THURSDAY, NOVEMBER 10, 1904.

JUSTUS VON LIEBIG AND FRIEDRICH MOHR.

Monographieen aus der Geschichte der Chemie. Herausgegeben von Dr. Georg W. A. Kahlbaum. viii. Heft. Justus von Liebig und Friedrich Mohr in ihren Briefen von 1834–1870. Pp. viii+274. (Leipzig: Johann Ambrosius Barth, 1904.) Price 8 marks.

DR. KAHLBAUM continues to put those chemists who are interested in the personal history of their science under an obligation to him by reason of the care and assiduity which he devotes to the editing of the letters of the great leaders of chemical inquiry such as Berzelius, Liebig, Wöhler, and others, as these from time to time come into his keeping. The volume before us deals with the correspondence of Liebig and Friedrich Mohr.

Of Liebig it is unnecessary at this date to say anything. His name and personal characteristics are well known to all who are interested in science, and his position in the history of science is assured for all time. Whilst his correspondence with Mohr adds but little to our knowledge of him as a man, it throws many sidelights on incidents which occurred during the most interesting and active periods of his career. Thus, for example, we learn for the first time of the relative share of Liebig and Wöhler in the work which resulted in the classical memoir on bitter almond oil. Most of the experimental work was due to Wöhler; the interpretation of the facts and the compilation of the memoir was made by Liebig. It would appear, in fact, that Wöhler never saw the memoir until the proof of it was sent to him.

Indeed, the chief interest of the correspondence, so far as it relates to Liebig, is concerned with his work as editor of the famous periodical—the *Annalen der Chemie und Pharmacie*—which is now permanently associated with his name.

The name of Friedrich Mohr is much less familiar, at all events to the chemists of this generation; and yet the author of the "Titrier-methode"—the practical founder of the art of volumetric analysis—deserves to be had in remembrance. He was a representative of a type of man of which few examples, at least in this country, are left to-day, viz. that of the scientific apothecary. He was by instinct, training, and practice a man of science, and he brought his knowledge, experience, and aptitudes as a man of science to the exercise of his calling. In this respect he resembled many of those who laid the foundations of modern chemical science. In the early part of the last century the occupation of the apothecary was practically the only one open to the man who had his living to make, and who at the same time wished to exercise his passion for chemical inquiry. Teaching appointments were few, and even where chemistry was taught the opportunities for experimental work were very meagre.

Mohr was born in Coblenz at about the time that Dalton gave the New Philosophy to the world. His father, Karl Mohr, apothecary, town councillor and member of the Rhenish Medical College, was a person of some importance in the city, and it was probably in his house that the authors of this correspondence first made each other's acquaintance.

Coblenz, from its proximity to the French frontier, was the scene of many stirring episodes during the early years of the nineteenth century, and Mohr himself lived through the time of, and was personally witness to, the rise and collapse of French military power during the interval between Moscow and Sedan. As a little boy he might have seen the passage of the Rhine by the French troops on the occasion of Napoleon's invasion of Russia, and have spelled out the magniloquent inscription on the fountain before St. Castor which commemorates that event, as well as the caustic words which St. Priest, the Russian commander following on the heels of the retreating French, caused to be added:—"*Vu et approuvé par nous, Commandant Russe de la Ville de Coblence: Janvier 1er* 1814." As an old man he saw, after the *debâcle* of Sedan, the spectacle of a ruined and discredited War Minister skulking about in the twilight under the shade of the chestnuts in the Poppelsdorfer Allée in Bonn in just fear of the taunts and insults of the unfortunate soldiery whom he had betrayed.

In 1829 Mohr went to Heidelberg, where he came in contact with Leopold Gmelin. He had already acquired a considerable knowledge of operative chemistry and of pharmacology under his father's tuition. In those far-off days the laboratory of an apothecary was a reality, and those who practised the calling were not merely chemists by prescription, but were such in fact. They were for the most part well skilled in chemical processes, and actually made the greater number of the substances in which they dealt. The influence of this early training is to be seen in the character and scope of Mohr's subsequent work. He was essentially a *practical* chemist, and his services to the science consisted mainly in the improvements he effected in operative chemistry. Many of these humble but useful inventions were not calculated to bring their author much fame, but if his connection with them is well-nigh forgotten they at least secured for him the gratitude of his contemporaries. How many of the present generation of workers, it may be asked, associate his name with that commonest of laboratory appliances—the cork-borer?

Mohr remained at Heidelberg two years, and then repaired to Berlin to listen to Heinrich Rose's lectures. In 1832 he returned to Heidelberg and took his degree —*summa cum laude*. What a *summa cum laude* meant in 1832, so far as regards chemistry, may be inferred from the fact that the "hoch berühmten Führer," Gmelin, recorded that "the Herr Kandidat answered his questions on the chemical relations of iodine, the preparation of potassium iodide, the discovery of arsenic and on the preparation and composition of ether to his complete satisfaction." Creuzer found that he displayed considerable knowledge of what the old Greeks and Romans knew of botany and *materia medica*, and that he had a competent acquaintance with their languages; Muncke was satisfied with his answers concerning the balance,

the pyrometer, and the electrical relations of bodies; Leonhard with those on mineralogy and geology; and Schweins recorded that the "Kandidat als Pharmazeut ungewöhnliche Kenntnisse in der Mathematik besitzt" —whatever that might imply.

The subjects in which Mohr took his degree continued to interest him to the end of his days. In chemistry he was no theorist; indeed, the speculative side of this science seemed to have little or no attractions for him; and this is the more remarkable when it is remembered that in other departments of human thought he let his imagination have the fullest play, as may be seen in his "History of the Earth." Further, Mohr has some claim to be regarded as an independent discoverer of the law of the conservation of energy, as his tombstone in the old "Friedhof" in Bonn testifies.

To the historian of chemistry these letters have a special interest. If, as has been said, they add little to our knowledge of Liebig as a man and as a leader in science, they nevertheless afford much valuable information concerning matters which agitated the chemical world during some of the most stirring periods of the last century. They have been most carefully annotated by the editor and his assistants, as the numerous foot-notes indicate. Many passages and allusions which might have been obscure have been elucidated by their patient research. We can heartily commend the book to all who are interested in the personal and biographical history of chemistry.

T. E. T.

THE BIONOMICS OF EXOTIC FLOWERS.

Handbuch der Blütenbiologie. Begründet von Dr. Paul Knuth. iii. Band. Die bisher in ausser-europäischen Gebieten gemachten blüten-biologischen Beobachtungen unter Mitwirkung von Dr. Otto Appel. Bearbeitet und herausgegeben von Dr. Ernst Loew. i. Theil. Cycadaceæ bis Cornaceæ. Pp. 570; mit 141 Abbildungen im Text. (Leipzig: Engelmann, 1904.) Price 17*s.* net.

THIS valuable summary of available information concerning the pollination of exotic flowers maintains the high standard of the preceding volumes, though it naturally deals with knowledge essentially fragmentary and only rarely founded on a statistical basis. The work does not limit itself to imparting information upon actual observations on pollination, but in some cases includes accounts of the forms and colours of flowers, the arrangement of their nectaries, and even the microscopical details of fertilisation. As examples of the various matters dealt with, the following may be cited:—Freycinetia and its suggested pollination by bats, the remarkable synchronous blossoming habits of *Dendrobium crumenatum*, parthenogenesis in Ficus, Kooders's work on tropical geocarpous plants, the fertilisation of Rhopalocnemis, the peculiar flowers of the commelinaceous Cochliostema and their morphology, species of Yucca and their relations with Pronuba.

Among the many interesting features of the work we may note that in bringing together in one work the scattered observations on ornithophilous pollination it renders possible a survey of existing knowledge concerning the inter-relations of birds and flowers. Yet the facts recorded show the rudimentary stage of our knowledge as to the significance of birds in the shaping of flowers. Scattered through the present work we find evidence of actual or possible ornithophilous flowers belonging to a considerable number of natural orders, including the Bromeliaceæ, Liliaceæ (Alöe), Scitamineæ, Orchidaceæ, Proteaceæ, Loranthaceæ, Ranunculaceæ (Aquilegia), Capparidaceæ, Rosaceæ (almond, peach, quince), Caricaceæ, Leguminosæ, Melianthaceæ, Balsaminaceæ (Impatiens), Malvaceæ, Cactaceæ, Rhizophoraceæ, Myrtaceæ, Marcgraviaceæ, and Passifloraceæ. Included among these are flowers, such as the peach and almond, obviously not originally ornithophilous, and others, such as Passifloraceæ and *Aquilegia canadensis*, the pollination of which by birds is dubious. Still others there are, such as *Carica Papaya*, the structure and creamy tint of the flowers of which scarcely suggest ornithophily. Other observations show that in different parts of the earth the same species of flower is visited by different animals. For example, the entomophilous Japanese *Eriobotrya japonica* is visited by humming-birds in South America, and by honey-birds in South Africa. On the other hand, certain natural orders, such as the Loranthaceæ and Mimosaceæ, markedly show pollination, or at least regular visitation, by honey-birds in the Old World and by humming-birds in the New World; and some flowers of remarkable structure, such as those of *Amherstia nobilis* and *Hibiscus schizopetalus*, visited by birds seem to demand correspondingly remarkable methods of pollination.

The fragmentary nature of our knowledge in regard to pollination is shown by the lack of published information in regard to some of the commonest plants. For instance, *Bombax malabaricum* is not mentioned in this work, yet it is very widely distributed, and even common in some regions; and in southern China I know that its large red flowers are visited by small birds. In some cases the omission of information is due to oversight on the part of the authors; for example, there is no reference to the Vallisneria-like pollination of the submarine Enhalus. The work also shows that additional observations are required in regard to some of the commonest tropical plants. As a case in point, it may be said that few of those who have scented *Pandanus odoratissimus* at distances of a quarter of a mile will accept without further examination the view that littoral species of Pandanus are anemophilous. Or, again, Knuth found that the flowers *Cassytha filiformis* were mostly cleistogamous on the coral islands of the Java Sea; but unpublished observations of my own on Dane's Island, near Canton (China), sufficiently showed that this is not the case everywhere.

In regard to the printing of the work, it must be confessed that misprints are too numerous, a brief examination showing the following:—Kleistoam, Magroglossa, Abitulon, Spahtiphyllum, and Bromeliaceenhlüten.

PERCY GROOM.

RECENT PHILOSOPHICAL WORKS.

(1) *A Primer of Philosophy.* By A. S. Rappoport, Ph.D. Pp. 118. (London: John Murray, 1904.) Price 1s. net.

(2) *Religion und Naturwissenschaft. Eine Antwort an Professor Ladenburg.* By Arthur Titius. Pp. 114. (Tübingen und Leipzig: J. C. B. Mohr (Paul Siebeck), 1904.) Price 1.80 marks.

(3) *Philosophische Propädeutik auf Naturwissenschaftlicher Grundlage.* By August Schulte-Tigges. Zweite verbesserte und vermehrte Auflage. Pp. xvi+221. (Berlin: Georg Reimer.) Price 3 marks.

(4) *Der Skeptizismus in der Philosophie.* By Raoul Richter. Erster Band. Pp. xxiv+364. (Leipzig: Dürr'sche Buchhandlung, 1904.) Price 6 marks.

(1) DR. RAPPOPORT'S book, which appears in Mr. Murray's new series of primers, is on the whole a very satisfactory introduction to the study of philosophy. The statement is always accurate, interesting and suggestive, and the terminology is carefully chosen. There are many interesting quotations; perhaps those from the German will not always be understood without a translation by the average reader of a primer. On p. 2 the statement "it was astonishment that first made man philosophize" is attributed to Aristotle. No doubt Aristotle said so, but Plato had the same idea before him. On p. 45 the term sociology is said to be derived from the Latin word *socius*, society (*sic*).

(2) "Religion und Naturwissenschaft" is a counterblast to a lecture given by Prof. Ladenburg of Breslau, on the influence of the natural sciences on the *Weltanschauung*. Prof. Ladenburg, as represented by the quotations from his work, appears to believe that experiment, observation, induction, are the key of all knowledge, and that all the progress of the last centuries has been caused chiefly by the enlightenment due to the natural sciences. This rather extreme position Prof. Titius assails with some success, and then proceeds to vindicate the spiritual life of man, individualisation, *Wertbestimmung*, Christianity, even miracles, on lines that are not altogether novel. But the author is no obscurantist, and the argument is probably as convincing as any popular discussion can make it.

(3) The third work on our list is intended to introduce pupils of the highest classes in *Realgymnasien* to the philosophic principles that underlie scientific method and the general scientific thought of our time. The first part deals with *Methodenlehre*, and discusses observation and experiment, induction, causal law and hypothesis, deduction. In the second part, entitled "The Mechanical View of the Universe, and the Limits of Knowledge," there is an adequate account of such things as atomism, teleology, the Darwinian theory, and the relations of psychical events and their physiological accompaniments. On this last head the author declares himself for a theory of parallelism, not as being the solution of the problem, but the problem itself. The book is excellent both in form and statement, and all the arguments both for and against a particular view are most fully and impartially stated. The quotations show a wide range of reading; but it would perhaps be well if the author's name and the title of the work in question were added in every case.

(4) The first volume of "Der Skeptizismus in der Philosophie" contains an account only of Greek scepticism, that is to say, of Pyrrhonism and of the scepticism of the Later Academy. But as many of the chief problems raised by scepticism in all ages are discussed here at considerable length, this first volume cannot safely be neglected even by those who are chiefly interested in Hume, the "partial" scepticism of Kant, or modern positivism. The author shows himself a most competent guide. He is always fair minded; even where it is most difficult to be patient with certain well-known quibbles of the Pyrrhonists he labours seriously to discover the grain of truth amid the heap of chaff. Almost a hundred pages are given to a discussion of "sensual scepticism," *i.e.* the scepticism which bases itself upon the contradictory perceptions of the same object experienced by different living creatures, by different human beings, by the same human being at different times, and the like. These arguments, according to this work, have weight only as against extreme realists, and both (extreme) idealism and moderate realism (*e.g.* the realism of Locke) are represented as able to face the situation. With which of the two last named the author's sympathies ultimately lie is not apparent from this first instalment; it will doubtless become evident in the second (and concluding) volume. It is to be hoped for every reason that so excellent a work will soon reach completion.

THE CHRISTIAN CENTURY IN JAPAN.

Geschichte des Christentums in Japan. By Dr. J. Haas. Band ii. Pp. xxvii+383. (Tokio: 1904.)

IN this second volume Dr. Haas—whom we congratulate on the well merited doctorate in theology recently conferred upon him by the University of Strassburg—pursues the history of the Christian missions in Japan from the departure of Xavier in 1549 to the year 1570 under the leadership of the Jesuit superior Cosmo de Torres, of Valencia. During that period, and, indeed, almost up to the close of the sixteenth century, the task of conversion lay entirely in the hands of the Jesuits, while the increasing trade with Japan was monopolised by the Portuguese. The sources of Dr. Haas's history are almost wholly European, and above all the famous letters of the Jesuit missionaries from Japan, of which the volume is largely a précis. These authorities are not, however, sufficient, and with the progress of the work it becomes more and more evident that the true history of the Christian century in Japan can only be written in the Peninsula, where, as Father Cros's great book on "St. François de Xavier" tells us, in the inexhaustible archives and libraries of Lisbon and Madrid, and in those of Simancas, Coimbra, Evora, and Ajuda, are to be found the original documents in vast numbers from which alone an adequate account of that most interesting chapter in the world's history can be gathered.

In the score of years covered by the present volume the faith was preached over the whole of Kiushiu and most of Central Japan, the northern and eastern Daimiates and the whole of the great island of Shikoku

being untouched. This work was accomplished by eleven Jesuit fathers, assisted by four converts. In 1564 the Daimio of Ōmura, the first Christian Daimio, known as Sumitada, or Ōmura Risen (Risen was his Buddhist name), was baptised, and adhered to the faith until his death in 1587. It is of this convert that Crasset writes :—

"He went to the chase of the bonzes as to that of wild beasts, and made it his singular pleasure to exterminate them from his states" ("Murdoch," p. 238).

It would, however, be merely special pleading to take this language literally, otherwise than as expressing the worthy father's admiration of the vigour with which the newly made convert promulgated Christianity within his petty domain. Up to 1570, out of the fifteen or sixteen millions of Japanese, some twenty thousand had been baptised. This seems a small proportion, but the true measure would be the ratio of the baptised to the population of those parts of Japan where the gospel had been, with some adequacy, preached. As to the quality of their Christianity it is difficult to form a judgment. The steadfastness of large numbers under persecution is some guarantee of the reality of their belief; on the other hand many in becoming Christians followed the example or obeyed the commands of their feudal superiors.

Another much debated point, not easy to determine, is to what extent the native converts "provoked" the immense majority who still adhered to the Way of the Gods and the Way of Buddha. It is certain that the Buddhists were "provoked," but there is little evidence that they had any real cause of complaint during the period now considered—the provocation was of a passive, not of an aggressive character. On the whole, the fathers were far from unpopular with the common folk. They were looked upon as superior beings, and Froez says of his reception at Yokoseura :—

"All the Christian inhabitants came to meet us and were so delighted at our arrival that they would willingly have taken us on their shoulders and borne us off."

It was not until 1587 that persecution began, the result of a fit of policy of the cruel, crafty, but capable Taiko, Hideyoshi.

Dr. Haas writes lucidly, and his pages are full of interesting details; but the narrative is obscured by an over-abundance of matter that might well be relegated to notes or appendices. The Germans seem unable to distinguish between books and note-books.

F. VICTOR DICKINS.

OUR BOOK SHELF.

Lectures on the Diseases of Children. By Robert Hutchison, M.D., F.R.C.P. (London: Edward Arnold.) Price 8*s.* 6*d.* net.

IT is difficult to praise this little volume too highly. It deals with one of the most attractive and satisfactory subjects in medicine, the treatment of children's diseases; the style is excellent, and the illustrations, which, with one or two exceptions, are taken from photographs of the author's cases, are unusually good.

