu$) to nearly 100 per cent. at about $1{\cdot}80\mu$.

No indication of a general water vapour absorption has been found in the region $0{\cdot}68\mu$ to $2{\cdot}00\mu$.

Mr. Fowle's complete results, illustrated by some of the bolograms obtained, are published in No. 1, vol. ii., of the quarterly issue of the *Smithsonian Miscellaneous Collections*.

THE SUPPLY OF VALUABLE FURS.

FEW persons, other than those in some way connected with the fur trade of this country, or who have had occasion to make statistical inquiries on the subject, have any conception of its enormous volume and value. Yet every thoughtful observer who strolls along the fashionable shopping streets of the metropolis at this season can scarcely fail to be struck with the number of establishments for the sale of furs and the richness and variety of their contents, or with the great extent that furs are worn by ladies. Any real and comprehensive idea of the magnitude of the trade can, however, only be gained either by attending the great London quarterly fur sales, such as those of Messrs. C. M. Lampson and Co., or by a study of the catalogues and price-lists of such sales. By a perusal of these documents the inquirer will gain some conception of the immense number of skins of the more valuable kinds of fur-bearing animals imported into this country alone; and when the great Continental sales, such as the Leipzig and Nijni-Novgorod fairs, are also taken into consideration, he will marvel where the supply comes from, and wonder that a clean sweep has not long ago been made of the chief fur-producing species. Nevertheless, the supply of most descriptions of furs seems to be well kept up, and, with the exception of a few species, such as the sea-otter, the beaver in many districts, the West African guereza monkeys, and certain kinds of fur-seal, it does not appear that any of the valuable fur-bearing mammals are in present danger of extermination, or even of becoming unduly scarce. The truth is that we have probably little real conception of the abundance of such creatures in the more remote districts of North America and in the fur-producing countries of northern Asia.

To attempt, within moderate limits, any general account of the mammals which yield the more valuable kinds of furs is impossible, as it would be with the means at our disposal to give a survey of the world's fur trade, and we shall accordingly content ourselves with referring to some of the more striking items in trade circulars for the current year, and with making such notes on certain of the species there mentioned as may seem desirable. Here it may be recalled that there appeared in 1892 a valuable and interesting work on "Fur-Bearing Animals" by Mr. Henry Poland. This work, needless to say, is now altogether out of date, and it is much to be hoped that the author could see his way to the issue of a new edition, especially, if we may say so without offence, if he would seek the assistance of a professed naturalist in the revision.

We commence our brief review of the more interesting items in the 1903–4 sale-lists by referring to some of the most valuable descriptions of furs employed as articles of dress or as carriage rugs, a large proportion of which are yielded by the Carnivora, and especially by members of the family Mustelidæ. One of the foremost places in this respect is occupied by the sea-otter (*Latax lutris*), an animal which formerly abounded on the coasts of Kamchatka and the Aleutian Islands, but which now stands in imminent jeopardy of extermination unless prompt measures are taken for its protection. Between the years 1772 and 1774 some 10,000 skins of this species were taken in the Aleutians, while at the end of the eighteenth century the annual take was 120,000 in certain newly discovered haunts in Alaska. This number, however, soon fell to 15,000, and when Alaska was ceded to the United States it had sunk to 700. A temporary improvement then took place, but in 1901 the number had fallen to 406. In 1903 Messrs. Lampson sold 463 skins, but they had none to offer in January, 1904, and there are none down in their October list, the latter deficiency being perhaps due to the recent loss of a whole cargo of furs from the Kommandorski Islands and Kamchatka. Of late years 100*l*. is no uncommon price for a sea-otter pelt, while from 200*l*. to 300*l*., and even, it is said, 500*l*., have been paid for unusually fine skins.

These prices are, however, paralleled by those given for American silver or black fox (*Canis vulpes argentatus*). Nowadays the trade distinguishes the pure black from the silver or white-tipped skins. Black skins are said to have been sold in St. Petersburg at from 300*l*. to 800*l*. each. In London a pair of silver skins realised 480*l*. and an inferior pair 200*l*. in 1902, but single skins are reported to have fetched 200*l*. Messrs. Lampson offered 670 skins of this fox in 1903, and have 55 in their current October list. The white and blue phases of the Arctic fox (*Canis lagopus*), which are the winter dress of different animals, although often regarded as the winter and summer coats of the same form, have of late years become very fashionable. Of the former 20,341, and of the latter 3685, were sold by Messrs. Lampson last year, but none of the blue variety appear in this autumn's catalogue, against 57 in October, 1903, and it would accordingly seem that the demand is telling on the supply. White fox skins, which some years ago sold for between 2*s*. 6*d*. and 15*s*. each, have recently risen to from three to five guineas, although they are now declining; on the other hand, blue fox, which has long fetched from ten to fifteen guineas per skin, appears to be rising in value. Both white and blue fox come from the northern parts of both hemispheres; the blue should be a pure bluish French grey.

Of lynx skins 5828 were sold by Messrs. Lampson in 1903, and 6316 were offered this autumn, the catalogue prices ranging between 22*s*. and 42*s*. for good samples. Probably most of these skins belong to the circumpolar *Felis lynx*, although they may include some of the American *F. rufa*.