In some three hundred pages Dr. Hutchison describes aspects of some of the more common diseases of childhood which, as he says, "are not usually dealt with in systematic lectures." In the first instance, the lectures were given at the London Hospital; subsequently they were published serially in the *Clinical Journal,* while their present appearance in book form is in response to the request of a number of readers who wanted them in a convenient form for reference.

The early chapters deal with the problems of infant feeding, and the subject, which unfortunately is closely allied, of the various digestive disturbances which occur in hand-fed babies. Upon questions of diet Dr. Hutchison speaks with special authority, and his remarks on the difficult subject of artificial feeding are concise and practical.

In the space of a short lecture it is not possible or desirable to deal with all the conceivable methods by which children might be, or have been, fed, but it seems an omission not to mention "laboratory" milk, which, whatever its objections, certainly offers the physician a method of wonderful precision in prescribing the exact percentage of fat, proteid, and lactose which he requires for any individual patient. The establishment in London of the Walker Gordon Laboratory, at which this milk can be obtained, and the existence of a farm in connection with it at which every precaution is taken to procure germ-free milk with scientific accuracy, certainly deserve mention in any book which deals with the subject of substitute feeding. The expense of "laboratory" milk puts it beyond the reach of many babies, but it is less expensive than a wet nurse, and avoids all the disadvantages inseparable from employing one.

In succeeding chapters Dr. Hutchison deals with various common diseases of childhood. They are all delightful reading, full of common sense and helpful suggestion as to diagnosis and treatment. One would like to quote extensively, but the book is one that every student of the subject, whether he be qualified or not, should possess.

Special interest attaches to the lecture on mental deficiency in childhood, often a subject of great difficulty in practice, and one with which the ordinary text-book scarcely deals. The photographs illustrating this chapter are particularly good.

The concluding chapters are devoted to the diagnostic significance of some common symptoms, such as wasting, cough, fever, &c. It is impossible to do full justice to this delightful book in a short notice. The work forms a valuable adjunct to the good text-books already written on the subject, and it shows to the full the clinical knowledge and the literary ability of the author, whose reputation, already high, will no doubt be increased by it.

Elementary Manual for the Chemical Laboratory. By Louis Warner Riggs, Ph.D., Instructor in Chemistry in Cornell University. Pp. vi+138. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1904.) Price 5*s.* 6*d.* net.

THIS volume embodies the author's idea of what should be taught during a one-year course of chemistry, the time available being not less than a hundred and twenty hours for laboratory practice, and sixty for "recitation" work. It is arranged in short numbered paragraphs, each containing a direction to the student or an explanation of some point or process, and is intended to be used, under the guidance of an instructor, in conjunction with some general text-book of chemistry and physics.

About one-third of the work is devoted to preliminary experiments in general chemistry. The student is then introduced to simple volumetric analysis, the principles of which are very well explained

—this forming, perhaps, the best portion of the book. After three experiments in gravimetric work the learner passes on to systematic qualitative analysis, treated from the standpoint of electrolytic dissociation. The author recognises that, "logically," the quantitative work should follow rather than precede the qualitative; but after repeated trials he prefers the order indicated. In the present connection, however, the matter is more one of convenience than of logic.

Accepting the author's system, the experiments themselves are judiciously selected, and well fitted for their purpose. But there are educationists who would by no means agree that "theoretical explanations should be reserved for the recitation-room," and not given in the laboratory. Still less would they say that the students should "study thoroughly all the details of an experiment before attempting to perform it," and that "this should be done outside the laboratory." Whether such a system would tend to produce a hodman or an architect would depend, as it seems to the writer, less upon its own merits than upon the personality of the instructor. C. S.

Die Einheit der Naturkrafte in der Thermodynamik. By Richard Wegner. Pp. viii+132. (Leipzig: Von Veit and Co., 1904.)

As described in the secondary title, this pamphlet is an attempt to deduce from the kinetic energy of non-elastic atoms, corporeal and ethereal, all known physical forces, chemical, electrical, and mechanical, including gravity. Nothing Boschovichian is assumed; only the kinetic energy of moving atoms of different sizes. It is not easy to follow an argument which provisionally assumes that the atoms are held together to form molecules with regular vibration frequencies capable of propagating through the surrounding swarm of ether-atoms waves of condensation and rarefaction, by means of the reactions and interference of which (when there are two or more molecules) attractions are brought into being; and which then, in terms of this general outlook, gives reasons why the reaction of the ether atoms may be found sufficient to hold the corporeal atoms together. A necessary consequence of the investigation is that gravity is propagated in time, and should be a function of the temperature. The author has tested the latter point by experiment, and finds some evidence in favour of its truth. The source of the chemical elements is found in the different magnitudes of the atoms, with the corresponding differences in their energetic combinations. The temperature of a body is proportional to the mean molecular weight, multiplied by the square of the mean translational velocity of the molecule; divided by the relative number of molecules in unit volume; multiplied by the relative mean path of the molecule. Since, according to the theory elaborated, the kinetic energy of the elementary particles implies attraction, all bodies will be surrounded by a layer of condensed gas and ether particles. In the waves in the ether sheath is found the source of the electrical current. Electrostatic action, on the other hand, depends on chemical actions in the ether sheath. The applications to chemical and electrical phenomena are admittedly crude and imperfectly worked out; but the author claims to have proved the possibility of deducing all the recognised forces of nature from the kinetic energy of non-elastic Lucretian atoms.

The Science and Practice of Photography. By Chapman Jones, F.I.C., &c. Fourth edition. Pp. 569. (London: Iliffe and Co., Ltd., 1904.) Price 5*s.* net.

THIS volume, which is the fourth edition of the work, has been very greatly enlarged and rewritten since the appearance of the third edition, the number of chapters having been increased from fifty-five to sixty-eight. It may be considered as forming a most excellent guide to the practice of photography, and a perfect reference for those who so continually question one as to "the best book on photography, for a beginner, you know"; and it will doubtless prove useful as a reference book to many who have long passed the beginner stage. There is a decision of tone and clearness of exposition, combined with an intelligent anticipation of the many questions which arise at every step of the path, which render it especially suitable for this purpose.

At the same time, the scientific reader who hopes to gain from it some account of the work which has been done of late years, with a view to the clearing up in some measure of the chemical and physical problems in which photography abounds, will probably be greatly disappointed. The two most noteworthy features of this, as of almost all English works on photographic science, are found in the method in which contemporary German literature is ignored, and in which the whole of modern physical chemistry is disregarded. The fact, for instance, that development may be regarded as a reversible heterogeneous reaction occurring between ionised salts, in accordance with the mass law, seems to be entirely beyond the idea of this or any other book on the subject. Development with ferrous oxalate is here represented by the equation:—

$$3AgBr+3FeC_2O_4=FeBr_3+Fe_2(C_2O_4)_3+3Ag,$$

which, involving as it does the existence of ferric ions in the developer after use, gives a sufficiently distorted view of the reaction. While we find the chemical theory of the book to be of this type, the information as to the progress of sensitometry is of the slightest, no mention whatever being made of the notable researches by Dr. Eder. A most original suggestion as to the nature of the developable condition is to be found at the close of the chapter devoted to that subject. In brief, this book is a most delightful manual of the practice of photography, but can scarcely claim to represent the scientific side of the subject in any sense whatever. C. E. KENNETH MEES.

Ants and Some Other Insects. An Inquiry into the Psychic Powers of these Animals. With an Appendix on the Peculiarities of their Olfactory Sense. By Dr. August Forel. Translated from the German by Prof. William Morton Wheeler. Pp. 49; figures. (Chicago, 1904.) Price 2*s.* 6*d.*

AN elaborate treatise on the senses of insects, especially ants, illustrated by numerous experiments. The book deserves the most serious attention of students of psychology and animal intelligence; but it would occupy too much space, nor would any useful object be gained, by attempting to epitomise either the body of the work or even the author's deductions. We may, however, quote the following conclusions:—

"Even to-day I am compelled to uphold the seventh thesis which I established in 1877 in my habilitation as *privat-docent* in the University of Munich:

"'All the properties of the human mind may be derived from the properties of the animal mind.'

"I would merely add to this:

"And all the mental attributes of higher animals may be derived from those of lower animals. In other words, the doctrine of evolution is quite as valid in the province of psychology as it is in all the other provinces of organic life. Notwithstanding all the differences presented by animal organisms and the conditions of their existence, the psychic functions of the nerve-elements seem nevertheless everywhere to be in accord with certain fundamental laws, even in the cases where this would be least expected on account of the magnitude of the differences."

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.]*

Archebiosis and Heterogenesis.

THE columns of the daily papers have during the last two weeks contained many references to the question of the origin of life. One of the most recent utterances has been that of Lord Kelvin, who has roundly declared himself an unbeliever in the natural origin of living matter either in the present or in the past. We must suppose, therefore, that in reference to this question he is content to believe in miracles.

Prof. Ray Lankester and Dr. Chalmers Mitchell, however, proclaim themselves, as followers of Huxley, believers in evolution generally, and in the natural origin of living matter in the past. They, like many others, refuse to believe that it takes place at the present time, because undoubted proof of its occurrence cannot be produced by laboratory experiments. The uniformity of natural phenomena would certainly lead us to believe, as Sir Oliver Lodge has intimated, that if such a process occurred in the past, it should have been continually occurring ever since—so long as there is no evidence to show cause for a break in the great law of Continuity. Certainly no such evidence has ever been produced, and if the origin of living matter takes place by the generation in suitable fluids of the minutest particles gradually appearing from the region of the invisible, such a process may be occurring everywhere in nature's laboratories, though altogether beyond the ken of man.

My point may be illustrated thus. Bacteriologists all over Europe and elsewhere have been working for the last thirty years by strict laboratory methods, and notwithstanding all that they have made out and the good that has thereby accrued to suffering humanity, they have apparently never yet seen the development from Zooglœa aggregates of Fungus-germs, of flagellate Monads, or of Amœbæ. If, however, they would only examine what goes on in nature's laboratory when a mixed bacterial scum forms on suitable fluids, they would have no difficulty in satisfying themselves as to the reality of these processes. I described such processes in your columns in 1870, more fully in the *Proceedings* of the Royal Society in 1872, and finally in my "Studies in Heterogenesis" (pp. 65–84, pls. vi. and vii., Figs. 53–71). Even during the last week I have again obtained photomicrographs demonstrating the origin of flagellate Monads from Zooglœa aggregates forming in a bacterial scum, and if you will admit an illustrated communication on this subject to your columns, proving by such a test case my position as to the reality of heterogenesis, I shall be happy to present it, and to show that something beyond the recognised strict laboratory methods of the day is needed if we are to fathom some of nature's deepest secrets.

The councils of the Royal and Linnean Societies are guided in the acceptance of papers by referees who are wedded, on biological questions, to laboratory methods. It is useless for me, therefore, again to attempt to submit such a communication to them. Their referees (probably not having worked at such subjects themselves) would not advise the acceptance of the paper, and my communication might simply be consigned to their archives. The Royal Society "for the Promotion of Natural Knowledge" on two occasions would not even allow me to submit my views to the consideration of, and discussion by, its fellows. In these circumstances, Sir, I appeal to you, in the interests of science, to allow me to send you an illustrated paper proving, so far as such proof can go, the heterogenetic origin of flagellate Monads and of Fungus-germs.

H. CHARLTON BASTIAN.

Manchester Square, October 31.

[IN reply to Dr. Bastian's appeal we will print his communication, and also any important replies from competent workers on the subject which may be sent to us.—ED.]

Average Number of Kinsfolk in each Degree.

I WAS glad to read the first paragraph of the reply by Prof. G. H. Bryan to my letter, in which he acknowledges his mistake, but I cannot allow the second paragraph to pass without protest, in which he says "the discrepancy can be accounted for more simply still" in a way he describes. I do not wholly understand his present view, but only enough of it to be assured that it is vitiated by some fundamental misconception. In these circumstances it is best to re-state my original argument in different words. We agree to start on the assumptions that boys and girls are on the average equally numerous, and that all other conditions are to be ignored. Then, if an individual be taken out of a family of $2d$ children, $2d-1$ children will be left, of whom $d-\frac{1}{2}$ will, *on the average of many experiences*, be girls and $d-\frac{1}{2}$ will be boys. The sex of the individual who was taken out in the first instance is quite unimportant; the result will be the same whether that individual be a boy or a girl.

Prof. G. H. Bryan thinks, if I understand him rightly, that the sex of the individual in question *is* of importance.

Some persecuting demon must have again caused my pen to write and my eye to overlook an absurdly erroneous figure in my last letter. The faulty passage runs ". . . is 80 ($=2\frac{1}{2}\times 16$, as it should be)"; the 16 ought to be replaced by 32. It is intended to be quoted from the right hand column of line (5) in the table which accompanies that letter.

FRANCIS GALTON.

Misuse of Words and Phrases.

IN the preface to my book on "Cubic and Quartic Curves" I have stated my views on the matters referred to in the last paragraph of T. B. S.'s letter. I am a strong advocate of the use and, if necessary, the invention of words of classical origin to express new ideas, and I consider the phrase *self-cutting* inelegant.

My objection to the phrase non-singular cubic or quartic curve is that no such curves exist, since Plücker has shown that all algebraic curves, except proper conics, possess a determinate number of singularities. Thus anautotomic quartics possess 52 simple singularities, viz. 28 double and 24 stationary tangents. It is also possible for such curves to possess compound singularities, formed by the union of one double and two stationary tangents.

With regard to the use of *an*, the rule is that before a word beginning with a vowel *an* is to be used instead of *a* for the sake of euphony, but when a word beginning with a vowel is pronounced as if it commenced with a consonant, *a* must be used instead of *an*. The phrases *such an one, an uniform rod, an wonderful sunset, an yew tree*, are all equally incorrect.

A. B. BASSET.

November 4.

The Coming Shower of Leonids.

THE pretty abundant shower of Leonids witnessed last year encourages the hope that a fairly rich return may be observed this year. There will be no moonlight to interfere with the brilliancy of the display should it occur, and the most probable time of its apparition will be before sunrise on November 15.

In 1903 the maximum occurred between 5 and 6 a.m. on November 16, and, allowing for leap year, the ensuing maximum should take place on November 15 at about noon. The shower seems likely to be observed to the best advantage at American stations, as in 1901, but it should be carefully watched everywhere, and with a special view to ascertain the hour of greatest abundance.

It is to be hoped that some further attempts will be made to determine the place of the radiant by photography. We have already a sufficient number of eye observations of the position, and the work of ordinary observers will be better directed to counting the number of meteors visible at regular intervals during the night, and registering the most brilliant objects. The meteors from other showers should also be noted, and especially any conspicuous Taurids that may appear. The latter by their slow long flights and yellow trains are readily to be distinguished from the swiftly moving Leonids with their green streaks.

W. F. DENNING.

OWING to the large numbers of shooting stars visible on the night of November 15, 1903, the expectation of witness-

ing a meteoric spectacle on perhaps a more extensive scale will probably be revived on the near approach of the Leonid epoch of 1904. Reasons have already been given for supposing that last year's display was connected by the nineteen years' period with a very similar phenomenon observed on November 13, 1865, the interval between the two events representing two complete revolutions of the meteoric cycle. The present epoch, therefore, which is thus associated with the historic meteor shower of November 14, 1866, will be liable to reproduce its brilliant prototype, though only to a limited extent.

The anticipated shower, however, if it takes place, will not occur on the night of November 14, as it might naturally have been expected to do, owing to 1904 being a leap year. The meteor-swarm, according to calculations made by the present writer, has undergone considerable retardation since 1903, and as a result of this perturbation the Leonid meteor shower becomes due in 1904 on the night of November 15. It is on the latter night, therefore, that the maximum will take place, whether it culminate in a shower or not. There will occur, however, on November 14, 15h., an interesting miniature meteor display. The shower on the night of November 15, though not so intense, will be more extensive than that of 1866, as maxima fall due at 9h., 12h. to 15h., and 17h. 30m. G.M.T. JOHN R. HENRY.

The Definition of Entropy.

FROM time to time controversies have appeared in various journals regarding that most difficult of all physical conceptions—entropy. I have purposely avoided passing any opinions as to the merits of the views of different writers, as I have considered the question far too large a one to be dealt with satisfactorily by destructive criticism directed towards particular points. I have, however, now found a definition of entropy which certainly appears to meet most of the objections to the conventional treatment. That definition may be stated somewhat as follows:—

Let the available energy of any system at any instant relative to a refrigerator of temperature T_0 be defined by the condition that it is the maximum amount of energy that could be obtained from the system at that instant by reversible thermodynamic engines working between the system and the refrigerator T_0, the remaining portion of the energy being, of course, called non-available energy. Then in any change of the system the increase of entropy is the quantity obtained by dividing the increase of non-available energy by the temperature T_0 of the refrigerator.

I hope to publish a detailed treatment shortly, but in the meantime I would mention that this definition overcomes all the difficulties inherent in the conventional treatment of at least the more ordinary irreversible phenomena, such as friction, impact, gas rushing into a vacuum.

If we adopt the principle of degradation of energy as the fundamental second law of thermodynamics (as I suggested in the Boltzmann *Festschrift*), Clausius's statement that the entropy of the universe tends to a maximum now follows at once. So, too, do his inequalities. For every irreversible transformation in the interior of a system produces loss of available energy, and therefore (since it does not affect the total energy) increase of non-available energy, and therefore increase of entropy. We may say that entropy can be generated, but never destroyed. It follows that the total increase of entropy in the system is greater than the quantity of entropy entering from without. This is Clausius's inequality for an irreversible non-cyclic process. If the process is cyclic the total gain of entropy is zero, and therefore the entropy generated in the system must be exported during the cycle. This is Clausius's inequality for a cyclic process.

The introduction of the refrigerator presents no real difficulty. If non-available energy, instead of being given to the refrigerator T_0, is worked down reversibly to a refrigerator at a lower temperature T_1, its amount will be decreased in the ratio $T_1 : T_0$. G. H. BRYAN.

The Direction of the Spiral in the Petals of Selenipedium.

IN *Selenipedium grande*, *S. longifolium*, and *S. conchiferum*, the twisted petals are so arranged that the direction of the spiral is right-handed on each side.

They are not heteronymous, *i.e.* the right petal with a left twist and the left petal with a right twist, as in all antelopes' horns, nor are they arranged homonymously, as in most sheep's horns,[1] but the twisted petals have the same direction on each side, and in the cases above mentioned the right-handed spiral is always present. In trying to find a cause for the direction, I expected it to appear that before and during the unfolding of the flower the petals were twisted when lying together, and thus took the bias, which continued during growth. If two strips of paper be laid together and twisted into a pipe-lighter, each, when separated, would exhibit the same spiral twist.

Examination of the still-folded flower proves that this simple explanation is not the true one, and, at least in *S. grande*, the petals are straight when they show at first (two inches or more in length), and become afterwards spirally twisted during growth and elongation.

The necessary bias to determine the direction of the spiral evidently acts after the unfolding of the flower, and is a slight force acting continuously during growth, such as would be made by the circulation if there were a difference in the circulation of the sap in the two edges of each petal.

This difference would act alike in each, and would make each petal twist in the same way; but, of course, this is a mere conjectural suggestion. GEORGE WHERRY.

Cambridge, October 30.

Thinking Cats.

THE story of the cat that saved the cook, in your last issue, is certainly remarkable, but surely it is not unusual for cats to find out how to direct attention when they want to get into or out of a house, or for them to conceal their kittens in curious places.

Two instances of the former occur to me among many. A cat in my father's house used to rattle the letter-plate at the front door (it was in a window near the door) whenever it was shut out, and another, in my own house, would come to any *lighted* window, even on the top storey, and tap at the glass if it was shut out at night. In the same house a cat hid its kittens, after one family had been destroyed, under the boards of a lead flat, so that, as they grew, it could not get them out, and directed our attention to them by running backwards and forwards. They were released by taking up the boards.

From cats to birds seems a natural transition. I have a curious instance, at this moment, of a pair of robins mistaking their own importance. Last spring they built, and reared their family, in a hole in the wall of an old country mansion, which was being rebuilt under my supervision. The wall was inside the house, in the great hall, and the female sat on her nest, looking out at the workmen, amid all the noise and disturbance of building. They disappeared in the summer, but now that the house is finished and occupied, the pair have returned, and flit about the same hall and the adjoining drawing-room, evidently under the impression that the house was built for them.

R. LANGTON COLE.

Change in the Colour of Moss Agate.

A FRIEND of mine possesses a penholder the handle of which is made of moss agate. Originally the colour of the handle was bluish throughout, but recently the upper part of the handle has become very much lighter in colour and much more transparent.

I thought perhaps some of your readers could tell me whether it is usual for moss agates to undergo changes of this kind after having been cut and polished, and, if it is usual, to what agent or agents the change is ascribed.

W. A. WHITTON.

County School, Bridgend, November 7.

The Origin of Life.

MR. HOOKHAM ingeniously argues that experiments to evolve living out of non-living matter are inconclusive and must probably always fail because the sterilising agent used, which is commonly heat, "eliminates not only life, but its potentiality at one stroke."

Most of us believe that the earth was at one time an incandescent globe. Neither life nor the potentiality of life could have existed in such circumstances. How would Mr. Hookham, on the theory of evolution, explain their first introduction? GEOLOGIST.

[1] NATURE, December 12, 1901; *Lancet*, January 1, 1898.

ON THE OCCURRENCE OF WIDMANNSTÄTTEN'S FIGURES IN STEEL CASTINGS.

SOME little time ago, during his inspection of the metallurgical laboratories at the University College of Sheffield, Sir Norman Lockyer exhibited considerable interest in the fact then communicated to him that almost invariably small steel castings exhibited in the first stage of their manufacture the Widmannstätten figures, provided that the carbon was near the semi-saturation point of steel, namely, 0·45 per cent. The authors communicated the following brief note in the hope that it would be interesting to mineralogists and astronomers.

For many years an exhaustive research into the properties of steel castings has been proceeding at the Sheffield College. This research necessarily involves a close investigation of the influence of mass; hence the weight of the experimental castings varies from about 28 lb. to 2 tons. In such heavy castings as those last named the Widmannstätten figures are seldom found, the slow cooling of the mass exerting an influence similar to that of annealing, an operation which, as will presently be seen, causes a change in structure so profound as almost always to destroy the figures. The authors therefore selected for purposes of demonstration research casting No. 541, weighing about 30 lb. The mean analysis of drillings from this metal, taken from a portion of the casting $1\frac{3}{8}$ inches in diameter, registered the following figures :—

	Per cent.
Carbon	0·39
Silicon	0·08
Manganese	0·03
Sulphur	0·03
Phosphorus	0·02
Aluminium	0·03
Iron by difference	99·42

The structure of the metal as cast is shown in the upper half-section of Fig. 1. As usual, it exhibits two

FIG. 1.—Research casting 541. Reduced from micrograph. Magnified 22 diameters.

constituents, the magnification being too low to reveal its third and fourth constituents, namely, the sulphides of manganese and iron also present in minute quantities. The dark etching constituent is pearlite ($21Fe+Fe_3C$), its colour being due to the liberation during etching of an automatic stain composed of that dark, carbonaceous colouring matter upon which the well-known carbon colour test depends. The pale constituent is, of course, ferrite, in this case nearly pure iron, and has obviously assumed that crystalline structure characteristic of the Widmannstätten figures.

The lower half-section of Fig. 1 delineates the structure of the metal after the operation of annealing. The two stages of annealing were carried out as follows :—first, the steel, protected so far as possible

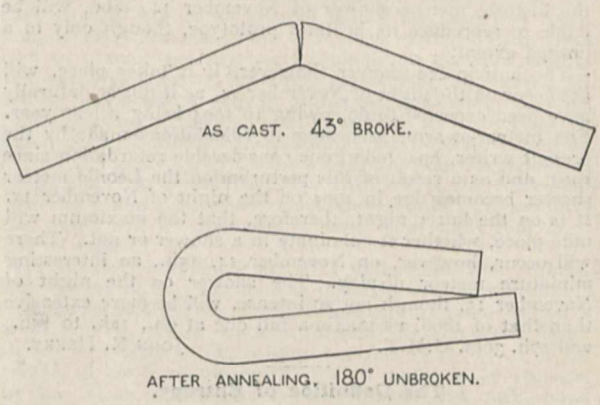


FIG. 2.—Dimensions of test-pieces :—10″×¾″ diam. ; bending radius, ″.

from the air, was maintained for about seventy hours at a temperature of about 950° C.; secondly, it was allowed to cool very slowly, occupying, perhaps, another seventy hours in falling to a temperature at which it could be comfortably handled. The result was a total re-arrangement of the pattern presented by the ferrite and pearlite, and a consequent elimination of the figures. This change in structure was accompanied by a profound change also in the mechanical properties of the steel.

Fig. 2 reproduces, before and after annealing, bending tests made on bars 10 inches long and ¾ inch in diameter. The metal as cast snapped sharply after bending through an angle of 43° over a radius of ⅜ inch. The annealed steel bent through an angle of 180° without exhibiting any signs of fracture. At the request of Prof. Lewis, of Cambridge University, the authors have submitted to him duplicate sections of the steels figured in this paper. Prof. Lewis considers that an interesting point raised is as to whether the occurrence of the Widmannstätten figures in pieces of metallic iron dug out of the earth necessarily proves them to be of meteoric origin.

The authors have to thank their colleague Mr. J. H. Wreaks, demonstrator of metallography at the Sheffield College, for his patient and precise reproduction of the structures figured in this note.

J. O. ARNOLD.
A. MCWILLIAM.

FORESTRY IN THE UNITED STATES.

AMONG the professional papers of the United States Geological Survey we have already noticed the first six reports dealing with the various forest reserves in the States of Oregon, Washington, and California. The two latest reports, Nos. 7 and 8, now to hand, deal with the forest conditions in the San Francisco Mountains Forest Reserve and the Black Mesa Forest Reserve in the State of Arizona. The former report is by John B. Leiberg, Theodore F. Rickson, and Arthur Dodwell, with an introduction by F. G. Plummer; while the latter report was prepared by F. G. Plummer from notes by Theodore F. Rickson and Arthur Dodwell. Both forest reserves were first created by proclamation of President M'Kinley, dated August 17, 1898. The region in which the San Francisco Mountains Forest Reserve

is situated forms a kind of plateau, traversed by numerous deep canons and dotted by several hundred

FIG. 1.—Fire Scars on Yellow Pine.

volcanic cones, which vary in height from 100 feet to 1000 feet. The soil is various, but gravelly loam is the prevailing type. On the slopes of the volcanic cones and ridges in their neighbourhood scoriaceous soils prevail. The water-retaining capacity of the latter class of soil is not very great. The loamy soils are best adapted for forest growth. As regards drainage, the visible run of permanent surface flow is small. Most of the precipitation sinks either within the reserve or in the desert or semi-desert tracks which border it.

Electric storms do considerable damage to the standing crop in the reserves, and it is estimated that in some places as many as 5 per cent. of the trees have been struck and killed by lightning. There are twelve coniferous species in the reserve, but the yellow pine predominates, producing more than 99 per cent. of the merchantable timber, and forming 90 per cent. of the total forest. About the same number of broad-leaved species occur, but a complete list of them is not available. All over the reserve the stands of yellow pine do not carry an average crop of more than 40 per cent. of the timber they are capable of producing. This unsatisfactory condition is attributable to the numerous fires which have occurred in this region within the last 200 years. In addition to the destruction caused by fire, careless cutting and grazing have done much damage in the reserve.

The reproductive capacity of the yellow pine in the reserve is extremely small—there being a great deficit in seedling and sapling growth. There has apparently been a complete cessation of reproduction over large areas during the past twenty or twenty-five years. This low reproductive capacity is attributed to various causes—some depending on the operation of natural agencies, others on human intervention. The grazing value of the reserve was at one time very great. As the gramineous flora of the region is a rich one, there was formerly a luxuriant growth of grass, but owing to the persistent and excessive pasturing, especially by sheep, the turf-forming grasses were reduced in size and vegetative activity, which led to various changes in the character of the subsequent vegetation. What was formerly pasture land is now covered by exuberant growths of various low desert shrubs and herbaceous Compositæ, particularly species of sunflowers.

The agricultural value of the region is not great, there being only some 2500 acres under the plough, and these occur in the now dry beds of what were formerly Stone-man and Mormon lakes, or at the foot of ridges where local areas of seepage exist. The crops consist of oats, wheat, and potatoes. There is no fruit culture in this region. This reserve, like the others, is subdivided into townships and ranges, the detailed descriptions of which are included in the report. At the end we have a very useful summary, showing in tabular form a classification of lands in the reserve by townships. The maps and photographic illustrations are of the same high standard as those which accompany the other reports of this series.

The Black Mesa Forest Reserve comprises an area of 2786 square miles, made up as follows:—

	Square miles.		Square mil
Timbered area ...	2248·5	Burned area	5·5
Woodland	391	Logged area	1·0
Timberless area ...	140		

FIG. 2.—Large Growth of Alligator Juniper.

A very striking feature of the report is the decrease in the water supply due to successive seasons of drought, which have practically destroyed the value

of the grazing and agricultural areas in the reserve. Three years ago the wheat crop yielded 5000 bushels. The following year it fell to 2500 bushels, and last season the yield was only 800 bushels. A cattle ranche in the range, which used to graze more than 100,000 head, will now support not more than 9000 head. As a remedy it is suggested to adopt stringent rules, regulating the number of stock and the areas on which they shall be grazed on each permit. Very little lumbering has been carried out within the reserve, which is apparently due to the difficulties and expense of transport. The timber species, coniferous and broad-leaved, number fifteen, the yellow pine being the principal timber tree. It is distributed uniformly throughout the extent of the reserve. In some ranges it forms a pure forest. Its average height is 125 feet, with 24 feet of clear trunk with a diameter of 18 inches at breast height. It varies in age from 125 to 150 years.

The Engelmann's spruce occupies the moister areas above an altitude of 9000 feet. It averages 70 feet in height and 10 inches in diameter. Its age varies from 50 to 75 years. Its growth is extremely rapid, but the tree is usually clothed with branches to the ground. A variety of the Engelmann's spruce, *Picea engelmannii*, var. *Franciscana*, known as the Arizona spruce, gives much better results, averaging 100 feet in height with 20 feet of clear trunk and a diameter of 18 inches. Red fir, white fir, western white pine, alligator juniper, and Arizona cypress also occur within the area. The deciduous trees are confined to the borders of streams and marshy areas. The reproductive capacity of the various species is exceptionally good, especially where the young growth is afforded shelter by the larger trees. The underbrush throughout the areas in which the yellow pine predominates is very small, and consequently this region has not suffered much injury from forest fires. The report also embodies detailed descriptions of the various subdivisions of the range, together with carefully prepared maps and beautiful photographic plates. Of the latter we have reproduced two as an example of the interesting way in which these papers are illustrated.

TECHNICAL EDUCATION IN LONDON.[1]

THE last report of the Technical Education Board of the London County Council, dealing with the year 1903–4, directs special attention to the progress made in the provision of technical, secondary, and higher education in London during the past eleven years. Under the recent Education Act (London), 1903, the administration of the whole of the education of London passed into the hands of the new Education Committee, and the Technical Education Board ceased to exist. The present report is consequently opportune, and serves to record the great services which have been rendered to education in London by the late Board.

The most striking features of the report are the evidences provided of the increase and rapid development of polytechnic institutions, the establishment and success of London County Council schools and technical institutes, and the improvement in the equipment and staffing of secondary schools. The extent of the advances made can be estimated satisfactorily by comparing the number of educational institutions providing good scientific and technical education at the time of the supersession of the Technical Board with the number in existence in 1893, when Mr. Llewellyn Smith reported on the provision made for technical instruction at that time. To take the case of the laboratory accommodation for the teaching of chemistry. In 1893 there appear to have been about fourteen chemical laboratories in London open in the evening for instruction; since that time well equipped departments for teaching practical chemistry have been opened in eleven new polytechnic institutions. The total volume of instruction in evening classes in chemistry in 1893 was only about 38,000 student-hours per session, and in polytechnics under 15,000 student-hours. In 1893, after omitting the attendances of students who did not attend for more than twenty hours during the session, the amount of time devoted to evening work in theoretical and practical chemistry amounted to 64,554 student-hours in the polytechnics alone.

The result obtained by comparing the advance made in the teaching of electricity and electrical technology is just as striking as in the case of chemistry. In 1893 there were five electrical laboratories open for evening instruction, while in 1903 there were twenty-three institutions giving evening instruction in electricity or electrical technology, or both. In practical electrical engineering there were only four centres in 1893 available for evening instruction, and only one applied for aid from the Board, and at this institution there were thirty-eight students. During the session 1902–3 there were, in polytechnics aided by the Board, a large and increasing number of students for electrical engineering, and the volume of instruction, omitting students who attended for less than twenty hours during the session, amounted to 43,909 student-hours. In addition to these, a large number attended classes in electricity and magnetism in the physics departments of the institutions. The volume of instruction here reached 32,872 student-hours.

Ten years ago there was scarcely any provision in London for pure technological teaching. From the list of evening classes for 1903 it appears that technological instruction is now available in a great variety of subjects, of which the most important are:—bricklaying and brick-cutting in twelve institutions, cabinet-making in nine, carpentry and joinery in twenty, furniture design in nine, masonry in nine, metal-plate work in eight, painting and decorating in twelve, photo-process work in four, plastering in nine, plumbing in fifteen, printing in four, smithing in six, tailors' cutting in seven, and upholstery in six. This rapid increase in the number of polytechnics and technical institutes in which adequate provision is made for practical instruction in trade subjects has had a remarkable effect in producing an interest in the scientific principles underlying the various trades concerned. As an example, the report quotes the case of the Northampton Institute in Clerkenwell, in which district there is a very large number of special trades. In order to meet the demands of the neighbourhood, classes were started in subjects in which no organised technical instruction had previously been given in London. Some of these have been remarkably successful, and in several cases it has been found necessary to increase the number of evenings of instruction in order to provide for the large number of students in attendance.

There has been also, says the report, a natural tendency during the past few years for sporadic classes in trade subjects to disappear in consequence of the increasing popularity of the polytechnics and larger technical institutes, in which are found thoroughly well equipped laboratories and workshops. The number of distinct trades in which practical instruction is provided, and also the number of centres where such courses of instruction can be obtained, have more than doubled during the past nine years,

[1] "Annual Report of the Technical Education Board of the London County Council, 1903–1904." (Westminster: P. S. King and Son, 1904.) Price 2s. 6d.

and the number of apprentices and young workmen attending them has increased four-fold.

The great success which the rapid growth of polytechnics in different parts of London, since the formation of the Technical Education Board in 1893, has had in the development of evening instruction has not, the report points out, been achieved at the expense of other institutions; it represents a new growth, not the transference of instruction from old to new institutions. Many changes have taken place in the older polytechnics to bring them more into touch with modern requirements, and this has been accompanied in nearly every case by an increase in the volume of instruction. Statistics have been compiled, with regard to the attendances which have been made, from 1893 for a period extending over eight years. It has been impossible to give particulars with regard to all the 4000 classes in the numerous subjects of instruction aided by the London County Council, but mechanical engineering, electrical engineering, carpentry and joinery, plumbing, other building trade classes, experimental physics, chemistry, and mathematics have been selected. The total volume of instruction in these subjects, taken together, shows an increase from 118,732 student-hours in 1893 to 454,363 student-hours for 1900–1. Since then the number of artisan students has been increasing steadily. The increase in the amount of work done by the students, speaking generally, appears to have been even greater than the growth in numbers. A growing proportion of the students are now, it is satisfactory to find, taking advantage of the systematic courses which have been arranged, involving attendance on several evenings a week; and it is not surprising to find the Board recording its belief that the educational value of the work done in polytechnics, especially as regards the young mechanic, has been in this way greatly increased.