Another handsome fur now in considerable demand is that of the glutton or wolverine (*Gulo luscus*), of which 47,139 skins were sold last year by one firm, the catalogue price ranging this autumn from 16*s*. to 34*s*. for good samples. The sales of Russian sable (*Mustela zibellina*) by the same firm last year reached the enormous total of 29,547, which compares with a total of 9247 for the whole of London in 1891, an increase which seems to imply either the tapping of a fresh source of supply or an undue drain on the normal stock. The catalogue prices range from 10*s*. to 15*l*. per skin, but specially fine skins will fetch from 50*l*. to 70*l*. each. As its trade name implies, all the best sable comes through Russia. "Kolinsky" or Siberian sable (*M. sibirica*) is the trade name of an allied species of which enormous numbers of skins come into the market, Messrs. Lampson quoting 472,796 for last year; the price is, however, low, usually less than two shillings, and now declining.

Ermine (*M. erminea*), of which the returns for 1903 are not given in the list before us, has recently risen 30 per cent. in value; 1379 skins were sold in January, 1903, and 461 this October. From 20*s*. to 180*s*. per "timber" of 40 skins was the price some years ago. Ermine is imported both from Russia and America. When made up with specks of black fur instead of with the black-tipped tails, it is called minever. Japanese sable, of which only 179 skins were sold by Messrs. Lampson in 1903, is represented by 1211 this autumn, a circumstance which may indicate that our allies are endeavouring to make as much as possible out of their exports.

A similar increase is noticeable in the case of Japanese mink (a species it is a little difficult to identify zoologically, but which would appear to be allied to *M. sibirica*), of which 13,728 skins were disposed of at the sales in 1903, while 7228 were offered this autumn, against 3543 at the corresponding sale of last year. Of American mink (*M. vison*) the imports are always heavy, and for 1903 Messrs. Lampson record 253,001 skins, this being about 100,000 less than the total number sold in London in 1901. Prices range from 1*s*. to 13*s*., but are on the decline. The various kinds of real marten, such as *M. martes* and *M. americana*, with 55,106, and the inferior sorts known in the trade as "baum" and "stone" (*M. foina*), with 10,940 and 8323 in the past year, bulk less large, although prices range higher, fine pelts of the pine or American marten realising from 30*s*. to 40*s*.

Leaving certain others of the marten group, we pass on to otters (*Lutra vulgaris, L. canadensis*, &c.), of which 14,757 pelts were disposed of in sales last year, the catalogue prices in January ranging to as much as from 50*s*. to 60*s*. With modern methods of curing, the handsome black and white fur of the various species of skunk (Mephitis and Conepatus) has come into extensive and fashionable use, no less than 948,447 skins having been sold last year, the price ranging from about 1*s*. to 7*s*. each. Of badger skins (*Meles taxus*) the number sold by the same firm was 13,543; formerly the price was from 1*s*. to 2*s*. per skin, but the range in the list varies now from 4*d*. to 13*s*.

Of the larger land Carnivora, the skins of which are used for fur rather than for floor rugs, we may mention the sale last year by Messrs. Lampson of 47,139 wolf skins and 12,834 bear skins. Of the former the catalogue price ranges from 1*s*. or less to 30*s*., while for the latter, which include the brown, black, grizzly, and white species, prices up to 4*l*. are quoted. Reference has already been made to the silver, white, and blue foxes; in addition to these are quoted 62,052 skins of red fox (*C. vulpes*, &c.), 2957 of the cross-fox (*C. v. pennsylvanicus*), 64,431 of the American grey fox (*C. cinereo-argentatus*), and 2186 of the kit-fox (*C. velox*). Raccoon skins number 268,190 in the list under consideration, while 9650 civet skins are quoted in the January list.

Among rodents, beaver skins total 16,504 in the list before us, while the Hudson Bay Company sold in January last 34,806, the latter number comparing badly with the 63,419 sold by the same company in January, 1891, which was greatly inferior to the sales of half a century or so earlier. In 1891 the price varied from 5*s*. to 69*s*. per skin; in Messrs. Lampson's list quotations range up to 30*s*., but there had been a fall of 12½ per cent. from the previous year. The next largest fur-bearing rodent is the South American coypu (*Myopotamus coypu*), known in the trade as nutria, of which 80,269 skins appear in last year's sale-list. Far more valuable are, however, the much smaller beautiful silver-grey pelts of "real" chinchilla, of which 23,587 were sold last year by Messrs. Lampson, 60*s*. to 240*s*. per dozen being the price quoted by Mr. Poland in 1891, but a maximum of 310*s*. appearing in the list before us. I take it that by "real" chinchilla is meant the typical *Chinchilla lanigera*, although the latter name is applied by Mr. Poland's book to the "bastard chinchilla" of the trade, which one would have thought meant one of the species of Lagidium. Be this as it may, "bastard chinchilla" is represented by no less than 132,996 pelts in Messrs. Lampson's 1903 sales, the maximum price being 145*s*. per dozen.

Of the smaller and less valuable rodent furs briefer notice must suffice, the chief interest connected with these being the enormous numbers in which they are imported. Thus musquash (*Fiber zibethicus*) is represented by no less than 2,979,460 pelts of the normal, and by 117,412 of the black phase, while 1,678,667 skins of the former were disposed of at the January sale this year. Squirrel (of various kinds), on the other hand, totalled only 142,501. Rabbit and hare skins are not of sufficient value to find a place in these sale-lists. Among marsupials, skins of the so-called Australian opossums, that is to say, various species of phalangers, press hard on musquash skins in point of numbers, 2,455,765 being the quotation in last year's list. True, or American, opossum (Didelphys), on the other hand, totals only 168,396. Of kangaroo skins the number in the same list is 21,963, while wallaby skins (that is to say, those of the smaller kinds of kangaroos) reach 520,087, and wombat skins 255,332.