As has been frequently pointed out, it was from the first the policy of the Board to avail itself of the opportunity of aiding the supply of technical instruction rather than of creating a direct supply, wherever public institutions have existed capable of responding to the Board's aid by such developments of efficient technical instruction as might be expected to meet the requirements of the district. It has been necessary, however, to provide two classes of institution, for the conduct of which the London County Council is wholly responsible, viz. :—

(*a*) Institutions which provide instruction of such a highly specialised character that it is necessary for them to draw their students from the whole of London; for it has been impossible for any institution with the ordinary sources of income to provide the equipment and the highly specialised teachers necessary.

(*b*) Local institutions, providing instruction of a more ordinary character in districts in which no public institutions under a responsible governing body existed which could be utilised for the Council's requirements.

There are many other subjects of interest included in the report, and some of them have already been dealt with from time to time in these columns. It must suffice here, by way of conclusion, to mention briefly the work the Board has accomplished in aiding and extending satisfactory instruction in science in the public secondary schools of London. Seventeen chemical laboratories have been equipped in new buildings, generally in wings added to existing school premises, and three rooms used for class purposes have been converted into chemical laboratories. Four large rooms have been fitted up for practical work in physics and chemistry. Sixteen physical laboratories have been equipped in new buildings, and ten large classrooms have been adapted for practical work in physics, in addition to the four mentioned above, in which practical work in chemistry is also carried on. Thus fifty laboratories have been equipped in secondary schools for boys, with bench accommodation for more than 1200 pupils working simultaneously, or for 6000 pupils working one day a week. Twenty-five science lecture-rooms have been provided, sixteen of these being specially constructed for the purpose in new buildings. A large number of additional science masters have been appointed as a result of the Board's maintenance grants. In secondary schools for girls, laboratories have in some cases been provided for practical work in physics, chemistry, and botany, and some of those in existence have been equipped suitably to meet modern requirements. A. T. S.

NOTES.

THE list of appointments on the occasion of His Majesty's birthday includes the following honours conferred upon men of science :—Mr. W. H. M. Christie, C.B., F.R.S., has been promoted to the rank of Knight Commander of the Order of the Bath (K.C.B. Civil Division). Dr. J. W. Swan, F.R.S., has received the honour of Knighthood. The Hon. C. A. Parsons, F.R.S., has been appointed a Companion of the Order of the Bath (C.B.). Mr. Francis Watts, Director of Agriculture in the Island of Antigua, and analytical and agricultural chemist for the colony of the Leeward Islands, has been made a Companion of the Order of Saint Michael and Saint George (C.M.G.).

THE council of the Royal Society has made the following award of medals for this year :—The Copley medal to Sir William Crookes, F.R.S., for his long-continued researches in spectroscopic chemistry, on electrical and mechanical phenomena in highly rarefied gases, on radio-active phenomena, and other subjects. The Rumford medal to Prof. Ernest Rutherford, F.R.S., for his researches on radio-activity, particularly for his discovery of the existence and properties of the gaseous emanations from radio-active bodies. A Royal medal to Colonel David Bruce, R.A.M.C., F.R.S., for his researches in the pathology of Malta fever, nagana, and sleeping sickness, and especially for his discoveries as regards the exact causes of these diseases. A Royal medal to Prof. William Burnside, F.R.S., for his researches in mathematics, particularly in the theory of groups. The Davy medal to Prof. William Henry Perkin, jun., F.R.S., for his discoveries in organic chemistry. The Darwin medal to Mr. William Bateson, F.R.S., for his contribution to the theory of organic evolution by his researches on variation and heredity. The Sylvester medal to Prof. Georg Cantor for his researches in the theories of aggregates and of sets of points of the arithmetic continuum, of transfinite numbers, and Fourier's series. The Hughes medal to Dr. Joseph Wilson Swan for his invention of the electric incandescent lamp and various improvements in practical applications of electricity.

THE following is a list of fellows who have been recommended by the president and council of the Royal Society for election into the council for the year 1905, at the anniversary meeting to be held on November 30 :—president, Sir William Huggins, K.C.B., O.M.; treasurer, Mr. A. B. Kempe; secretaries, Prof. J. Larmor, Sir Archibald Geikie; foreign secretary, Mr. F. Darwin. Other members of the council :—Dr. Shelford Bidwell, Mr. G. A. Boulenger, Colonel D. Bruce, R.A.M.C., Mr. F. W. Dyson, Prof. Percy F. Frankland, Prof. F. Gotch, Dr. E. W. Hobson, Prof.

J. N. Langley, Mr. J. E. Marr, Sir William D. Niven, K.C.B., Prof. W. H. Perkin, jun., Prof. J. Perry, Mr. A. Sedgwick, Dr. W. N. Shaw, Prof. W. A. Tilden, Rear-Admiral Sir William Wharton, K.C.B.

We announce with deep regret that Dr. Frank McClean, F.R.S., died at Brussels on Tuesday morning in his sixty-seventh year.

Mr. James Cosmo Melvill has presented his general herbarium to the Manchester Museum of the Victoria University. The herbarium has taken nearly forty years to collect, and it was formally opened in its new quarters by Sir W. T. Thiselton-Dyer, K.C.M.G., on October 31.

The portraits of Prof. Osborne Reynolds and Prof. A. S. Wilkins, by the Hon. John Collier, will be formally presented to the Victoria University of Manchester on Friday, November 18. Dr. A. W. Ward, the master of Peterhouse, Cambridge, formerly principal of the Owens College, and Vice-Chancellor of the Victoria University, will make the presentation on behalf of the subscribers.

A Christmas course of lectures, adapted to a juvenile auditory, will be delivered by Mr. Henry Cunynghame, C.B., at the Royal Institution, on "Ancient and Modern Methods of Measuring Time."

An inaugural dinner of Royal School of Mines men resident in South Africa was held at Johannesburg on Saturday, October 8. The chair was taken by Mr. A. R. Sawyer, president of the Geological Society of South Africa, and many old students of the school were present.

The *Times* correspondent at Tokio reports that a serious earthquake occurred in Formosa at 4.30 a.m. on Sunday, November 6. The centre of the disturbance was at Kia-yih, where 150 houses were overthrown and 33 damaged, 78 persons killed, and 23 injured.

The deaths are announced of Forstmeister Schering, formerly professor of mathematics and geodesy in the School of Forestry at Munich; Clemens Alexander Winkler, professor at Freiberg; and Dr. Francesco Chizzoni, professor of geometry at Modena.

The Society of Arts will commence its fourth half-century on November 16, when Sir William Abney, as chairman of the society's council, will open the 151st session with an address. The subjects on which papers will be read at the meetings before Christmas include British trade, canals, the St. Louis Exhibition, patent law, Burma, and street architecture. There will also be a course of lectures on wind instruments, with musical illustrations.

The *Times* correspondent at Copenhagen announces that Mr. Mylius-Erichsen's expedition returned there from Greenland on November 6, having been absent two years and a half. Mr. Mylius-Erichsen was accompanied by Mr. Knud Rasmussen and Count Harald de Moltke, a well known painter. The expedition travelled along the west coast, and drove round Melville Bay on sledges. During the whole time the explorers lived with the natives, learning their language, and studying their manners and customs of life.

It was decided early last year, soon after the death of Mr. F. C. Penrose, to commemorate his work in Athens by building on to the Students' Hostel of the British School in Athens a library to bear his name. Mr. Penrose was the first director of the school in Athens, and was called on more than once by the Athenian authorities to advise as to the preservation of the Parthenon. The total cost of the building and fittings will be about 1150*l*., and so far 400*l*. has been received in subscriptions toward this object. The school can, if necessary, afford out of its own resources the sum of 600*l*., but no more, so it seems that at least 150*l*. should be raised by subscription if the building is to be opened free of debt during the archæological congress in Athens next spring. The committee will have, it is to be hoped, no difficulty in securing this further sum of money. Subscriptions may be sent to Mr. George Macmillan, St. Martin's Street, London, or may be paid into the account of the Penrose Memorial Fund at the London and County Banking Company, Ltd., Henrietta Street, Covent Garden, W.C.

Mr. J. Fletcher Moulton, F.R.S., gave an address on the "Trend of Invention in Chemical Industry" before the Society of Chemical Industry on Monday. In the course of his remarks he said that there are two departments of great interest at the moment from the inventive development they are manifesting in their products. The first is that of pharmaceutical products. Physiologists are beginning to associate specific effects on the human organism with specific chemical groups. These groups appear in countless combinations, and their effect may be masked or hindered by the setting in which they are placed. It may thus be that many of the forms in which these effective groups have up to now been administered have influenced and distorted their normal action, and a line of genuine research and invention is now being pressed forward seeking practical solutions of the problem of the best way to use these operative groups. The second department concerns food-stuffs. A vast waste of nutritious matter is going on all round us. A substantial part of the ability now devoted to the practical solution of difficult chemical questions in existing industries could be usefully applied to the preservation of food-stuffs. The main trend of invention in chemical industry is rendering certain and complete in their action processes formerly unmanageable or unprofitable by reason of the uncertainty of the reactions that actually and locally took place. The realisation of the necessity of uniformity of conditions in order to obtain full yield manifests itself not only in the efforts to improve old processes, but also in the choice of new ones; that process is a good one which permits the necessary conditions to be secured at every point and at every moment.

A list of awards to exhibitors from Great Britain and Ireland at the St. Louis International Exhibition has been received from the secretary of the Royal Commission appointed for the exhibition. The number of grand prizes gained by Great Britain is 121, while 238 gold medals, 162 silver medals, and 132 bronze medals have been awarded to British exhibitors, making a total of 653. It is therefore only possible here to mention a few of the awards to men of science and scientific bodies. Among these awards are the following:—Department of Liberal Arts: photography, grand prize, Sir W. de W. Abney, K.C.B., F.R.S.; the Royal Observatory, Greenwich; the Royal Photographic Society; the Solar Physics Observatory; and Sir Benjamin Stone; gold medal, the Geological Photographs Committee of the British Association; the Cretan Exploration Fund; and the Survey of India. Maps and apparatus for geography, grand prize, Board of Agriculture and Fisheries; Ordnance Survey of Great Britain and Ireland; Royal Geographical Society; Admiralty (Hydrographical Department); the Survey of India; Palestine Exploration Fund. Chemical and pharmaceutical arts, grand prize, low temperature research exhibit of the British Royal Commission; Sir

William Ramsay, K.C.B., F.R.S.; gold medal, Dr. Ludwig Mond, F.R.S.; the Owens College; Royal College of Science, London. Awards to collaborators, gold medal, Prof. James Dewar, F.R.S. (low temperature research exhibit); Mr. T. Wilton, and Dr. A. R. Garrick. Various applications of electricity: awards to collaborators, grand prize, Lord Kelvin (for important contributions to electrical engineering); gold medal, Prof. Hugh Langbourne Callendar, F.R.S., Mr. W. du Bois Duddell. Theory of agriculture: grand prize, the Rothamsted Experimental Station (Lawes Agricultural Trust); gold medal, Board of Agriculture and Fisheries; Royal Agricultural Society. Department of Horticulture: appliances and methods of pomology, grand prize, Board of Agriculture and Fisheries; Royal Horticultural Society; the British Royal Commission; gold medal, Dr. Henry. Department of Forestry: appliances and processes used in forestry, gold medal, Forest Department, India; silver medal, the Royal Scottish Arboricultural Society. Department of Mines and Metallurgy: ores and minerals, grand prize, Home Office (Mining Department); Department of Agriculture and Technical Instruction for Ireland. Geological maps and plans of mines, grand prize, Geological Survey of India. Mining literature, grand prize, the Iron and Steel Institute; the Geological Survey of India; gold medal, the Institution of Mining Engineers. Fishing equipment and products: grand prize, Marine Biological Association of the United Kingdom, for an exhibit prepared at their Plymouth laboratory illustrating the life-history and the food of fishes, and a gold medal for publications. Department of Anthropology: ethnography, grand prize, Cretan Exploration Fund; Egypt Exploration Fund; Palestine Exploration Fund.

A CONFERENCE on the teaching of hygiene and temperance in relation to physical deterioration was held at Caxton Hall, Westminster, on November 2, under the auspices of the National Temperance League, Sir John Gorst presiding. The various speakers dealt with the evils of intemperance, and attention was directed to the petition prepared by the British Medical Association in which the medical profession urged that the teaching of the elements of the laws of health should be made compulsory in the elementary schools.

THE American Bar Association has passed a resolution in favour of establishing in the Department of Justice, Washington, a laboratory for the study of the criminal, pauper, and defective classes. In the Bureau of Education, Washington, Mr. MacDonald has for some years been carrying on work of this kind under many difficulties, and it is mainly owing to his initiative that the foregoing resolution was framed.

IN connection with the review on "Cancer Research" (NATURE, vol. lxx. p. 279), an American correspondent, Mr. Harbert Hamilton, has directed our attention to the reported occurrence of a tumour in an oyster. The original paper (Prof. J. A. Ryder in *Proc.* Acad. Nat. Sciences, Philadelphia, 1887, p. 25) records that the tumour was growing in the pericardial cavity; it consisted of alveoli containing numbers of round nucleated cells resembling the colourless blood and lymph cells of the oyster. The opinion is expressed that the growth was of mesodermal origin, and probably benign.

WITH regard to the note on anti-typhoid vaccination which appeared in these columns last week (p. 14), it may be of interest to direct attention to a statistical inquiry on the same subject contributed by Prof. Karl Pearson, F.R.S., to the *British Medical Journal* (November 5, p. 1243). Prof. Pearson analyses mathematically certain statistics submitted to him by Lieut.-Colonel Simpson, R.A.M.C., and concludes that while most of the correlations both for immunity and recovery are distinctly sensible, having regard to their probable errors, yet they are so irregular that little reliance can be placed upon them as representing any definite uniform effect. He considers that the data suggest that a more effective method of inoculation must be found before it should become a routine practice in the Army.

AT a special meeting of the Charity Organisation Society on October 31, Dr. Orme Dudfield, medical officer of health for Kensington, contributed a paper on the need for sanatoria for persons suffering from consumption. He pointed out that more than one-tenth of the total mortality from all causes was due to tuberculous diseases, and that consumption accounted for nearly three-quarters of the tuberculous mortality. He suggested that the Metropolitan Asylums Board, which, on an order by the Local Government Board, has the power to do so under the various Health Acts, should take the matter in hand and equip sanatoria, the present Gore Farm Asylum being a very suitable building and site. With regard to the expense of such institutions, Dr. Dudfield remarked that the loss caused to London by tuberculosis could not be less than 4½ millions per annum, and he contended that the expense incurred would be amply recouped by the money saved to the community. On the motion of Sir W. Broadbent, it was resolved "That it be referred to the Administrative Committee to consider Dr. T. Orme Dudfield's paper and the discussion upon it, and to report to the Council of the Charity Organisation Society at some subsequent meeting."

DURING last week a demonstration was given at Stratford, in connection with the process invented by Mr. Powell for treating timber with a solution of sugar. The result is that all kinds of wood are made tougher, heavier, and more lasting, while the softer varieties become more useful and more ornamental when worked. Besides this it is possible to put fresh and unseasoned timber through the process without delay, and after treatment the "powellised" wood is ready for immediate use, as there is no danger of its shrinking or warping. The timber is placed in cages which are wheeled into a boiler, and after this has been closed, a solution of beet sugar is pumped in, though apparently an open tank can be utilised. The solution takes the place of the air in the timber, and is absorbed by the individual fibres, for microscopical examination fails to demonstrate the presence of sugar crystals between them. It is therefore difficult to remove the sugar, and wood blocks which have been treated are no longer porous, so that pavements made from them should be more sanitary than those in present use. After being taken from the receiver the wood is dried in ovens by artificial heat, the temperature varying with the kind of wood. When subjected to a breaking strain, "powellised" timber recovers itself to a greater extent than untreated wood, and is able, even when broken, to support a greater weight without collapsing. It is also claimed that timber so treated is not subject to "dry rot," and by the addition of some poison to the sugar it is hoped to make it withstand the attacks of termites in tropical countries.

ACCORDING to the report of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne for 1903–4, the "museum talks" given once a month in winter by the curator have been continued. They were fairly well attended, although most of the audience contented themselves with listening to the discourse, only a few taking the opportunity of inspecting the museum.

SOME excellent photographs of rorquals "spouting" illustrate a paper on these cetaceans by Dr. G. M. Allen in the September issue of the *American Naturalist*. In height and volume the "spout" of all the species is much less than was supposed to be the case by the older observers, even that of the huge "sulphur-bottom" averaging only about 14 feet in height, although it may occasionally reach 20 feet. In the same number Dr. C. R. Eastman has an article on fossil plumage, in which it is pointed out how extremely seldom are birds' feathers preserved in marine deposits; indeed, the only formations of this nature from which they have been recorded appear to be the Solenhofen limestones, the Cretaceous of Kansas, and the Monte Bolca Eocene.

THE practice of planting trees and shrubs by stockmen around their ranch-houses is advocated in a *Bulletin* of the New Mexico Experimental Station, in which the author, Mr. Wooton, describes the native ornamental plants. Poplars or cottonwood trees are recommended for shade, also the hackberry, and a maple known as box-elder. The indigenous flora contains many climbers, including species of Ipomœa, Maurandia, and clematis, while for the gardens on the Mesa native yuccas, the sotol, Dasylirion, and the ocotillo are suitable.

THE latest number of the *West Indian Bulletin*, vol. v., No. 2, contains an article on the cold storage of fruit, in which it is pointed out that previous to storage it is necessary to have the fruit cool before and while it is being packed. Reference is made to the installation of Hall's system for cooling the fruit chambers on board the West Indian Royal Mail Steamers *Tagus* and *Trent*. A review of the cacao industry indicates that Trinidad and Grenada continue to show a satisfactory increase in their exports, and Trinidad stands fourth in the list of cacao-producing countries.