An item of considerable interest in the sale-list of January, 1904, is 343,996 mole skins, ranging in price from 1*s*. to 7*s*. 3*d*. per hundred, such prices being stated to be exceptionally low, and not, one would think, paying for the trouble of collecting. No year's total for mole skins is given, but since Mr. Poland mentions "several thousands" as being the annual collection in 1891, it would seem that the demand—perhaps for motoring coats—has vastly increased of late years. Another item evidently connected with motoring is that of 403 musk-ox skins at the March sale of last year. The trade in these skins has only lately been developed, and it cannot but be looked upon with suspicion by naturalists, as the musk-ox might easily be exterminated.

Although the total numbers of skins offered at sales in January last compared well with those of the preceding year, prices ruled lower, which may be accounted for by the general commercial depression.

In addition to Messrs. Lampson's sales, it should be mentioned that there are the Hudson Bay Company's sales, as well as several smaller fur sales in London. In January of the present year (after the loss of a valuable cargo of furs at sea) the Hudson Bay Company sold 34,806 beaver skins, as already mentioned (against 47,777 the preceding year), and 923,053 musquash pelts (against 1,482,670 in 1903). The skins disposed of at the smaller sales we have not space to quote. We may refer, however, to the following items in Messrs. Culverwell, Brooks, and Co.'s sale catalogue of this October. These are 9280 Australian opossum, 3214 "wallarine" (smaller kangaroos), 673 chinchilla, 934 fox, 2772 wolf, and 2313 African monkey skins.

The latter probably belong in great part to the West African guereza (*Colobus vellerosus*), the species already referred to as, according to consular reports, being in danger of extermination on account of excessive pursuit.

As regards the prospects of the trade in fur-seal pelts for the current season, Messrs. Lampson, after referring to the loss by shipwreck of the Kamchatka Commercial Co.'s vessel already mentioned, and adding that in consequence they may have no Copper Island fur-seals to offer, write as follows:—

"The Alaska seal-catch this year amounts to 13,134 skins, as against 19,378 last year. . . . The North-west catch is not yet completed, but our receipts to date are about the same as at this time last year. With regard to the Lobos Island seals, no news has been received so far. . . . The total supply of seals this season is likely to fall considerably short of last year's quantity."

From the introductory statements this diminution may, however, be merely temporary, and need not necessarily indicate a permanent falling off in the supply of fur-seal pelts.

In respect to skins used solely for rugs or ornamental purposes, very few words must suffice. In Messrs. Culverwell, Brooks, and Co.'s list for October of this year appear 100 South American guanaco skins (from which the beautiful orange carriage-rugs are made), 24 tiger, and 266 leopard skins, while Messrs. Lampson's January list gives 184 tiger and 557 leopard skins (inclusive of snow-leopard and "leopard-cat").

The leopard skins range in price from 10*s.* or less to 34*s.* (55*s.* for snow-leopard), while tiger skins vary from 2*l.* to 60*l.* each.

Imperfect and sketchy as this review of recent London fur sales necessarily is, it serves to give some idea of the enormous—we may almost say appalling—number of wild animals annually slaughtered for the sake of their pelts. What, however, it does not—and cannot—give is the effect that this continuous slaughter is having on the numbers of the various species of fur-bearing animals throughout the world.

This is what naturalists want to know from the point of view of zoology, and it is also what the fur trade community ought to desire to know from the point of view of their own and the world's interest. Of late years furs have become increasingly fashionable, with a corresponding appreciation in price; but as to whether this increased demand is having any serious effect on the numbers of fur-bearing animals in general we appear, except in the case of a few species, such as the sea-otter, the beaver, the West African guereza, and the fur-seals, to be in a state of utter and hopeless ignorance. R. LYDEKKER.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The new statute, the object of which is to exempt candidates for honours in mathematics or in natural science from Greek in Responsions, was brought before Congregation on Tuesday, November 29. The changes proposed in the statute were in strict accordance with the resolutions passed by Congregation in Hilary Term, 1904, except in one small detail. Candidates for honours in mathematics or in natural science have two courses open to them under the proposed statute. They may offer the subjects required by the present regulations, viz. Greek, Latin, arithmetic, and elementary algebra or Euclid, or in place of Greek they may substitute French or German, together with a mathematical or scientific subject to be prescribed by the board of studies for Responsions. Candidates who had not offered Greek would be allowed to substitute an additional knowledge of the subject-matter of the Bible for that part of the examination in Holy Scripture which involves a knowledge of the Greek text of the Gospels. The statute was lost by 200 votes to 164.

Dr. William Osler, F.R.S., regius professor of medicine, has been elected to a studentship at Christ Church.

A NEW professorship of applied chemistry has been established at Trinity College, Dublin. Mr. Emil Alphonse Werner, assistant to the professor of chemistry, has been appointed as the first occupant of the new chair.

WE learn from *Science* that Park College, near Kansas City, has received an additional endowment of 20,000*l.*, of which 5000*l.* has been given by Dr. D. K. Pearson; and that at a recent meeting of the trustees of Columbia University gifts amounting to about 9400*l.* were announced by the trustees. Among these was the sum of 3000*l.* from General Horace W. Carpentier.

THE Minister of Public Instruction for Austria has issued a decree concerning the admission to the universities of students from the Realschulen, according to which those wishing to be on the same footing as candidates from the Gymnasia are required to pass an additional examination, held twice a year, in Greek, Latin, and philosophy. Candidates may prepare for this examination either by private study or by courses held at certain secondary schools.

IT would do much good if everyone spoke their minds on the subject of free libraries as straightforwardly as did the Countess of Jersey last Saturday afternoon. When laying the foundation stone of a library which the generosity of Mr. Carnegie is providing for Hanwell, she touched on the great usefulness of books of reference, especially with regard to the particular life-work of the reader. In fact, one would judge that novels would find but a small place on the shelves if Lady Jersey were to choose all the books, for she very sensibly pointed out that the best volumes of fiction can now be bought for a few pence, and that more expensive books and those more difficult to get should form the bulk of a public library.

AT the winter session of the General Medical Council last week a report was considered from the Education Committee on the proposals for a school certificate submitted to the council recently by the Board of Education. After discussion it was decided to inform the Board of Education (1) that any well considered plan which would tend to a diminution in the number of examinations in preliminary subjects of education, and to a unification of standard of those which remain, would meet with the hearty approval of the Medical Council. (2) That if the standard of the examination contemplated in the scheme were such as to be generally accepted for matriculation by the universities, the council would be prepared to recognise it as qualifying for entrance on a course of professional study. (3) That, pending the general adoption of a uniform system of unification of educational tests, the council would welcome the establishment under the Board of Education of a central board for the purpose of classifying examinations according to standard and arranging for the mutual recognition of certificates; and, further, that they regard the establishment of such a board as highly desirable from an educational point of view.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, November 2.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Mr. J. E. **Collin** exhibited a specimen of *Platyphora lubbocki*, Verr., a species of Phoridæ parasitic upon ants. No specimen has been recorded since the one originally bred by the present Lord Avebury in 1875, and described for him by Mr. G. H. Verrall in the *Journal* of the Linnean Society for 1877.—Mr. P. J. **Barraud** exhibited an aberrant *Epinephele jurtina* (*janira*), ♂, taken by him this year in the New Forest, in which the usual apical spots were absent from the fore-wings, giving the specimen a curious appearance, noticeable even when flying.—Mr. J. **Edwards** sent for exhibition three specimens of *Bagous lutosus*, Gyll., one found by himself on Wretham Heath, Norfolk, on August 4, 1900—the first authentic British example—and two taken in the same locality by Mr. Thouless on May 22, 1903; also *Bagous glabrirostris*, Herbst., from Camber, Sussex, for comparison.—Dr. T. A. **Chapman** exhibited bred specimens of *Hastula* (*Epagoge*, Hb.?) *hyerana*, Mill., from larvæ taken at Hyères last March, and said the fact that the pale forms only have hitherto been known, whereas of those bred nearly half are dark, suggests either that really very few specimens are in collections—which is the most probable case—or that melanism is now affecting the species.—Mr. W. J. **Kaye** exhibited specimens of the moths *Castnia fonscolombei* and *Protambulyx ganascus* showing protective and warning coloration of the two species.—Mr. H. W. **Andrews** exhibited specimens of *Eristalis cryptarum*, F., and *Didea alneti*, Fln., two species of uncommon Syrphidæ from the New Forest.—Mr. Edward **Harris** exhibited a brood of *Hemerophila abruptaria* reared by him this season, together with the parents, a dark male and a normal female, showing considerable variation.—Mr. Gervase F. **Mathew**, R.N., exhibited some beautiful and interesting examples of *Leucania favicolor*, Barrett, including the varieties described by Barrett in the current volume of the *Entomologist's Monthly Magazine* (p. 61), and, more recently, by Tutt in the *Entomologist's Record* for this year. He also exhibited a series of twenty-four *Camptogramma fluviata*, the descendants of a wild pair

captured on September 22, 1903, showing a wide range of colour variation.—The **President** exhibited a photograph taken by Mr. A. H. Hamm to illustrate the protective flower selection of *Pieris rapae*. He also exhibited four specimens of *Conorrhinus megistus*, Burm., the large South American Reduviid which is well known to attack man; these were brought back by W. J. Burchell in the year 1828, and still have the original labels affixed to them.

Geological Society, November 9.—Dr. J. E. Marr, F R.S., president, in the chair.—Mr. E. T. **Newton**, in exhibiting, by permission of the director of H.M. Geological Survey, a specimen of Fayolia near to *Fayolia grandis*, found by Dr. L. Moysey, of Nottingham, in the Coal-measures of Ilkeston (Derbyshire), pointed out that Fayolia was first described by Profs. Renault and Zeiller in 1884, in their monograph on the "Houiller de Commentry." In 1894 Mr. Seward described the first British specimen, from Northumberland, in the Leeds *Naturalist*, but thought that it was not a plant. There was some resemblance to certain spiral egg-cases of Elasmobranchs, but Dr. Günther was unwilling to accept the Northumberland fossil as the egg-case of a fish. Mr. Kidston had not yet seen the specimen now exhibited, but from a sketch he recognised its relation to Fayolia. At present there was still uncertainty as to the exact nature of this fossil.—Notes on Upper Jurassic Ammonites, with special reference to specimens in the University Museum, Oxford, ii.: Miss Maud **Healey**. This paper gives a re-description of the types of *Cardioceras vertebrale*, Sow., *C. scarbrugense*, Y. and B., *C. cordatum*, Sow., and *C. excavatum*, Sow., and their varieties. Four varieties of the first, nine of the second, three of the third and fourth are defined, and a description is given of a new species of Cardioceras belonging to the same group. Notes on species allied to the group and on others which have been wrongly confused with it are added. These species are so closely connected by innumerable transitional forms that their limits cannot be definitely fixed. The term "species" is therefore used as equivalent to Prof. J. W. Gregory's *circulus*: "It includes a number of 'forms,' which vary along lines radiating outward from a central type."—Sarsen-stones in a clay-pit: Rev. E. C. **Spicer**. Near to Bradenham, midway between High Wycombe and Prince's Risborough, certain clay-pits yield a clay for brick-making, in which are embedded large angular sarsen-stones, white saccharoidal sandstones with a siliceous cement.—On the occurrence of *Elephas meridionalis* at Dewlish (Dorset). Second communication: human agency suggested: Rev. Osmond **Fisher**. This paper is in continuation of one published by the author in 1888. The site in which the elephant-remains were found is a narrow trench, examined to a depth of 12 feet in places, with nearly vertical sides, a smooth, chalk bottom, and an abrupt end. It was not a fault or a stream-course, and it was partly filled with fine dust-like sand which may have been wind-borne. The trench cuts diagonally across the scarp; and, even if it could be accounted for by natural agencies, it is difficult to explain how it happened that so many elephants fell into it. The author points out that in Africa elephants are caught by the natives in pitfalls of similar character constructed on the tracks leading to watercourses. This trench is in a corresponding position with regard to a stream, and it is suggested as possible that the trench may have been of human origin. There is, however, no conclusive evidence elsewhere that man was contemporary with *Elephas meridionalis*, which is characteristic of the Pliocene age.