CONTINUING the "Materials for a Flora of the Malay Peninsula," Sir George King, F.R.S., with the cooperation of Mr. J. S. Gamble, F.R.S., has worked out in the latest part (No. 15) the uniovulate series of the Rubiaceæ. This coincides with the subdivision Coffeoideæ adopted by Schumann in Engler's "Pflanzenfamilien." The authors retain Cephælis as a generic name, and include under Webera only a portion of the genus as understood by Hooker in the "Flora of British India." The most important genera are Ixora and Lasianthus, for the latter of which no fewer than twenty-five new species are given. No species of the Indo-Malayan genus Myrmecodia is recorded, and only one species of Hydnophytum.

WE have received from Messrs. J. R. Gregory and Co., of Kelso Place, London, W., the prospectus and first part of the "Twentieth Century Atlas of Microscopical Petrography." This elaborate work is intended to supply drawings, descriptions, and microscopic slides of typical rocks to its subscribers; while, for an additional guinea, chips of the same rocks, mounted by a smooth face on glass plates, are issued to complete the materials for study. There are many good points about the idea, and we do not know why so capable a draughtsman as the author should veil his identity under the not very attractive title of "a senior medallist and first-class honoursman in Natural Science of the University of Edinburgh." The subject is not treated systematically, and we note that, while the plates can be arranged in a portfolio according to the owner's taste, the text is paged continuously, and cannot be cut up. There are many students, especially those forced to work alone, who will welcome a book of this kind, accompanied as it is by the actual specimens that are described.

THE Royal Society has published its second annual issue of that part of the "International Catalogue of Scientific Literature" dealing with meteorology, including terrestrial magnetism. Our readers generally will know that this catalogue is an outgrowth of the catalogue of scientific papers published by the Royal Society. This second issue comprises mainly the literature of 1902, but includes some works published in 1901. Not only the titles of papers appearing in periodicals or as independent works are given, but their subject-matter has been indexed. The referee of this valuable contribution is Mr. T. D. Bell (librarian of the Meteorological Office), which, we consider, is sufficient guarantee of the care that has been taken in the preparation of the work. We note that a very important addition has been made by including the contents of the *Meteorologische Zeitschrift* for 1902 as well as for 1901 which were omitted in the first issue. But we also note some important omissions which will probably be remedied in a future issue, *e.g.* the valuable papers which appear in the *U.S. Monthly Weather Review*. The Royal Society appears to receive notification of very few daily weather reports, as only those of four countries are included out of some twenty-five that are actually published.

MR. JOHN W. BUTTERS, writing in the Edinburgh Mathematical Society's *Proceedings*, advocates a much more extensive use of the principle of *symmetry* in teaching geometry, a proposal with which many mathematicians will no doubt agree.

AN amusing anecdote about *Linnea borealis* is told by M. V. Brandicourt in *Cosmos* for October 1. This rare plant was reported to have been discovered in 1810 by the Empress Josephine when on a visit to the Montanvert at Chamounix. But it transpired later that the specimens were planted there by a certain Bonjeau, who was pharmacist to Her Majesty, and the secret was let out by the man who planted them in a letter to her asking for help when he was incapacitated by an accident. As M. Brandicourt remarks, no one will ever again find *Linnea borealis* at the Montanvert or anywhere near—the Empress took them all!

IN the *Proceedings* of the Royal Society of Edinburgh, xxv., 4, Dr. J. Erskine Murray describes a simple differentiating machine. In it the differential coefficient of a function the graph of which has been drawn is obtained by recording the slope of the tangent at each point, and to give this the machine is guided so that two near dots on a piece of celluloid shall at each instant lie along the curve, while a tracing point on a second sheet describes the required graph of the first derived function as thus obtained approximately. This method, rough as it sounds in description, is said to give valuable information in many statistical problems where existing methods would prove too laborious.

WE have received parts i. to vii. of the *Rendiconto* of the Naples Academy (January to July), and in them notice obituary accounts of three members of the academy. Antonio de Martini studied medicine at Naples and Paris. In 1839 and 1840 he published with Salvatore Tommasi two papers on the organism of reptiles and one on the lamprey, and these were soon followed by many other papers. In 1847 he was appointed professor of anatomy and physiology at the veterinary college. The new morphology emanating from Germany at that period attracted Martini's attention, and

he published a valuable work on embryology. About 1860 he was nominated professor of physiology, and two years later he was appointed to a newly founded chair of pathology. He was also appointed consulting physician to Princess Margherita, mother of the present King. Throughout his career he worked hand in hand with his colleague Tommasi. Gaetano Giorgio Gemmellaro was born at Catania in 1832. At the age of twenty he produced his first paper on certain volcanic minerals from Patagonia, and from then onwards published papers almost continuously for fifty years. The geological history of Sicily was almost made by him. He was professor of geology and mineralogy at Palermo, a member of the Accademia dei Lincei and of many other academies of different countries, one of the "Forty" of the Italian Society of Science, a Senator, and Knight of the Order of Savoy. Prof. Giustiniano Nicolucci was born in the island of Liri, and graduated in medicine at Naples in 1843. Under Stefano delle Chiaje he developed a taste for biological science, and in 1842 published his first paper on the structure and functions of the human cerebral nerves. During the political disturbances he left his country, and three years later returned to practise medicine. The various types of humanity with which he came in contact in his profession attracted his attention to the study of anthropology, which he continued to his last day. His researches dealt with both historic and prehistoric anthropology, his favourite theme being the prehistoric anthropology of Italy, and especially of southern Italy.

A NEW and revised edition of "Object Lessons in Elementary Science," by Mr. Vincent T. Murché, has been published by Messrs. Macmillan and Co., Ltd., in two parts at 2s. each.

THE "London University Guide and University Correspondence College Calendar" for 1905 contains in a convenient form the kind of information required by a private student desirous of taking a degree at the University of London.

MR. HEMMING'S book entitled "Billiards Mathematically Treated" has reached a second edition, which has just been published by Messrs. Macmillan and Co., Ltd. In appendix iii. of the new edition Mr. Hemming institutes a comparison of strokes played through and fine, and of the margin of error in each case.

MESSRS. WHITTAKER AND CO. have published a third edition of "The Optics of Photography and Photographic Lenses," by the late Mr. J. Traill Taylor. The short chapter on lenses of Jena glass which was included in the last issue of the book has been omitted, and one on anastigmatic lenses, written by Mr. P. F. Everitt, inserted in its place.

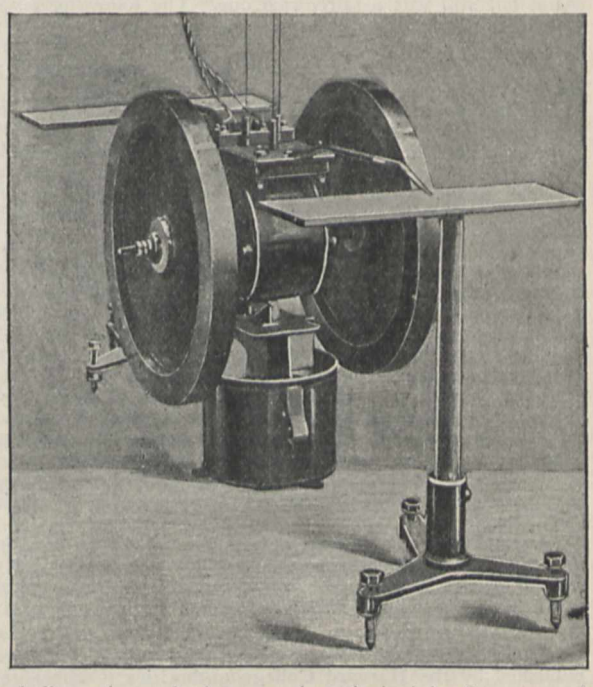
AN authorised translation, by Dr. M. Ernst, of the presidential address delivered by Mr. Balfour at the Cambridge meeting of the British Association has been published by Herr J. M. Barth, Leipzig, under the title "Unsere heutige Weltansschauung." Dr. Ernst has rendered the address into fluent German, and has added a few short descriptive notes—mainly of a biographical character—which will be of interest to readers unfamiliar with the names of Newton, Cavendish, Stokes, Maxwell, Kelvin, Rayleigh, and other natural philosophers to which reference is made. In the first note, on the foundation and objects of the British Association, the list of sections should have included the section of educational science.

THE "Notes on Shooting, with Instructions Concerning the Use of Nitro-Powders," written by "An Expert," and published by Messrs. Curtis's and Harvey, Ltd., has reached an eighth edition. This little volume of 83 pages has been completely re-written, and now contains a practical account of the results of recent researches in sporting gunnery. The actions of guns and gunpowder are based on the laws of physics and chemistry, and the results which have followed the application of the scientific method to the problems in connection with this branch of technology have been incorporated in the book. The volume provides evidence that manufacturers are coming to realise that substantial advantages in their work follow an acquaintance with results arrived at by the man of science. The six chapters into which the book is divided deal with smokeless powders and the methods of testing them, with patterns on the distribution of pellets on the target, with cartridge shooting, and aiming at moving objects.

OUR ASTRONOMICAL COLUMN.

APPARATUS FOR MEASURING THE VELOCITY OF THE EARTH'S ROTATION.—Prof. A. Föppl, of the Munich Technical High School, has devised a new gyroscopic apparatus for measuring the angular velocity of the earth's rotation.

As shown in the accompanying figure, the apparatus consists of a large top carrying at each end of a horizontal



spindle an iron wheel 50 cm. (19·7 inches) in diameter and 30 kilograms (66·1 lb.) in weight. This spindle is the axle of a small electro-motor which is capable of turning the wheels 2400 revolutions per minute. The whole framework is suspended by three fine, strong steel wires to the ceiling of the room in which the experiment is performed, and a cross piece immediately under the centre of the axle dips into a bath of oil, thereby deadening the subsidiary interfering oscillations. The angle through which the whole apparatus turns about its vertical axis is read off, on the two scales shown in the figure, to about the tenth of a degree.

To perform the experiment the current is disconnected from the motor, and the latter run as a generator for a short period, when a reading of a voltmeter placed in circuit enables the angular velocity of the revolving wheels to be found. Knowing this, one deduces the moments of inertia of the turning masses, and then by an equation which takes for its arguments the combined moment, the constant angular velocity of the wheels, the torsion of the trifilar

suspension, &c., one may calculate from the observed readings, taken from the scales each minute of the quarter or half an hour that the wheels continue to revolve at a constant rate, the angular velocity of the earth's rotation.

For this quantity Prof. Föppl has obtained a value within 2 per cent. of that obtained from astronomical phenomena, and hopes, with the assistance of M. O. Schlick, the maker of the apparatus, to obtain a still more accordant value by further modifying and perfecting his device (*Revue générale des Sciences*, No. 19, October 15).

THE PERSEID SHOWER.—Mr. A. King sends an account of his observations of Perseid meteors during July and August. The observations were divided into two periods, namely, (1) July 12 to 18 inclusive at Sheffield, (2) August 3 to 18 inclusive at Leicester.

The total time spent in watching was twenty-one hours. Considerably more than 200 shooting stars were seen, of which nearly 130 were Perseids; 152 meteors were noted, about 80 being Perseids. The *maximum* of the shower seems to have occurred on August 11, or in the daylight hours of the morning of August 12. By August 14 the strength of the shower had much decreased, but on the following night there was a recrudescence of Perseid activity, for within the first fifteen minutes of a watch from 10h. to 11h. two beautiful Perseid fireballs, both nearly equalling Jupiter in brilliance, appeared, and altogether the hourly rate of Perseids was higher than on August 14. Mr. King considers that the display was scarcely so strong as of late years, but still was a fairly rich one. The following positions were obtained :—August 6, α 38, δ +56½ (10 meteors); August 11, α 45½, δ +57½ (35 meteors); August 12, α 46½, δ +57½ (13 meteors); August 14, α 50½, δ +58½ (7 meteors).

The movement of the radiant is thus well shown. In conclusion, Mr. King says:—"All the brilliant Perseids had pear-shaped heads. Of 47 Perseids the colours of which were recorded 31 were yellow, a few of these having a greenish tinge. The tints of the streaks usually eluded observation, but the streak of a bright Perseid which appeared on August 13 was muddy."

THE DUMB-BELL NEBULA.—From a special study of the various forms of nebulæ which he has photographed with the Meudon reflector, M. Louis Rabourdin has arrived at the conclusion that the dumb-bell nebula may be correctly classified as elliptical, and that the ring nebula in Lyra should also be placed in the same category.

On comparing a number of photographs of these two objects he found that they have the same elliptical form, and that the stars enclosed in each are, generally speaking, similarly arranged. Consequently, he believes them to be objects which started with the same primal form, but have arrived at different stages in the order of their evolution.

Several other well known objects are placed by him in the same class, and he suggests that the nebulæ generally may be of two general types only, viz. elliptical and spiral (*Bulletin de la Société astronomique de France*, October, 1903).

HARVARD COLLEGE OBSERVATORY.—In a small brochure published by the Harvard College authorities (Cambridge, Mass., 1904) the establishment, growth, and work of the college observatory is briefly recorded. The various stations and the instruments located in each are named and described, and the work already performed, the publications of the observatory, and the officers employed are mentioned in chronological order. Two reproductions of photographs show the stations at Cambridge and Arequipa respectively.

In a second similar publication Prof. E. C. Pickering outlines the second part of his "Plan for the Endowment of Astronomical Research," in which he suggests several methods of usefully spending the money he is seeking to raise for this purpose. Among other things he discusses solar eclipse expeditions, and states that the English method of organisation by means of a central permanent eclipse committee is one which might be usefully copied in other countries, where much money has been "wasted" by sending out a number of mutually independent expeditions, often in charge of incompetent persons, to attempt to obtain results which are but seldom adequately discussed or published.

IRON AND STEEL INSTITUTE.

THE opening meeting of the Iron and Steel Institute was held on October 24 in New York under the presidency of Mr. Andrew Carnegie. Addresses of welcome were delivered by the Mayor, by Mr. John Fritz, chairman of the reception committee, and by Mr. James Gayley, president of the American Institute of Mining Engineers. On behalf of the council Sir James Kitson presented to Mr. Carnegie the Bessemer gold medal in recognition of his great services to the iron and steel industries of the world. On October 26 a selection of papers was read and discussed.

The first and most important read was that by Mr. James Gayley (New York) on the application of dry air blast to the manufacture of iron. The variable moisture in the atmosphere has long been recognised as a barrier to further progress in blast furnace practice. The problem of extracting the moisture has been solved by Mr. Gayley by the adoption of refrigeration by means of anhydrous ammonia. A plant was put in operation at the Isabella furnaces of the Carnegie Steel Company at Pittsburg on August 11, and remarkable results have been obtained. Prior to its adoption, the furnace from August 1 to August 11 produced on an average 358 tons of pig iron daily with a coke consumption of 2147 lb. Using dry air blast from August 25 to September 9 the daily production of pig iron averaged 447 tons with a coke consumption of 1726 lb. Similar advantages would doubtless be effected in the Bessemer converter, in the open-hearth steel process, in copper smelting, and in other processes where air in large quantities is used.

The next paper read was on the influence of carbon and phosphorus on the strength of iron and steel, by Mr. H. H. Campbell, of Steelton, Pennsylvania.

The paper by Mr. C. V. Bellamy, Director of Public Works, Lagos, was of great ethnological interest. He described the process of iron manufacture in the hinterland of the British colony of Lagos, within twenty days of London, where the methods are the same as those practised by the earliest workers in the metal. The smelting works are near Oyo, the capital of the Yoruba country, and it is only recently that they have been visited by a white man for the first time. Analyses given by Mr. F. W. Harbord, in an appendix to the paper, show that the metal is a pig iron partially decarburised by an oxidising flux. It is really a puddled steel, low in sulphur and phosphorus, its purity accounting for its good qualities.

Mr. J. M. Gledhill read a paper describing the development and rise of high-speed tool steel. Since the initiation of high-speed cutting at the Bethlehem Steel Works, great developments have been made, and results in cutting powers far beyond expectation have been attained. An analysis of one of the best qualities of rapid steels produced by Sir W. G. Armstrong, Whitworth and Co., Ltd., showed 0·55 per cent. of carbon, 3·5 per cent. of chromium, and 13·5 per cent. of tungsten.

The results of different analysts when operating on the same sample of iron or steel are far from concordant, and attempts have been made at various times to investigate the causes of difference. A further attempt has now been made to ascertain the most trustworthy methods for the determination of carbon and phosphorus in steel by a committee consisting of Mr. J. E. Stead, F.R.S., Baron H. von Jüptner (Austria), Mr. A. A. Blair (Philadelphia), and Mr. Gunnar Dillner (Stockholm), who presented an interim report covering fifty-two printed pages.

A paper on acid open-hearth manipulation was submitted by Mr. A. McWilliam and Mr. W. H. Hatfield (Sheffield), in which experimental results were recorded proving that, at about the temperatures occurring in Siemens steel-making practice, the chemical composition of the slag, particularly with regard to its acidity, is the factor which determines whether the percentage of silicon in the molten steel shall increase or decrease.

Mr. E. Demenge (Paris) submitted a paper on the utilisation of exhaust steam, from engines acting intermittently, by means of regenerative steam accumulators and of low-pressure turbines of the Rateau type. The process has been applied with conspicuous success at the Donetz Steel Works in Russia, at the Poensgen Steel Works at Düsseldorf, and at several French collieries.

The meeting concluded with the customary votes of thanks

to the reception committee, proposed by Mr. E. Windsor Richards and seconded by the secretary, Mr. Bennett H. Brough. The meeting was attended by more than 300 members, and an attractive programme of visits to metallurgical works in various parts of America was arranged.

THE INTERNATIONAL ELECTRICAL CONGRESS AT ST. LOUIS.

SINCE the article on the proceedings of the International Electrical Congress at St. Louis appeared in our issue of October 27, we have received the subjoined report to the congress of the chamber of Government delegates referred to on p. 639.

It will be noticed that the resolutions ask for the appointment by Governments of one international commission, at first of a temporary character, but which, it is hoped, may become permanent, to deal with electric units.

Report of the Chamber of Delegates.