Royal Astronomical Society, November 11.—Prof. H. H. Turner, president, in the chair.—The long-period terms in the lunar theory: P. H. **Cowell**.—Determination of selenographical positions from measurement of lunar photographs: S. A. **Saunder**. This was the author's third communication on the subject, and in it he discussed the measures, made by Mr. J. A. Hardcastle, of four negatives taken at the Paris Observatory. The methods employed were explained, and a comparison was given with the results of other determinations, showing that a considerable increase in accuracy had been obtained.—The magnetic disturbances, 1882 to 1903, as recorded at the Royal Observatory, Greenwich, and their association with sun-spots: E. W. **Maunder**. From the examination and tabulation of the more considerable disturbances recorded, it had been found that disturbances succeeded each other at intervals corresponding to a synodical rotation of the sun. This occurred with too great frequency and regularity to be the result of chance coincidence, and it was concluded that the magnetic influence radiates from very restricted areas on the sun's surface, certain streams reaching the earth with each solar rotation. The relation of the magnetic disturbances with sun-spots was discussed, and it was pointed out that the theory threw light on the cause of the long straight rays, seen proceeding from the corona at some solar eclipses, and which sometimes reach a distance of several degrees.—Determination of the apex of the solar motion in space, and of the constant of precession, from a comparison of Groombridge's catalogue (1810) with modern Greenwich observations: F. W. **Dyson** and W. G. **Thackeray**.—The discussion on a paper by Dr. Rambaut on a very sensitive method of determining the errors of a pivot, with special reference to the pivot errors of the Radcliffe transit circle, was deferred, and other papers were taken as read.

Mineralogical Society, November 15.—Prof. H. A. Miers, F.R.S., president, in the chair.—Dr. J. W. **Evans** described two new forms of quartz-wedge by means of which approximate quantitative estimations can be readily made of the double refraction of minerals in small grains or in rock-sections.—Mr. J. **Currie** contributed a note on some new localities in Scotland and the Færöes of gyrolite and tobermorite, and Mr. C. R. **Lindsey** one on the occurrence of microscopic crystals of brookite with anatase in the Cleveland ironstone.—Mr. R. H. **Solly** exhibited and described various minerals from the Lengenbach quarry, Binnenthal. Three of these were new, viz. marrite and bowmanite, of which the chemical composition has not yet been determined, and lengenbachite, which has been shown by Dr. Hutchinson to be a sulpharsenite of lead containing some copper and antimony, and having a specific gravity of 5·8. Marrite occurs in small lead-grey crystals resembling modified cubes, and lengenbachite in thin lead-grey blade-shaped crystals, some as long as 40 mm., showing a highly perfect cleavage. Marrite crystallises in the oblique system with $a:b:c=0{\cdot}57634:1:0{\cdot}47389$ and $\beta=88°\ 45'$, while lengenbachite is probably anorthic. Bowmanite occurs in small honey-yellow rhombohedral crystals with $111:100=53°\ 50'$. It has a highly perfect cleavage parallel to 100, and a specific gravity of about 3·2. The author also described twinned crystals of seligmannite dispersed over large crystals of dufrenoysite and baumhauerite, and curious highly modified crystals of blende showing a thin metallic lead-grey coating.—Mr. H. L. **Bowman** described crystals of a mineral from Cornwall which had been sent to him for determination by Mr. F. H. Butler. They were found to be bertrandite, a mineral new to the British Isles.—Mr. G. F. Herbert **Smith** exhibited a slightly modified form of the hand refractometer which he had previously described.—Mr. H. **Hilton** contributed notes on some applications of the gnomonic projection to crystallography, and on the construction of crystallographic projections.

Zoological Society, November 15.—Dr. W. T. Blanford, F.R.S., vice-president, in the chair.—The mammals collected by Mr. E. Seimund in Fernando Po: Oldfield **Thomas**, F.R.S. Twenty-four species, of which two were new, were enumerated and remarked upon. Mr. Oldfield Thomas also exhibited some skulls and a piece of skin, and gave an account, of a new species of pig from the forests of Central Africa.—The crowned cranes of the genus Balearica, and a new species obtained on the White Nile by Lady William Cecil: Dr. P. Chalmers **Mitchell**.—The mouse-hares of the genus Ochotona inhabiting the Palæarctic region: J. Lewis **Bonhote**. These numbered sixteen species, one of which was described as new.—Twelve new species of earthworms from the north island of New Zealand: Prof. W. Blaxland **Benham**.

Chemical Society, November 16.—Prof. W. A. Tilden, F.R.S., president, in the chair.—The following papers were contributed:—The isomerism of the amidines of the naphthalene series (fifth communication on anhydro-bases): R. **Meldola** and J. H. **Lane**. When 2:4-dinitroaceto-α-naphthalide is reduced (1) by tin and hydrochloric acid, and

(2) by iron and hydrochloric acid, two isomeric amidoamidines are produced, the former giving rise to that having the α-NH constitution, and the latter to the β-compound. This difference in action is explained by assuming that in presence of iron the two nitro-groups are fractionally reduced while with tin both are reduced simultaneously.—Theory of the production of mercurous nitrite and of its conversion into various mercury nitrates: P. C. **Rây.** Mercurous nitrite is the first product of the action of nitric acid (containing nitrous acid) on mercury. This is converted into nitrate by the nitric acid, and finally, under suitable conditions, there ensues an accumulation of nitrite owing to the occurrence of the reaction represented by the following equation:—

$$4Hg + 4HNO_3 = Hg_2(NO_2)_2 + Hg_2(NO_3)_2 + 2H_2O.$$

—Amidechloroiodides: G. D. **Lander** and H. E. **Laws.** Benzoylaniline imidechloride reacts with hydrogen iodide furnishing an amidechloroiodide to which the constitution Ph.CCl.NHPh is provisionally assigned.—A new synthesis of *iso*caprolactone and certain derivatives: D. T. **Jones** and G. **Tattersall.** The lactone was obtained by the interaction of magnesium methyl iodide with ethyl lævulate.—The influence of substitution in the nucleus on the rate of oxidation of the side-chain, part ii., oxidation of the halogen derivatives of toluene: J. B. **Cohen** and J. **Miller.** The authors have studied the behaviour of the dichloro-, chlorobromo-, and dibromo-derivatives, and the comparative oxidisability of these compounds is discussed.—The halogen derivatives of naphthacenequinone: S. S. **Pickles** and C. **Weizmann.**—The constitution of pyrazolidone derivatives; β-phenylazo*iso*valeric acid and *s*-β-phenylhydrazidobutyric acid: B. **Prentice.**—Preliminary notice of some condensations of phenanthraquinone with ketonic compounds: F. R. **Japp** and J. **Wood.**—The decomposition of ethylene iodide under the influence of the iodide ion: A. **Slator.**—The spectrum generally attributed to chlorophyll, and its relation to the spectrum of living green tissues: W. N. **Hartley.** The author confirms his previous observations on the difference in the absorption spectra of alcoholic extracts of (*a*) fresh green leaves and (*b*) dried green leaves.—Studies on comparative cryoscopy, part ii., the aromatic acids in phenol solution: P. W. **Robertson.** The influence of various substituents on the molecular association of aromatic acids is discussed.—Isomeric change of diacylanilides into acylaminoketones. Transformation of dibenzoylaminobenzophenone into 1-benzoylamino-2-4-dibenzoylbenzene: F. D. **Chattaway** and W. H. **Lewis.**

Royal Meteorological Society, November 16.—Capt. D. Wilson-Barker, president, in the chair.—Meteorological observing in the Antarctic: Lieut. Charles **Royds,** R.N.—Decrease of fog in London during recent years: F. J. **Brodie.** The author had discussed the number of days of fog reported at Brixton, the London station of the Meteorological Office, for the thirty-three years 1871–1903, and found that the mean annual number of fog days was 55, of which 45 occurred in the winter half of the year, and only 10 in the summer half. December is the foggiest month with 9·5, the next being November with 8·5, January with 8·2, and October with 7·8. The clearest months are July with 0·4, June with 0·6, and May with 0·8. The greatest number of fog days was 86 in 1886 and 83 in 1887, and the least 13 in 1900 and 26 in 1903. Dividing the thirty-three years into three periods of eleven years each, the author showed that the mean for 1871–1881 was 55, for 1882–1892 it was 69, while for 1893–1903 it was only 41, there being thus a very marked decrease in the number of days with fog during the last eleven years.—Hurricane in Fiji, January 21–22, 1904: R. L. **Holmes.**

PARIS.