At the meeting on September 13, after discussion in the chamber, two subcommittees were appointed to deal with the questions of international electromagnetic units and of international standardisation respectively.

At the meeting on September 15 the following report of the committee on international electromagnetic units was accepted and unanimously adopted :—

Committee on International Electromagnetic Units.

The subcommittee appointed September 13 begs leave to suggest that the chamber of delegates should adopt the following report :—

It appears from papers laid before the International Electrical Congress and from the discussion that there are considerable discrepancies between the laws relating to electric units, or their interpretations, in the various countries represented, which, in the opinion of the chamber, require consideration with a view to securing practical uniformity.

Other questions bearing on nomenclature and the determination of units and standards have also been raised, on which, in the opinion of the chamber, it is desirable to have international agreement.

The chamber of delegates considers that these and similar questions could best be dealt with by an international commission representing the Governments concerned. Such a commission might in the first instance be appointed by those countries in which legislation on electric units has been adopted, and consist of (say) two members from each country.

Provision should be made for securing the adhesion of other countries prepared to adopt the conclusions of the commission.

The chamber of delegates approves such a plan, and requests its members to bring this report before their respective Governments.

It is hoped that if the recommendation of the chamber of delegates be adopted by the Governments represented, the commission may eventually become a permanent one.

The following report was also received and unanimously adopted from the committee on international standardisation :—

Committee of the Chamber of Delegates on International Standardisation.

The committee of the chamber of delegates on the standardisation of machinery begs to report as follows :—

That steps should be taken to secure the cooperation of the technical societies of the world by the appointment of a representative commission to consider the question of the standardisation of the nomenclature and ratings of electrical apparatus and machinery.

If the above recommendation meets the approval of the chamber of delegates, it is suggested by your committee that much of the work could be accomplished by correspondence in the first instance, and by the appointment of a general secretary to preserve the records and crystallise the points of disagreement, if any, which may arise between the methods in vogue in the different countries interested.

It is hoped that if the recommendation of the chamber of delegates be adopted, the commission may eventually become a permanent one.

At the meeting on September 16 the following resolutions were unanimously adopted :—

"That the delegates report the resolution of the chamber as to electrical units to their respective Governments, and that they be invited to communicate with Dr. S. W. Stratton (Bureau of Standards, Washington, D.C.) and Dr. R. T. Glazebrook (National Physical Laboratory, Bushy House, Teddington, Middlesex, England) as to the results of their report, or as to other questions arising out of the resolution."

"That the delegates report the resolution of the chamber as to the international standardisation to their respective technical societies, with the request that the societies take such action as they may deem best to give effect to the resolution, and that the delegates be requested to communicate the result of such action to Colonel R. E. B. Crompton, Chelmsford, England, and to the president of the American Institute of Electrical Engineers, New York City."

THE NATIONAL ANTARCTIC EXPEDITION.

THE narrative of the National Antarctic Expedition, related by Captain Scott to an audience of about seven thousand people at the Albert Hall on Monday, was the first account of the work of the expedition given to the Royal Geographical Society since the *Discovery* returned home. Captain Scott made a general statement of the work of the expedition, referring particularly to the various sledging journeys—nine of which were made in the first season and six in the second season—for exploration to the south, west, and east; but his remarks were chiefly of the nature of descriptions of a magnificent collection of photographs of scenes and incidents in the areas visited. These pictures themselves constitute a unique record of Antarctic conditions, and with the results of meteorological, magnetic, hydrographic, biological, and geological observations make the expedition most notable in the history of polar exploration. An exhibition of the photographs taken by Lieut. Skelton, water colour sketches and coloured drawings by Dr. E. A. Wilson, and other objects of interest connected with the voyage of the *Discovery*, is now open at the Bruton Galleries, 13 Bruton Street, Bond Street, W.

At the end of the lecture the chairman, Sir Clements Markham, K.C.B., on behalf of the Royal Geographical Society, presented a gold medal to Captain Scott and silver medals to the officers and men. The gold medal of the Geographical Society of Philadelphia for 1904 was presented to Captain Scott by the United States Ambassador in the name of that society. The medal bears on one side a medallion of Dr. Elisha Kane, their own discoverer, in whose honour the society was organised, and on the reverse this inscription :—"For eminent geographical research. *Per mare et terram.* The Philadelphia Geographical Society. Incorporated 1803. Awarded to Captain Scott in the year 1904."

As the scientific work of the expedition will be described at subsequent meetings of the Royal Geographical Society, Captain Scott only made incidental reference to it, and added little to what has already appeared in these columns (vol. lxix., p. 543, April 7). The following brief summary of the lecture is, however, of interest in showing some of the incidents and inquiries of the expedition.

The Antarctic area was divided into four quadrants, of which the Ross quadrant was allotted to the British expedition. It was there that Sir James Ross in 1840 discovered the sea that bore his name. But Sir James Ross was in a sailing ship, and only saw things dimly and in the distance. The geographical problem was therefore in brief to find out what lay to the east, to the west and to the south of what Ross had seen. In addition to the geographical problem, there were many scientific ones connected with a region so little known. The principal of these was magnetism, and the course taken by the *Discovery* was especially adapted for a magnetic survey.

Accompanied by two other members of the expedition, Captain Scott left the ship for a southern journey early in November, 1902, and on December 29 arrived at a point in latitude 80° 17′, when they were obliged to retrace their

steps. Finally, the party returned safely to the ship, and found that the *Morning* relief ship had arrived in McMurdo Sound. Mr. Armitage made a journey to the westward with a large party. After one or two failures he found a good route to the main ice cap over the surface of a glacier of great length. He gradually rose in altitude until he arrived on the inland plateau at a height of 8900 feet, and was thus the first to penetrate into the interior of Victoria Land.

The expedition had hoped to accompany the *Morning* home, and it was not until the end of February, 1903, that this was seen to be impossible, because of the condition of the ice. They expected the ice in the bay in which they lay to break up, but unfortunately it got so late that there was only one thing for the *Morning* to do, and that was to return. She got home with a good deal of difficulty, but the *Discovery* was forced to remain a second winter.

Captain Scott next made a sledging expedition in a westerly direction, reaching his "furthest west" point on November 30, 1903. The party had reached the top of a mountain range some 7000 feet above the sea-level when a blizzard came on and prevented further movement for six days. The party then set out westward, rising another 1500 feet, and for another week advanced over a huge plain that extended as far as the eye could reach. The temperature was forty degrees below zero, and the lips, nostrils, and cheeks of the party were blistered by the incessant wind from the west. The rarefied air, too, had a great effect in reducing staying power. On this expedition they reached a very interesting spot—that at which the compass pointed south instead of north. They had reached for the first time the line of no variation lying between the South Pole and the south magnetic pole.

By the middle of December, 1903, all the sledging parties were ordered to be back, in order that an attempt might be made to free the *Discovery* from the ice by sawing out a channel. The attempt to clear a channel had to be abandoned, but on January 15 the *Morning* and the *Terra Nova* were sighted. They brought word that unless the *Discovery* could be freed it must be abandoned, and to obviate this hard necessity blasting operations were undertaken. But by the end of January the ice began to break up of its own accord, and by the middle of February there was a clear channel for the *Discovery*, which was then free to start on its return voyage.

MOUNT EVEREST: THE STORY OF A LONG CONTROVERSY.

THE highest mountain in the world is situated in a country from which Europeans have with few exceptions been jealously excluded; and the recent visit to the capital of Nepal of an experienced British surveyor, equipped with instruments and with full permission to use them, is an event of no small interest in the annals of Himalayan geography.[1] It is clear from Captain Wood's report that this event has been brought about by the personal intervention of Lord Curzon.

Surveyors have penetrated the Himalayas east and west of Nepal into Sikkim and Kumaon, and have from these points of view been enabled to observe a few of the Nepalese peaks; but from flanking stations the ranges of mountains are seen "end on," and the nearer peaks shut out the more distant from view. The knowledge that we possess of the heights and positions of the peaks of the Nepalese Himalayas has consequently been obtained from observations taken with theodolites at stations situated in the plains of Bengal and Oudh.

From maps of small areas we are able to estimate that the number of peaks existing in Himalayan regions, including Kashmir and Bhutan, probably exceeds 40,000, and that of these more than 10,000 are always clothed with snow. Such estimates, rough as they are, suffice to show that the problem which confronted the Indian Survey when it first undertook the determination of the positions and heights of the peaks of the Himalayas was not a simple one.

It is difficult now to discover how many of the 10,000 snow-peaks were known to the natives of India by name before the British commenced their survey. The number so named was certainly small, and possibly less than fifty. Not only were the two highest mountains of all without a name but many of the most conspicuous peaks throughout the whole length of the Himalayas were nameless. The few peaks that serve as landmarks to travellers on frequented thoroughfares have probably always had names, and the few that mark the sources of sacred rivers and indicate to weary pilgrims on distant plains the positions of the shrines that are their goals have for ages been recognised by names.

It is questionable whether some of the Hindu names now attaching to peaks were not given in the first instance by British surveyors; in the earlier days of the survey names were accepted from villagers more readily, perhaps, than would now be done. Even the celebrated name of Dhawlagiri, as attaching to a particular peak, is not altogether free from suspicion. The story of the controversy over Mount Everest shows how easy it is to find native names that have no existence in fact, and how hard it is to identify the precise peak even when a native name is current.

When 10,000 snow-peaks have to be fixed, and when but 50 of these have names, some system of classification has to be devised. The case is analogous to that of the stars; a few of the brighter stars have names of their own, the remainder are classified by constellations, and are designated by letters or numbers. The snow-peaks of the Himalayas are classified by areas, and are designated by Roman numerals or by letters with numbers attached; thus the highest mountain in the world is known in the official records as Peak XV, and the second highest is recorded as Peak K_2, both having been nameless at the time of their discovery.

The height of Peak XV, now better known as Mount Everest, is 29,002 feet, and that of K_2 is 28,250 feet. Sixty years ago Dhawlagiri, in Nepal, was considered the highest mountain in the world; Dhawlagiri is 26,795 feet high, and has since been found to be surpassed in height by six Himalayan peaks; of these K_2 is in Kashmir, and the other five, Everest (29,002), Kangchenjunga I (28,146), Kangchenjunga II (27,803), Makalu (27,790), and Peak T_{45} (27,000) are in or near Nepal.

The Discovery of Mount Everest.[1]—In 1848 trigonometrical surveyors commenced to build a line of survey stations along the plains of Oudh and Bengal from west to east, and to determine the positions of these stations in latitude and longitude by means of triangles observed with large theodolites. Sir George Everest had intended originally to carry the series along the mountains, but abandoned his design in consequence of the refusal of the Nepalese Government to allow the operations to enter their territories. Consequently, after crossing the hills of Kumaon, the stations were brought down into the plains near Bareilly, from which point they were carried for 800 miles through the deadly tracts which fringe the Himalayas. At almost every station the snowy range of Nepal was visible, and the northern horizon appeared broken by numbers of peaks. Just as some stars appear brighter to the eye than others, so do some snow-peaks against the sky-line appear loftier than others. The superior magnitude of certain stars may be due either to their greater diameter or their lesser distance, and the superior elevation of certain peaks may be due either to their greater height or their lesser distance. The most refined observations with the most perfect of instruments, if taken from a single station only, will furnish no clue as to whether a mountain-peak is conspicuous on account of its magnitude or on account of its nearness.

As the surveyors moved across Bengal from west to east they witnessed changes in the apparent positions of the peaks; the analogy of the stars no longer serves us, as owing to the great distances of the latter they appear to preserve their relative positions in the sky; but the case of mountain-peaks may be compared to what a traveller witnesses when he journeys by rail through a forest of pines—the nearer tree-trunks continually appear to pass between his eye and the more distant ones. As the surveyor moves across the plains parallel to the mountains he sees

[1] Report on the Identification and Nomenclature of Himalayan Peaks. By Capt. H. Wood, R.E., with a preface by Colonel Gore, C.S.I., R.E., late Surveyor General of India. (Published by Order of Colonel F. B. Longe, R.E., Surveyor General of India, 1904.)

[1] In order to appreciate the distance from which Mount Everest is visible, we have only to consider that if it stood in Snowdon's place, it would be seen from Land's End to Edinburgh and from Kent to Connaught.

innumerable peaks, many snow-clad, many bare, always seemingly changing their places and forms.

It is a mistaken idea that particular peaks can be identified from different points of view by their characteristic shapes. Such a course may sometimes be possible from near stations, but at distances greater than forty miles the form of a peak is its cross-section in outline against the sky, and this changes as one moves round it. The same peak is often found noted in the field records of the survey by a different letter or number at each station from which it was observed. Colonel Sir Andrew Waugh, of the Bengal Engineers, who was Surveyor-General of India from 1843 to 1861, realised from the outset the difficulties of identification. His orders were that every visible peak, great and small, was to be observed from every observing station, but that the identification of peaks, with the exception of the unmistakable few possessing native names, must be left to computers. In accordance with these orders the true direction of every visible peak and the angular elevation of every summit above the horizon were determined from every observing station.

The identification of the peaks as observed from different stations was then effected as follows :—

1st Step.—The stations of observation were carefully projected on a map, and from each were drawn lines representing the directions of all peaks observed from it.

2nd Step.—When direction-lines from three or more stations met in one point, it was tentatively assumed that the same peak had been observed on the three or more occasions.

3rd Step.—By trigonometrical formulæ the distance of this assumed peak from each of the observing stations was then calculated, and from these distances independent values of the latitude and longitude of the peak were obtained; if the several values were accordant the identification was proceeded with.

4th Step.—From the observed angle of elevation and from the calculated distance of the peak from each station the height of the peak was deduced; a separate value for the height of the peak was thus obtained from each observing station. If the several values of height were accordant the identification was finally accepted.

Numerous peaks were found to have been observed only once or twice, and could not be identified; many others failed to satisfy all the tests, and had to be rejected.

About 1852 the chief computer of the office at Calcutta informed Sir Andrew Waugh that a peak designated XV had been found to be higher than any other hitherto measured in the world. This peak was discovered by the computers to have been observed from six different stations; on no occasion had the observer suspected that he was viewing through his telescope the highest point of the earth.

The following table shows the several values of height that were obtained for Mount Everest :—

THE OBSERVED HEIGHT OF MOUNT EVEREST.

Extracted from the Records of the Great Trigonometrical Survey of India.

Observing station	Height of observing station	Distance of observing station from Mount Everest	Date of observation	Observer	Instrument	No. of observations	Observed angle of elevation	Height above mean sea level
	Feet	Miles					° ′ ″	Feet
Jirol ...	220	118·661	Nov. 27, 1849	Mr. J. O. Nicolson	24-inch theodolite	2	1 53 33·35	28991·6
Mirzapur	245	108·876	Dec. 5, 6, 1849			12	2 11 16·66	29005·3
Janjpati	255	108·362	Dec. 8, 9, 1849			4	2 12 9·31	29001·8
Ladnia ...	235	108·861	Dec. 12, 1849			4	2 11 25·52	28998·6
Harpur ...	219	111·523	Dec. 17, 18, 1849			8	2 6 24·98	29026·1
Minai ..	228	113·761	Jan. 17, 1850			8	2 2 16 61	28990·4
							Mean ...	29002·3

Sir Andrew Waugh had always adhered to the rule of assigning to every geographical object its true local or native name; but here was a mountain, the highest in the world, without any local or native name that he was able to discover. He determined, therefore, to name the great snow-peak after Sir George Everest, his former chief, the celebrated Indian geodesist. The name of "Mount Everest" has since become a household word, and no objection to it has ever been raised by natives of the country.

The Devadhunga Controversy.—When Sir Andrew Waugh announced that the peak was to be named Everest, Mr. Hodgson, who had been political officer in Nepal for many years, intimated to the Royal Geographical and Royal Asiatic Societies that Sir Andrew Waugh had been mistaken, and that the mountain had a local name, viz. Devadhunga. Sir Roderick Murchison, the president of the Royal Geographical Society, approved Waugh's action, but the Royal Asiatic Society supported Hodgson and repudiated the name of Everest. Seeing that the Survey officers had been debarred from entering Nepal, Mr. Hodgson was amply justified in raising the question he did; but he had made no scientific measurements, and it is known now beyond dispute that he was mistaken in his identification of Everest. He apparently assumed that the great peak, which he saw standing in the direction of Everest, and which was so conspicuous from Katmandu, where he resided, was the highest peak in Nepal;[1] but Nepal covers a large area, and Mount Everest is more than a hundred miles from Katmandu. Either Mr. Hodgson was unaware of the real distance of Mount Everest, or he failed to realise that even the highest mountain on earth will look small at so great a distance. It is probable that Mr. Hodgson never even saw Mount Everest; it is certain that if he did so he was unaware that he was looking at it.

All subsequent information goes to show that there is no peak in Nepal called Devadhunga. Mr. Hodgson's sincerity has never been doubted, and it is believed now that the name Devadhunga is a mythological term for the whole snowy range.

The Gaurisankar Controversy.—In 1854 three brothers, Hermann, Adolphe, and Robert de Schlagintweit, undertook a scientific mission to India and Central Asia at the instance of the King of Prussia, and with the concurrence of Lord Dalhousie and the court of directors. Their labours lasted until 1857, by which date they had succeeded in taking numerous astronomical, hypsometric, magnetic, and meteorological observations; they had also made geological, botanical, and zoological collections for the India House Museum; and they had explored the high mountains of India and Tibet, and had constructed many panoramic drawings of the snow-peaks of the Himalayas. Their mission unfortunately ended in the death of the second brother, Adolphe, who was killed at Kashgar.

In 1855 Hermann de Schlagintweit visited a hill in Nepal named Kaulia, near Katmandu, and from it took observations to the snow-peaks. He saw the mountain called Devadhunga by Hodgson, and he identified it as Mount Everest;[2] he, however, repudiated Hodgson's name of Devadhunga, and certified that the local native name for the peak was Gaurisankar.

Continental geographers, accepting Schlagintweit's views, have continued to this day to call the highest mountain in the world Gaurisankar; the Indian Survey, however, were unable to reconcile Schlagintweit's results with their own, and have declined to follow him.

The diagram in Fig. 1 illustrates the tour of Hermann de Schlagintweit, who visited the two stations of Kaulia and Falut, which are 175 miles apart. From Kaulia he saw a high peak to the north-east which the natives called Gaurisankar, and which he identified as Everest. From Falut he saw a high peak to the north-west, which he also identified as Everest.

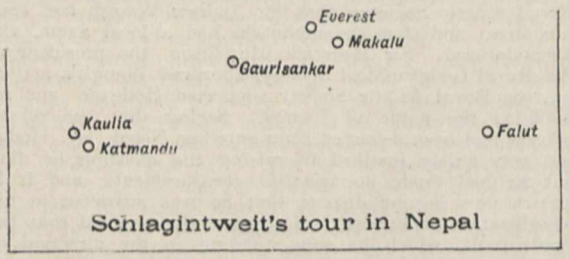
There is no doubt now that Schlagintweit was misled in his identification of Mount Everest. It is the common misfortune of all pioneers that posterity chiefly concerns itself with their mistakes. Indian geography owes much to Hermann de Schlagintweit, but she is more mindful now of his errors than of her debts. The mistakes of Schlagint-

[1] See *Proceedings* R.G.S., vol. viii., 1886, pp. 89 and 179.
[2] Schlagintweit's "India and High Asia," vol. iii. p. 193.

weit have formed the basis of controversy, and will continue to be remembered until controversy ceases.

In 1883 Colonel Tanner visited Falut, and found that Everest was barely visible from there, being almost shut out from view, and entirely surpassed in appearance by Makalu (height 27,790 feet), a lower though nearer peak; it was Makalu that Schlagintweit mistook for Everest, and it was Makalu that he drew as Everest, both in his panorama of the snows from Falut, and in his picture, which is preserved at the India Office.

In 1903 Captain Wood visited Kaulia by order of Lord Curzon; he found that Gaurisankar and Everest were



Heights in feet.		Distance from Mount Everest in miles.	
Everest	29,002		
Makalu	27,790	to Makalu	12
Gaurisankar	23,440	to Gaurisankar	36
Falut	11,815	to Falut	85
Kaulia	7,051	to Kaulia	109

FIG. 1.

different peaks thirty-six miles apart, and that Everest, far from being conspicuous, was almost obscured from view by intervening ranges. Captain Wood also discovered that an imposing peak of the snowy range, a peak long known in the records of the survey as Peak XX, height 23,440 feet, was the famous Gaurisankar of the Nepalese.

A comparison of the drawings of Schlagintweit and Wood tells us that the same peak was shown by the Nepalese to both observers as Gaurisankar. Schlagintweit was therefore right in giving the name of Gaurisankar to the great peak that is so conspicuous from Kaulia and Katmandu, but he has been proved to have been wrong in three particulars, namely, (1) in his identification of Everest from Kaulia, (2) in his identification of Everest from Falut, (3) in assuming that he had observed the same peak from Kaulia as he had done from Falut.

It is interesting to consider the magnitudes of the mistakes he made:—from Kaulia the direction of Gaurisankar differs from the true direction of Everest by two degrees; from Falut the direction of Makalu differs from the true direction of Everest by forty-two minutes.

From Kaulia the elevation of Gaurisankar differs from the true elevation of Everest by twenty-four minutes; from Falut the elevation of Makalu differs from the true elevation of Everest by fifteen minutes.

The two peaks Gaurisankar and Makalu, which Schlagintweit thought were the same, are forty-seven miles apart.

The supposed identity of Everest and Gaurisankar has rested only on Schlagintweit's evidence. It is true that successive British Residents at Katmandu have continued to regard Gaurisankar as Everest,[1] but their ideas have been based on the Schlagintweit tradition. It is also true that in a recent number of the *Geographical Journal*[2] the photographs of Dr. Boeck have been preferred as evidence to the observations of the Indian Survey; unfortunately Dr. Boeck made a mistake of thirty-two degrees in direction in his attempt at identifying Mount Everest,[3] and this initial slip led him to twist the whole area of Nepal round through a third of a right-angle.

Side Issues of the Controversy.—It is difficult to avoid the thought that this long controversy has of recent years been degenerating into a barren dispute over side issues.

(1) It has, for instance, been stated in the *Geographical Journal* that "the object of Captain Wood's visit to Nepal was to ascertain whether the mountain known as Mount Everest is visible from the heights in the neighbourhood of Katmandu, and forms part of the range known in Central Nepal as Gaurisankar."[1] But this statement is incorrect. The object of Captain Wood's visit to Nepal was to ascertain whether the peak known to the Nepalese as Gaurisankar was identical or not with the peak known to us as Mount Everest, and this main issue ought to be kept in view. It is also inaccurate to speak of a range in Central Nepal known as Gaurisankar: there is no range so known; Gaurisankar is a double peak.

(2) A side issue on which some argument has been expended is whether Mount Everest is visible from Kaulia or not. This point may be of interest to individuals, but it has no scientific importance; and I am surprised to see it asserted, as though some geographical issue were involved, that the Survey officers have generally held the view that Everest was not visible from Kaulia.[2]

In a paper published in 1886, the late General Walker, R.E., gave some calculations of azimuth and elevation to show that the two peaks of Gaurisankar and Everest could not be identical; after proving his point in a convincing way, he added the following general remark:—"Obviously therefore Gaurisankar, the easternmost point of Schlagintweit's panorama of the snowy range, cannot have been Everest, and the great pinnacle must have lain hidden away from his view by intervening mountain masses."[3]

If we wish to discover whether a place A is visible from a place B, we have but two courses open to us: we can make calculations from contoured maps of the country, or we can send an observer to B to ascertain if A can be seen. If there are no maps, the second course alone is open.

Mount Everest is 109 miles from Kaulia; the intervening space is taken up by mountains and valleys, ridges and hollows, spurs and basins; this complicated area is unsurveyed, and questions of visibility are not mathematically arguable.

How came it, then, that an expert like General Walker expressed the opinion that Everest was not visible from Kaulia? General Walker was, of course, merely judging from Hermann Schlagintweit's recorded evidence. At Kaulia Schlagintweit made a careful drawing to scale of the snowy and nearer ranges; in Fig. 2 is given a copy of his drawing of Gaurisankar.

Schlagintweit wrote against the peak Gaurisankar on his drawing the words "Gaurisankar or Everest," but

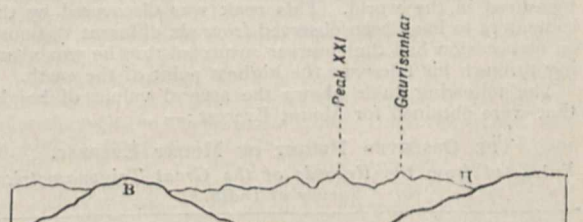


FIG. 2.

General Walker showed by calculations that if Everest had been really visible it would have been seen by Schlagintweit as a low peak near the spot marked H. As Schlagintweit showed no low peak at this spot, General Walker concluded that it had been obscured from his view by one or another of the many unsurveyed intervening ranges.

1 "In the Himalayas," by Waddell, 1899, p. 346.
2 *Geographical Journal*, March, 1903.
3 Colonel Gore's preface to Captain Wood's Report, 1904.

1 *Geographical Journal*, January, 1904, p. 89.
2 *Geographical Journal*, March, 1903, and January, 1904.
3 *Proceedings* R.G.S., vol. viii., 1886, where it will be seen that Schlagintweit described Everest as the easternmost point of his panorama.

When Captain Wood visited Kaulia in 1903 he was unable to discover the place from which Schlagintweit had made his drawing; he selected another spot, and made a careful drawing to scale of the snowy and nearer ranges. In Fig. 3 is given a copy of his drawing of Gaurisankar.

On the advice of the Prime Minister of Nepal, Captain Wood recorded on his drawing against the lower peak of the Gaurisankar double the name Gauri, and against its loftier companion the name Sankar.

If we compare Wood's drawing with Schlagintweit's, we see that the nearer range B appears higher in Schlagintweit's picture than in Wood's. This same peculiarity is visible throughout the panoramas of the two observers; the near ranges appear in Schlagintweit's drawing higher always with regard to the distant ranges than they do in Wood's. The inference is that Schlagintweit drew his panorama from a considerably lower point than Wood did; this may account for the fact that Schlagintweit shows no signs of Everest.

Again, in Schlagintweit's drawing the near range K cuts off laterally more of the snowy range than it does in Wood's, and obscures the shoulder of Gaurisankar just at the point where Everest should have been visible.

In Wood's drawing Mount Everest appears as a low peak at the spot where General Walker calculated that it would appear.

The omission of Everest from Schlagintweit's panorama led General Walker to believe that it was not visible from

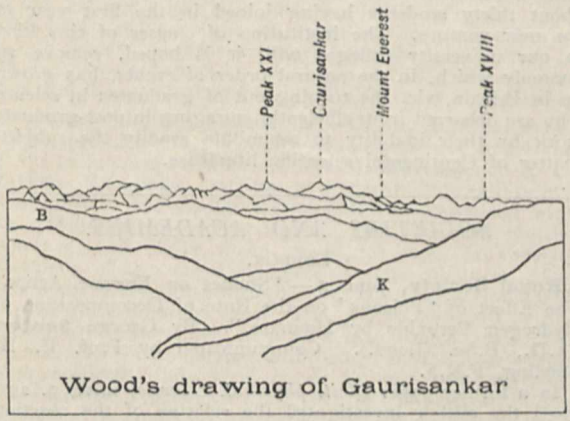


FIG. 3.

Schlagintweit's station at Kaulia. Whether it was visible or not was, I am sure, in General Walker's opinion not a question of moment.

(3) Now that Gaurisankar and Everest have been proved to be different peaks, a suggestion has been put forward [1] that they belong after all to the same "group" of peaks, and that "according to Alpine usage and precedent there is nothing to prevent the name Gaurisankar being applied to the loftiest peak of the group."

It is clear from this passage that the author is desirous of getting rid of the name of Everest, but it is not clear how his object is to be attained, whether by transferring the name Gaurisankar from the one peak to the other, or by giving the name Gaurisankar to both peaks. To displace the native name from the mountain which the natives know, and to attach it to a remote peak which they do not know, would be a course that would not commend itself to anyone interested in the preservation of local geographical names. To give the same name to both peaks would be to introduce a needless confusion.

Gaurisankar and Mount Everest, we are here told, belong to the same group; but what is a group? Controversialists give to the term different meanings to suit their own requirements. It is true that in some instances the same name has been given to different Himalayan peaks; Kangchenjunga I and Kangchenjunga II are the official designations of the two pinnacles which cap the lofty mass of Kangchenjunga; the eight peaks of a cluster in Kumaon are named Badrinath I, Badrinath II, &c.; but these peaks are slight prominences crowning the snow-clad pyramid of Badrinath, like turrets on a castle. Everest and Gaurisankar are separated by a wide interval and a deep valley, and are not spires of a single pile.

The extent to which we are justified in giving the same name to different peaks is, however, not altogether a question of intervening distance and depth; geographical significance has also to be considered. The peaks of the Badrinath cluster have a common, but no individual, significance; they are notable only as the several pinnacles of the sacred pile of Badrinath, and can therefore be classified without disadvantage under one general apellation. But the case of Gaurisankar and Everest is different: the former is remarkable in Nepal for the pre-eminence of its grandeur; the latter, screened from the gaze of man, is known only as the highest point of the earth. Would it not, then, be a mistake to include under one name two mountains the claims of which to celebrity are so different?

Before we blindly follow Alpine precedents in the settlement of Himalayan problems, we must consider well whether the conditions are identical. "It is no exaggeration to say," writes a great Himalayan authority, "that along the entire range of the Himalayas valleys are to be found among the higher mountains, into which the whole Alps might be cast, without producing any result that would be discernible at a distance of ten or fifteen miles." [1]

The Discovery of a Supposed Tibetan Name.—Colonel Waddell's book,[2] "Among the Himalayas," gives a good description of the Nepalese mountains with many interesting profiles; the author's investigations have enabled him to authenticate a Tibetan name for a high peak which he believes to be Mount Everest. This name is Jamokangkar, sometimes spelt Chamokankar.

Now let us suppose for one moment that it will be proved by future evidence—not at present forthcoming—that the mountain called Jamokangkar by Tibetans is identical with our Mount Everest. What then? Will it be incumbent upon us to abandon the name of Everest and to adopt that of Jamokangkar? I think not.

When the Gaurisankar controversy opened, the name of Everest was an interloper upon the map of Asia; but its trespass has long since been condoned. Time and usage have secured for it a right not less sacred than the right of origin; for what, after all, is the right of origin but that conferred by time and usage? To displace now this name from its lofty position in geography would seem to many of us an outrage.

It will, I think, be lamentable if former advocates of the name Gaurisankar, seeing that their cause is doomed, continue the struggle under this new flag of Jamokangkar. Already, to our regret, has Mr. Freshfield, a life-long defender of the claims of Gaurisankar, declared in favour of the Tibetan name.[3]

The old dispute has been settled; the names Gaurisankar and Everest have been proved to belong to different peaks; and it is to be hoped that Continental geographers, who have hitherto attached the name of Gaurisankar to the famous peak that we call Everest, will, in the interests of scientific harmony, now accept the name that has always been accepted by India. But before we can look for Continental acquiescence we must endeavour to show agreement at home. Few Continental geographers see the official reports of the Indian Government; the majority draw their conclusions from articles in our geographical Press.

In March, 1903, Mr. Freshfield, the late secretary of the Royal Geographical Society, wrote in the *Geographical Journal* as follows:—"The reason, for which the surveyors argued so strenuously forty-five years ago, that the 29,002 feet peak cannot be the Gaurisankar of Nepal was, of course, that their chief's proceeding in giving the mountain an English name was excused, or justified, at the time by the assertion that it had no local or native name."

The surveyors whose motives Mr. Freshfield has impugned were formed into a committee forty-five years

[1] *Geographical Journal*, March, 1904, p. 362.

[1] See the article on Himálaya by General Sir R. Strachey, R.E., in "Encyclop. Brit.," 9th edition.

[2] Published 1899.

[3] *Geographical Journal*, March, 1904, p. 363.

ago to consider the question whether the peak which Mr. Hodgson called Devadhunga was identical with the peak which Sir A. Waugh called Mount Everest; from the geographical evidence available they concluded that the two peaks were not identical, and their conclusion has been found correct.[1] In those early days there had arisen no such subtle questions as whether Mount Everest formed part of a certain range, or whether it belonged to a certain group of peaks, or whether it was just visible to those who knew where to search for it. To the clear minds of our predecessors, to Hodgson and Waugh and Schlagintweit and Walker, there was but one question at issue, namely, the identity of Hodgson's and Schlagintweit's peak with the Mount Everest of the Survey.

This question has now been answered, and after fifty years of discussion the Hindu and Nepalese names have been proved to be inapplicable; let us, then, close a controversy that has fulfilled its purpose, and let us suffer the English name to rest on our maps in peace.

S. G. BURRARD.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Vice-Chancellor has appointed Prof. Ray Lankester, hon. fellow of Exeter College, to be Romanes lecturer for 1905.

Sir John Burdon Sanderson, Bart., hon. fellow of Magdalen College, late regius professor of medicine, has been constituted a perpetual delegate of the university museum.

Mr. Walter J. Barton, scholar of New College, has been elected to the geographical scholarship for 1904–5.

The executive committee of the Oxford division of the British Medical Association has had the electric light permanently installed in the Pitt-Rivers Museum as a mark of their appreciation of the generosity of the university in allowing the association to make use of their various buildings and of the help the university gave them in other ways during the meeting of the association in Oxford in July last. The cordial thanks of the university have been conveyed to the Oxford division of the association for their most acceptable gift, and the curators of the university chest have been empowered to erect a suitable record of the occasion in the Pitt-Rivers Museum.

CAMBRIDGE.—Mr. J. C. Willis, of Gonville and Caius College, director of the botanic garden at Peradeniya, Ceylon, has been approved for the degree of doctor of science.

Prof. G. H. Darwin, F.R.S., and Mr. A. E. Shipley, F.R.S., have been elected members of the council of the Senate.

Mr. A. Young, tenth wrangler in 1895, lecturer in mathematics at Selwyn College, has been elected a fellow of Clare College.

Mr. R. P. Gregory, demonstrator of botany, and Mr. E. Cunningham, senior wrangler 1902, have been elected fellows of St. John's College.

Prof. Marshall Ward, F.R.S., has been elected president, and Prof. Thomson, F.R.S., Prof. Liveing, F.R.S., and Dr. Hobson, F.R.S., vice-presidents of the Cambridge Philosophical Society.

WE learn from *Science* that the will of Mr. James Callanan, of Des Moines, makes bequests amounting to 27,000*l.* for educational institutions. Of this sum 20,000*l.* goes to Talladega College, Alabama.

THE chair of chemistry applied to the dyeing industry at the Paris Conservatoire des Arts et Métiers, rendered vacant by the death of M. Victor de Luynes, has been given, states the *Athenaeum*, to M. Maurice Prudhomme, who acted as reporter of the section devoted to textile industries and dyeing at the Exposition Universelle of 1900.

THE following deans of faculties of the University of London have been elected for the two years 1904–6:—medicine, Dr. J. K. Fowler; science, Dr. A. D. Waller, F.R.S.; engineering, Prof. J. D. Cormack; economics, Mr. G. Armitage-Smith.

[1] *Vide Proceedings* R.G.S., 1858.

MR. ANDREW CARNEGIE, who has been Rector of the University of St. Andrews for the past term of three years, was re-elected to that office on November 4.

AN open competitive examination for not fewer than twenty situations as assistant examiner in the Patent Office will be held by the Civil Service Commissioners in January next. The examination will commence on January 2, 1905, and forms of application for admission to it are now ready for issue, and may be obtained on request addressed by letter to the secretary, Civil Service Commission, Burlington Gardens, London, W.