Academy of Sciences, November 21.—M. Mascart in the chair.—On the changes in dimensions and volume that the organs and tissues of plants undergo under the influence of desiccation: M. **Berthelot.** The length of the stem is not greatly affected, but the lateral dimensions, and therefore the capacity, diminishes to a considerable extent during drying.—Remarks on the necessity of studying the variations of dimensions and volume of organs and parts of living or extinct beings in anthropological and palæontological work: M. **Berthelot.**—On a general theorem concerning algebraic surfaces of linear connection superior to unity: Émile **Picard.**—On the removal of moisture from the air blown into the Isabella blast furnace, near Pittsburg, by freezing: Alfred **Picard** and M. **Heurteau.** The efficiency of a blast furnace is dependent to a considerable extent on the amount of moisture in the air supplied to the furnace. An account is given of a plant for removing this moisture by passing the air through a refrigerating chamber cooled to about −10° C. The results obtained show a surprising economy of fuel, the saving in the coke used amounting to 20 per cent.—On the constitution of ricinine: L. **Maquenne** and L. **Philippe.** The authors have shown in a previous communication that ricinine is converted by the successive action of caustic potash and hydrochloric acid into a methyloxypyridone. In the present paper a detailed study of this substance is given.—New experiments on the photographic registration of the action of the *n*-rays on a small electric spark: R. **Blondlot.** A refinement of the method given in a previous paper, and an investigation of the possible sources of error. The photographic negatives obtained are regarded by the author as establishing beyond cavil the action of the *n*-rays on the electric spark.—On continued algebraic fractions: R. de Montessus **de Ballore.**—The generalisation of a theorem of Weierstrass: Maurice **Fréchet.**—Fourier's series and Taylor's series on its circle of convergence: P. **Fatou.**—On the chemical composition of the radio-active gaseous mixtures given off from the water of some thermal springs. The presence of helium: Ch. **Moureu.** The gases evolved from twelve different springs were analysed, and the figures given for the amounts of carbon dioxide, oxygen, nitrogen, and gases of the argon group.—The influence of the nature of the anode on the electrolytic oxidation of potassium ferrocyanide: André **Brochet** and Joseph **Petit.** The nature of the metal used as the anode has a very considerable effect on the electrolytic oxidation of potassium ferrocyanide, the yields varying from 75 per cent. in the case of copper to nil in the case of metals forming a soluble anode.—On the complexity of dissolved sulphates: Albert **Colson.** On the assumption that the lowering of the freezing point of a solution of sulphuric acid is due to the single molecule H_2SO_4, the author draws the conclusion that the sulphates of the bivalent metals in aqueous solution are present as double molecules.—The stimulating and paralysing influence of certain bodies in the production of rust: L. **Lindet.**—On the purification of solutions of vanadate of soda; observations relating to the methods of double decomposition for the industrial separation of metals: M. **Herrenschmidt.** An explanation of the use of vanadic acid in preference to sulphuric acid in the separation of silica and vanadic acid.—The action of iodine and yellow oxide of mercury on unsaturated acids. The separation of isomers: J. **Bougault.** The results obtained depend upon the position of the ethylene linkage in the molecule. Acids with the βγ linking fix hypoiodous acid in a very stable manner, giving rise to iodolactones.—Researches on the action of hydrobromic and hydrochloric acids on triacetin. Formation of some new halogen derivatives of triacetin: R. **de la Acéña.**—The addition of hydrogen to some aromatic ketones by means of reduced nickel. A new method of synthesis of aromatic hydrocarbons: Georges **Darzens.** With nickel reduced from its oxide at a temperature of 300° C., and working the Sabatier and Senderens reaction at 190° C. to 195° C., aromatic ketones of the formula $C_6H_5—CO—R$ are reduced to hydrocarbons of the type $C_6H_5—CH_2—R$, without the production of any appreciable amount of the hexahydroderivative. If, on the other hand, the nickel is reduced at the lowest possible temperature, so that it is very active, the addition product makes its appearance. Details are given of the application of this reaction to several ketones, and the method appears to be a general one for the production of hydrocarbons.—The action of pyridine and quinoline bases on bromosuccinic and dibromosuccinic esters: Louis **Dubreuil.**—The theory of colouring matters: Jules **Schmidlin.**—On trehalase, its general presence in fungi: Em. **Bourquelot** and H. **Hérissey.** Trehalase appears to be an enzyme generally present in fungi, the times of its appearance and disappearance being possibly in close relation with the utilisation of trehalose or the storage of the latter in the form of reserve material.—On the measurement and the laws of variation of the energy shown by the

ergograph according to the frequency of the contractions and the weight raised: Charles **Henry** and Mlle. J. **Joteyko.**—On the law of variation of weight of *Penicillium glaucum* as a function of its age: Mlle. W. **Stefanowska.** The results are expressed graphically, and show that the evolution of the weight of these fungi as a function of the time presents two well marked phases: a phase of rapid ascent up to the period of fructification, and a phase of decrease appearing suddenly after fructification.—Transformations of the new secreting apparatus in Conifers: G. **Chauveaud.**—On vegetation in atmospheres rich in carbon dioxide: E. **Demoussy.** With one exception, there is a marked advantage in supplying plants with an additional amount of carbonic acid, the average increase in the weight of the aërial parts of the plant being 60 per cent. greater in the case of the artificial atmosphere.—On the experimental production of radishes with starchy reserves: Marin **Molliard.**—*Solanum Commersoni* and its variations in relation to the origin of the cultivated potato: Edouard **Heckel.**—A new theory of phototropism: Georges **Bohn.**—On the geology of the Salzkammergut: Emile **Haug** and Maurice **Lugeon.**—On the mountain chains to the south of the Guadalquivir: Robert **Douvillé.**—The tension of carbonic acid in the sea and on the reciprocal influence of the carbonic acid of the sea and that of the atmosphere: August **Krogh.** From a study of the equilibrium between sea-water and the carbonic acid of the air, the conclusion is drawn that the proportion of carbon dioxide in the air tends to increase, the sea, by absorbing the gas, opposing this tendency.—The measurement of the sensitiveness of taste in men and women: N. **Vaschide.**—The elimination of sulphur and of phosphorus, the demineralisation of the organism, and the magnitude of the average molecule elaborated in persons suffering from skin diseases: A. **Desgrez** and J. **Ayrignac.**—On the relations between Surra and Mbori: MM. **Vallée** and **Panisset.**—Remarks by M. **Laveran** on the preceding communication.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 1.

ROYAL SOCIETY, at 4.30.—The Ascent of Water in Trees: Dr. A. J. Ewart.—On the Presence of Tyrosinases in the Skins of some Pigmented Vertebrates: Miss F. M. Durham.—On the Structure and Affinities of the Fossil Plants from the Palæozoic Rocks. V.—On a New Type of Sphenophyllaceous Cone (*Sphenophyllum fertile*) from the Lower Coal Measures: Dr. D. H. Scott, F.R.S.—On Chemical Combination and Toxic Action as Exemplified in Hæmolytic Sera: Prof. R. Muir and C. H. Browning.—Histological Studies on Cerebral Localisation. Part II.: Dr. A. W. Campbell.