DR. C. KASSNER has been appointed professor of meteorology at the Berlin Technical College; Dr. Maurer physicist to the German Navy; Dr. O. Lummer, from Charlottenburg, to succeed Prof. O. E. Meyer as professor of physics at Breslau; Prof. London, of Breslau, to succeed Prof. Heffter as professor of mathematics at Bonn. Dr. Augustin, of Prague, has been raised to the rank of ordinary professor of meteorology, and Dr. Karl Exner has retired from the chair of physics at Innsbruck with the title of Hofrat.

IN view of the importance of German to students of science, the University College of North Wales founded a lectureship in German, to which was attached the duty of conducting a beginner's class in that language, with especial reference to the needs of students qualifying for science degrees, and Mr. Rea, of Belfast, was appointed lecturer. The experiment bids fair to be a complete success, about thirty students having joined in the first year of the new venture. The institution of classes of this kind in our university colleges will, it is hoped, remove an anomaly which, in the natural order of events, has grown up in Britain, viz. the turning out of graduates in science who are debarred from efficiently engaging in post-graduate work by their inability to assimilate readily the subject-matter of Continental scientific literature.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 2.—"Studies on Enzyme Action: The Effect of 'Poisons' on the Rate of Decomposition of Hydrogen Peroxide by Hæmase." By George **Senter**, Ph.D., B.Sc. (Lond.). Communicated by Prof. E. H. Starling, F.R.S.

In a former paper (*Zeit. physikal. Chemie*, xliv., p. 257, 1903) the author investigated the relation of the reaction velocity to peroxide concentration and amount of enzyme present, as well as the acceleration caused by rise of temperature; the results correspond almost exactly with those obtained by Bredig in his experiments on the decomposition of hydrogen peroxide by colloidal platinum. In the present paper, assuming that hæmase is also a colloid in solution, it is suggested that the velocity of reaction between the catalysor and hydrogen peroxide is great in comparison with the rate of diffusion of the peroxide to the colloidal particles, so that what is measured is really a diffusion-velocity. This would account for the analogous results obtained with platinum and hæmase, since the nature of the catalysor would be of secondary importance.

The hæmase catalysis of hydrogen peroxide, like the platinum catalysis, is retarded by small quantities of many substances, more especially by those which act as poisons towards the living organism. Thus mercuric chloride, sulphuretted hydrogen, and hydrocyanic acid, in the concentration of 1 gram-molecule to 1 million litres, reduce the reaction-velocity to half its value; they are just the substances which have the greatest retarding effect on the platinum catalysis. Iodine, mercuric cyanide, and aniline have a much smaller effect. Arsenious acid, sodium fluoride, and formaldehyde do not greatly retard the catalysis; although powerful antiseptics, they have little effect on enzyme actions in general. Carbon monoxide, although an active poison for the platinum catalysis, does not affect hæmase. Hæmase, like other enzymes, but unlike platinum, is very sensitive even to minute quantities of acids and alkalis. The retarding effect of acids is, in most cases, proportional to the concentration of hydrogen ions, in other words, to the strength of the acid. The ways in which

poisons may act are discussed in the paper, and it is suggested that in many cases they enter into chemical combination with the enzyme.

Royal Microscopical Society, October 19.—Dr. Dukinfield H. Scott, F.R.S., president, in the chair.—A communication from Mr. W. D. **Colver** described the antennæ of *Pulex irritans,* on the terminal joint of which Mr. Wm. Jenkinson, of Sheffield, had discovered a lamellated structure that he believed to have an olfactory function. Mr. Jenkinson had found similar structures in several other members of the family Pulicidæ. A slide showing the entire antenna, and another showing the terminal joint, were exhibited under microscopes, and photographs of the latter slide were exhibited in the room and on the screen. —Part xvii., being the concluding part, of Mr. **Millett's** report on the recent Foraminifera of the Malay Archipelago was taken as read.—The **President** then gave a demonstration on the reconstruction of a fossil plant. The plant selected was *Lyginodendron Oldhamium.* The growth of our knowledge of its construction was illustrated by a number of actual sections and lantern slides shown on the screen. The identification of the stem of a Pinites, the fern-like petiole of *Rachiopteris aspera,* and the foliage of *Sphenopteris Höninghausi* as being corresponding parts of Lyginodendron was demonstrated. It was discovered that the stem was frequently branched, and certain fossil seeds are now, on structural evidence and association, considered to be the fruit of this plant. The reconstruction of the plant is, however, still incomplete, for the male organs have not yet been identified with certainty. The position of Lyginodendron as a seed-bearing plant allied at once to cycads and ferns was now established. A picture of the reconstructed plant was shown on the screen, and models of the seed lent by Prof. F. W. Oliver were exhibited.

Physical Society, October 28.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—An interference apparatus for the calibration of extensometers: J. **Morrow** and E. L. **Watkin.** The paper describes an apparatus for calibrating extensometers and similar instruments by comparison with the wave-length of sodium light. The apparatus is self-contained and easily made ready for use. It consists essentially of two metal cylinders of equal diameter, with their axes in the same straight line, but with a small gap between their adjacent ends. The gap is increased or decreased by the movement of a lever actuating a screw, and the alteration in its amount is measured by the interference rings produced in an optical system situated inside the gap. —A sensitive hygrometer: Dr. W. M. **Thornton.** The instrument is made by enclosing the cooled surface of a Regnault's hygrometer in a glass globe so that only the mass of vapour contained in the vessel is available for condensation. The cooled surface is made much smaller than usual—about 1 sq. cm. The surface-density of the deposited moisture depends on the total quantity of water-vapour present. If this is more than a minimum to be determined later, it will be visible either by the loss of brightness by scattering, or by observing, as in the Dines hygrometer, the scattered light itself. Little is known as to the manner in which moisture is deposited on smooth cold surfaces. Dr. Park has shown that the thickness of the deposit is of the same order as that of the black spot in interference films. The reflection of light from such a clear layer of uniform thickness backed by a bright surface is considered in the paper, and it is shown that the loss of light due to the thinnest possible films can be perceived. The opposite case to that of a smooth layer is that of clear spherical particles resting on the surface. This is also considered, and the surface-density to give a visible deposit is calculated. In connection with this an interesting note was received from Lord Rayleigh in reply to an inquiry, in which he shows that the maximum brightness of a cloud is about 4×10^{-5} that of the sun. Comparing all values, it is taken that 10^{-5} grams per sq. cm. can be detected by unaided vision with diffused light. The time taken for moisture to diffuse from a state of uniform distribution throughout the globe towards the centre is then calculated, and found to be less than ten minutes for a sphere of 20 cm. diameter. The paper is an attempt to make the somewhat neglected Regnault hygrometer an instrument of precision in the detection of small quantities of moisture.—Note on a property of lenses: Dr. G. E. **Allan.** A well known method of testing the concavity or convexity of a lens consists in holding the lens at arm's length and, while looking through it, moving it from side to side or up and down, when the image in the convex lens is found to move in the opposite direction to that of the lens, whilst in the case of the concave lens it moves in the same direction. The above facts hold if, instead of the naked eye, we employ a microscope.

PARIS.

Academy of Sciences, October 31.—M. Mascart in the chair.—Presentation of vol. xi. of the "Annales de l'Observatoire de Bordeaux": M. **Lœwy.**—Trypanosomiasis in French West Africa: A. **Laveran.** The sleeping sickness is endemic in several regions of Senegal; an examination of six specimens of biting flies from this district showed that they were all *Glossina palpalis,* the fly which, according to the researches of Dr. Bruce, propagates human trypanosomiasis. In the blood of horses from French Guinea, in two cases numerous trypanosomes were encountered. In the flies from this region, *Glossina palpalis* predominated. On the Ivory Coast, sporadic cases of human trypanosomiasis are common; here one specimen of *G. palpalis* was found, together with several *G. morsitans.* Round Lake Tchad numerous trypanosomes, having the characteristics of *Trypan. Brucei,* were found in the blood from infected horses; *G. tachinoides* here appears to be the characteristic tsetse fly.—On a case of long phosphorescence emitted by the wood of a cherry tree: M. **Clos.**—The rotation of Venus: P. **Lowell.** The results of spectroscopic observations show a velocity of about 0·005 kilometre a second, which favours a long period of rotation. For a twenty-four hour period, the velocity would be 0·450 kilometre a second.—The rotation of Mars: P. **Lowell.** The spectroscopic measurements give a velocity of 0·228 kilometre per second, as against 0·241 kilometre calculated from the previous eye observations.—On a new micrometer. History of the question: G. **Millochau.** An account of previous applications of the use of parallel glass plates as a micrometer.—On a new safety arrangement for electrical mains at high tension: L. **Neu.** Each line is furnished at its source with an interrupter which works automatically in the case of a wire breaking, of a bad insulation, or in the event of an accidental contact between the high tension wire and a telegraph or telephone wire.—On the atomic weight of aluminium: M. **Kohn-Abrest.** Aluminium, the impurities in which had been determined by analysis, was treated with acid, and the evolved hydrogen burnt to water. The mean of seven experiments gave 99·15 parts of water from 100 parts of the pure metal, corresponding to an atomic weight for the aluminium of 27·05 (oxygen, 15·88).—The action of halogen derivatives of the metalloids on halogen alkyl compounds: V. **Auger.** The alkyl iodides, bromides, and chlorides react with phosphorus iodide, giving alkylphosphinic acids. No reaction occurs with the chloride of arsenic; chloride of bismuth simply gives rise to an exchange of halogens, whilst with chloride of antimony the quantity of antimony-alkyl was too small to separate.—The tetrahydride and decahydride of naphthalene: Henri **Leroux.** These addition products were obtained from naphthalene by means of the Sabatier and Senderens reaction. Their properties and those of some halogen derivatives are described.—The action of the chlorides of phosphorus on the organomagnesium compounds of the aromatic series: R. **Sauvage.** The action of phosphorus oxychloride upon organomagnesium compounds of the aromatic series leads to the production of compounds of the type $R_3 : P : O$ and $R_2=POCl$, the latter, after treatment with water, giving acids $R_2=PO.OH$. The tetraoxycyclohexane-rosanilines: Jules **Schmidlin.** The author quotes some experiments of Lambrecht and Weil as affording a new confirmation of his views on the quinonic structure of these compounds, and also as showing that the benzene ring of the carbinol passes through the hexahydrobenzene ring before forming the quinone ring.—The density of nitrous oxide and the atomic weight of nitrogen: Philippe A. **Guye** and Alexandre **Pintza.** The nitrous oxide used in these experiments was prepared from sodium nitrite and hydroxylamine sulphate. After weighing the flask full of the gas, the latter was condensed by connecting the flask with a

side tube, well cooled, and containing charcoal. The effect of some of the impurities in the gas was thus eliminated. The atomic weight deduced for nitrogen from these experiments is 14·013. Previous values obtained in the author's laboratory by different methods are, from the limiting density of nitrogen, 14·004; by weighing nitrous oxide, 14·007; by the volume analysis of the same gas, 14·019. The mean of the four methods gives 14·011.—On the oxidation of ethyl and methyl alcohols at the temperature of their boiling points: René **Duchemin** and Jacques **Dourlen.** The rapid deterioration of some alcohol lamps had been attributed to the presence of some acid impurities in the alcohol used. It is now shown that these alcohols are rapidly oxidised at their boiling points in the presence of copper, and the effects noticed are possibly due to this action.—On the anatomy of some fishes of the genus Orestias: Jacques **Pellegrin.** The difference in the pharyngeal apparatus in these fishes is caused by a special adaptation due to the special food, small molluscs with very hard shells.—Contribution to the study of resorption of the vitellus during the embryonic development: H. **Dubuisson.**—On the coincidence between the geosynclinals and the great circles of maximum seismicity: de Montessus **de Ballore.**—On the continuity of the tectonic phenomena between the Ortler and the Hohe Tauern: Pierre **Termier.**—On the pit of Trou-de-Souci, Côte-d'Or: E. A. **Martel.**

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 10.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The premiums awarded for papers read or published during the session 1903-4 will be presented, and the president, Mr. Alexander Siemens, will deliver his inaugural address.

MATHEMATICAL SOCIETY, at 5.30.—Annual General Meeting.—Presidential Address on the Theory of Waves on Liquids: Prof. H. Lamb.—Note on the Application of the Method of Images to Problems of Vibrations: Prof. V. Volterra.—On the Zeros of Certain Classes of Integral Taylor's Series: G. H. Hardy.—The Linear Difference Equation of the First Order: Rev. E. W. Barnes.—Curves on a Conicoid: H. Hilton.—Remarks on Alternants and Continuous Groups: Dr. H. F. Baker.—On the Expansion of the Elliptic and Zeta Functions of $\frac{2}{3}K$ in Powers of q: Dr. J. W. L. Glaisher.—Examples of Perpetuants: J. E. Wright.—Two Simple Results in the Attraction of Uniform Wires obtained by Quaternions, with, for comparison, their Verification by the Geometry of the Complex: Prof. R. W. Genese.—On the Reducibility of Covariants of Binary Quantics of Infinite Order: P. W. Wood.—On some Properties of Groups of Odd Order: Prof. W. Burnside.

FRIDAY, NOVEMBER 11.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Note on the Variation of η Aurigæ: Col. E. E. Markwick.—On a very Sensitive Method of Determining the Irregularities of a Pivot; on the Pivot Errors of the Radcliffe Transit Circle, and their Effects on the Right Ascensions of the Radcliffe Catalogue for 1890: A. A. Rambaut.—The Determination of Selenographic Positions and the Measurement of Lunar Photographs: Third Paper—Results of the Measurement of Four Paris Negatives: S. A. Saunder.—Discussion of the Long-Period Terms in the Moon's Longitude: P. H. Cowell.—A Determination of the Apex of the Solar Motion and the Constant of Precession from a Comparison of Groombridge's Catalogue (1810) with Modern Greenwich Observations: F. W. Dyson and W. G. Thackeray.—Magnetic Disturbances 1882 to 1893, as Recorded at the Royal Observatory, Greenwich, and their Association with Sun-spots: E. W. Maunder.—Ephemeris for Physical Observations of the Moon, 1905: A. C. D. Crommelin.

MALACOLOGICAL SOCIETY, at 8.—Descriptions of Three New Species of Opisthostoma from Borneo: E. A. Smith, I.S.O.—Two Apparently New Species of Planispira from the Islands of Java and Gisser: Rev. R. Ashington Bullen.—The Anatomy of *Siliqua patula*, Dixon: H. Howard Bloomer.—On the Genus Tomigerus, with Descriptions of New Species: H. von Ihering.—Notes on Some New Zealand Pleurotomidæ: Henry Suter.—Notes on Some Species of Chione from New Zealand: Henry Suter.

SOCIOLOGICAL SOCIETY, at 4.—Relation between Sociology and Ethics: Prof. Höffding.

PHYSICAL SOCIETY, at 8.—Investigation of the Variations of Magnetic Hysteresis with Frequency: Prof. T. R. Lyle.—The Determination of the Mean Spherical Candle Power of Incandescent and Arc Lamps: G. B. Dyke.—Exhibition of Physical Apparatus: Robert Paul.

TUESDAY, NOVEMBER 15.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Discussion of Papers—Coast Erosion: A. E. Carey, and Erosion on the Holderness Coast of Yorkshire: E. R. Matthews.—*Succeeding Paper*:—Distribution of Electrical Energy: J. F. C. Snell.

ZOOLOGICAL SOCIETY, at 8.30.—(1) On Mammals from the Island of Fernando Po, collected by Mr. E. Seimund; (2) On Hylochœrus, the Forest-pig of Central Africa: Oldfield Thomas, F.R.S.—On the Species of Crowned Cranes: Dr. P. Chalmers Mitchell.—On the Mouse-hares of the Genus Ochotona: J. Lewis Bonhote.

MINERALOGICAL SOCIETY, at 8.—Anniversary Meeting.—New Localities for Gyrolite and Tobermorite: J. Currie.—Occurrence of Brookite with Anatase in the Cleveland Ironstone: C. R. Lindsey.—(1) Some Applications of the Gnomonic Projection to Crystallography; (2) The Construction of Crystallographic Projections: H. Hilton.—Some New Forms of Quartz-wedge and their Uses: J. W. Evans.—(1) On Three New Minerals from the Binnenthal; (2) On some Curious Crystals of Blende: R. H. Solly.

WEDNESDAY, NOVEMBER 16.

CHEMICAL SOCIETY, at 5.30.—The Isomerism of the Amidines of the Naphthalene Series: R. Meldola and J. H. Lane.—Theory of the Production of Mercurous Nitrite and of its Conversion into various Mercury Nitrates: P. C. Ray.—Amide Chloroiodides: G. D. Lander.—A New Synthesis of Isocaprolactone and some Derivatives: D. T. Jones and G. Tattersall.—The Influence of Substitution in the Nucleus on the Rate of Oxidation of the Side-chain, II. Oxidation of the Halogen Derivatives of Toluene: J. B. Cohen and J. Miller.—The Halogen Derivatives of Naphthacenequinone: S. S. Pickles and C. Weizmann.—Constitution of Pyrazolidone Derivatives: B. Prentice.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Theories of Microscopic Vision (a Vindication of the Abbe Theory): A. E. Conrady.

ENTOMOLOGICAL SOCIETY, at 8.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Meteorological Observing in the Antarctic: Lieut. Charles Royds, R.N.—Decrease of Fog in London during recent Years: F. J. Brodie.—Hurricane in Fiji, January 21-22, 1904: R. L. Holmes.

SOCIETY OF ARTS, at 8.—Inaugural Address by Sir William Abney, K.C.B.

THURSDAY, NOVEMBER 17.

ROYAL SOCIETY, at 4.30.

LINNEAN SOCIETY, at 8.—On the Structure of the Stems of Plants: Lord Avebury, F.R.S.—Observations on Undescribed or Little Known Species of Membracidæ: G. B. Buckton, F.R.S.

FRIDAY, NOVEMBER 18.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Impact Tests on the Wrought Steels of Commerce: A. E. Seaton and A. Jude.

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