CHEMICAL SOCIETY, at 8.—The Nitrites of the Alkali Metals and Metals of the Alkaline Earths, and their Decomposition by Heat: P. C. Rây.

RÖNTGEN SOCIETY, at 8.15.—The Perspective Nature of X-Ray Projection: Dr. W. Cotton.—The New Ultra-violet Glass recently produced by Messrs. Schott and Genossen, of Jena: J. H. Gardiner. Both will be illustrated by the Epidiascope.

LINNEAN SOCIETY, at 8.—Proteid Digestion in Animals and Plants: Prof. Sidney H. Vines, F.R.S.

FRIDAY, DECEMBER 2.

AËRONAUTICAL SOCIETY, at 8.—The Aëronautical Exhibits at the St. Louis Exhibition: the President, Major B. Baden-Powell.—Kites, Kite-flying and Aëroplanes: W. H. Dines.—The Work of the International Aëronautical Commission: Dr. M. H. Hergesell.—Captive Balloon Photography: Griffith Brewer.

GEOLOGISTS' ASSOCIATION, at 8.—On the Superficial Deposits of Central and Parts of Southern England: Dr. A. E. Salter.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Midland Railway, West Riding Lines: The Construction of Contract No. 1: R. T. McCallum.

MONDAY, DECEMBER 5.

SOCIETY OF ARTS, at 8.—Musical Wind Instruments: D. J. Blaikley. (Cantor Lecture II.—Brass Instruments.)

SOCIETY OF CHEMICAL INDUSTRY, at 8.—(1) Raschig's Theory of the Lead Chamber Process; (2) Theory of the Action of Metals on Nitric Acid: Dr. E. Divers, F.R.S.—A Rapid and Accurate Method for the Estimation of Phosphorus in Iron Ores: L. J. Davies.—Fluorescope for Comparing Substances under the Influence of Radium Rays: C. S. S. Webster.

VICTORIA INSTITUTE, at 4.30.—The Right Way in Psychology: Rev. F. Storrs Turner.

TUESDAY, DECEMBER 6.

ANTHROPOLOGICAL INSTITUTE, at 8.—Exhibition of a Slate Adze and Other Objects: Rev. R. Ashington Bullen.—Lantern Illustrations of Native Types from South India: Edgar Thurston.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Distribution of Electrical Energy (*Discussion*): J. F. C. Sneil.—On the Construction of a Concrete Railway-Viaduct: A. Wood-Hill and E. D. Pain.

WEDNESDAY, DECEMBER 7.

SOCIETY OF ARTS, at 8.—The International Exhibition at St. Louis: W. F. Reid.

SOCIETY OF PUBLIC ANALYSTS, at 8.

GEOLOGICAL SOCIETY, at 8.—The Chemical and Mineralogical Evidence as to the Origin of the Dolomites of Southern Tyrol: Dr. E. W. Skeats.—Certain Genera and Species of Lytoceratidæ: S. S. Buckman.

ENTOMOLOGICAL SOCIETY, at 8.—On *Erebia bejarensis* and *Erebia stygne* in Spain, with an Exhibition of Specimens: Dr. Thomas A. Chapman.

THURSDAY, DECEMBER 8.

ROYAL SOCIETY, at 4.30.—*Probable Papers*:—Memoir on the Theory of Partitions of Numbers. Part III: Major P. A. MacMahon, F.R.S.—Note on a Means of Producing a High-voltage Continuous or "Pertinacious" Current: Sir Oliver Lodge, F.R.S.—The *Rôle* of Diffusion during Catalysis by Colloidal Metals and Similar Substances: Dr. H. J. S. Sand.—The Effect of Liquid Air Temperatures on the Mechanical and other Properties of Iron and its Alloys: Sir James Dewar, F.R.S., and R. A. Hadfield.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—Notes on Portland Cement: H. E. Bellamy.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Hydrodynamical and Electromagnetic Investigations regarding the Magnetic-Flux Distribution in Toothed-Core Armatures: Prof. H. S. Hele-Shaw, F.R.S., Dr. A. Hay, and P. H. Powell. (Conclusion of Discussion).—Studies in Magnetic Testing: G. F. C. Searle.

SOCIETY OF ARTS, at 4.30.—Burma: Sir Frederic Fryer, K.C.S.I.

MATHEMATICAL SOCIETY, at 5.30.—On Groups of Order $p^{\alpha}q^{\beta}$: Prof. W. Burnside.—On the Linear Differential Equation of the Second Order: Prof. A. C. Dixon.—On a Deficient Multinomial Expansion: Major P. A. MacMahon.

FRIDAY, DECEMBER 9.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—Ticks and Tick-transmitted Diseases: Dr. Nuttall, F.R.S.

MALACOLOGICAL SOCIETY, at 8.—Description of a new species of Trachiopsis from British New Guinea: H. B. Preston.—A Correction in Nomenclature: E. A. Smith.—Notes on the American Cyclostomatidæ and their Opercula: W. H. Dall.—Note on the Dates of Publication of the Various Parts of Moquin-Tandon's "Hist. Moll. terr. fluv. de France": J. W. Taylor.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 8.—On a Rapid Method of Approximate Harmonic Analysis: Prof. S. P. Thompson, F.R.S.—A High-Frequency Alternator: W. Duddell.—Exhibition of Experiments to show the Retardation of the Signalling Current on 3500 miles of the Pacific Cable between Vancouver and Fanning Island.—Exhibit of Ayrton-Mather Galvanometers, Universal Shunts, and Electrostatic Instruments.

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