THURSDAY, JANUARY 3, 1907.

PLANT DISPERSAL AND KINDRED PROBLEMS.

Observations of a Naturalist in the Pacific between 1896 and 1899. By H. B. Guppy. Vol. ii. Plant Dispersal. Pp. xxvi+627. (London: Macmillan and Co., Ltd., 1906.) Price 21*s.* net.

FEW of the problems that confront the naturalist are wider in their range of interest than those connected with the origin of the present inhabitants of an oceanic island. Such a population is almost always a very mixed one, though it can usually be roughly divided into two classes, the one embracing the aboriginal or endemic element, whilst the other is composed of colonists hailing, it may be, from widely-sundered centres of emigration. But closer investigation shows that such a distinction is, after all, not a very profound one. The forbears of the endemic groups were themselves at one time colonists; time and circumstance have permitted and encouraged divergent variation, and so new types have arisen. The *causes* responsible for the variation itself for the most part elude recognition, and their study is the business of the physiologist rather than of the naturalist, but the *effects* may well serve to concentrate the attention of the latter on the larger problems bearing on the nature and significance of adaptation no less than on those more directly concerned with the sources and mode of dispersal of the individual species.

Mr. Guppy, in his "Observations of a Naturalist in the Pacific," has kept both sets of problems clearly before him, and has produced a book that will deservedly appeal to a wide circle of biologists, and, indeed, to all who are interested, not merely in the details, but also in the philosophical aspects of distribution.

The author will probably not expect his ideas to command universal assent. It is inevitable, and indeed desirable, that divergence of opinion should exist as to the true explanation of phenomena which are still but imperfectly comprehended. But such dissentience in no way detracts from the value of his work. Perhaps the highest praise that can be earned by any contribution to science is to say of it that its facts are really facts, and its theories, whatever be their ultimate fate, are stimulants to further research.

Although the book before us deals with matters affecting the distribution of plants in general, the subject is more especially considered in relation to the littoral floras of the Pacific islands. The author takes as types to illustrate the wider bearings of his own observations the floras of Hawaii, Tahiti, and Fiji. He discusses very fully the various causes which in the case of the three island groups chosen have produced results so dissimilar, notwithstanding the equality of conditions which at first sight appears to prevail between them.

The keynote of the explanation advanced to account for the facts is to be found in the buoyancy of the seed or fruit. But whilst many of the author's conclusions are both suggestive and interesting, it may be doubted whether others will be prepared to accept his views as to the connection between buoyancy and habitat.

Put briefly, his position is this. The capacity of floating determines the position of those species possessing buoyant fruits or seeds by the river or on the coast. Which of the latter stations is actually occupied will depend on the degree of transpiratory activity on the part of the plant, that is to say, on whether it happens to be a xerophyte or not. If the former, then it will be chiefly restricted to the coast, but if not it will be precluded from occupying a position that is only suited to plants that can withstand physiological drought, and it will be driven to take up its position by the river or pond. Mr. Guppy expressly and repeatedly states his conviction that it is not the station which is responsible for the development of buoyant seeds, but that the plants so characterised reach and colonise littoral or riparian stations because they can be distributed to them; in other words, position does not determine buoyancy, but buoyancy determines the station, subject to the further sorting-out process which is associated with xerophilous or hygrophilous habit.

But the author himself shows that seeds or fruits of the same species may exhibit great variation in their power of floatation, some sinking at once when placed in sea water, whilst others from the same tree may float without injury for months. He goes farther than this, and emphasises the need, in making such tests, of taking seeds from plants grown under similar conditions. Thus in *Afzelia bijuga*, experiment showed that of the seeds taken from a littoral example 70 per cent. floated in sea water, whilst of those gathered from an inland individual of the same species only 23 per cent. were able to swim. Several other similar examples could be cited. Such evidence would seem, however, to indicate that the environment is not without its direct influence in determining the floatability or the reverse of the seeds, and clearly if this is so natural selection has material enough to work on. At any rate, one would hesitate before accepting the author's conclusions as to the real relation between buoyancy and station.

A very useful account is given of the several structural features to which buoyancy may be due. As they are often remarkably simple, it seems not unreasonable to think that an experimental study of the direct reaction of the plant to the environment in such cases as these would almost certainly yield interesting and valuable results.

The author has some excellent remarks on the nature and origin of adaptive characters, and they deserve to be carefully read by members of that large but somewhat careless class of naturalists who imagine that when a structure has been shown to be useful for a particular purpose, its occurrence is thereby "explained." Nothing can be farther from the truth, and the more we know of "adaptive" structures the less directly does their origin appear to be related with the function they ultimately dis-

charge. One might go so far as to suggest that it is only by accident that a character developed at one period in the life-history becomes of use at another, for such utility almost always involves a change of primitive function that could not have been foreseen at the first appearance of the structure in question. Thus to quote the case of the floating mechanism, the stimulus that provokes the formation of air-filled spaces is most often connected with respiration, and they are first "adapted" for this purpose. Their subsequent use for floatation is an accident. It is true it may be of immense importance to the *species*, but its value could not, so to say, have been foreseen by the individual in which it arises.

A chapter on mangroves forms an interesting diversion from the main track of the thesis. It is known that curious barren forms of the genus Rhizophora occur in various regions. These apparently combine the characters of more than one species, but the suggestion is put forward that they are not hybrids, but represent examples of dimorphism. The hypothesis is rather startling, but it is very well worth while testing. If it should prove to be well-founded, the investigation would certainly yield results of considerable scientific importance.

Limitations of space preclude the possibility of attempting to discuss the great bulk of new and interesting observations that crowd the pages of Mr. Guppy's book, but enough has been said to show that the author has made a very real contribution to biological science. J. B. F.

PETROLEUM AND ITS PRODUCTS.

Petroleum and its Products. By Sir Boverton Redwood. Two vols. Pp. xxxii + 1064. Second edition, thoroughly revised and enlarged. (London: Charles Griffin and Co., Ltd.) Price 45*s.* net.

NO harder task exists than to criticise a book with which the reviewer is in complete accord, and so perfect an example of what a book of reference should be as Sir Boverton Redwood's monograph on petroleum and its products, of which the second edition has now been issued, offers no mark for criticism.

The ten years which have elapsed since the first edition of this work was published have seen many advances in the industrial use of petroleum products, and a period which has been marked by the growth of the use of liquid fuel from the experimental stage to the important position it now occupies in the principal navies of the world, and the perfection of the internal combustion engine with its widespread application, has brought in its wake so many alterations and modifications in processes that a complete revision, and indeed re-writing, of a very large portion of the book has been necessitated, the two volumes now containing more than a thousand pages.

The first section of the work deals with the history of the petroleum industry, from the use of bitumen in building the Tower of Babel down to statistics as recent as 1904, and this portion of the work is rendered the more valuable by the data being subdivided under the headings of the various countries in which petroleum is found.

The geological and geographical distribution of petroleum and natural gas occupies the second section, which is illustrated by maps of the principal oil-bearing districts, and cross sections of some of the more important oil fields and wells. A consideration of the oil fields of the world naturally leads to the discussion of the chemical and physical properties of petroleum and natural gas, which occupies the third section of the work, and contains a wonderfully complete compilation of the enormous amount of work which has been done on the subject, and which is rendered the more valuable by the references being given for all the works quoted.

The next section deals with the much-vexed question of the origin of petroleum and natural gas, and a discussion of the various theories which have been from time to time formulated, and although the balance of evidence is distinctly in favour of the views expressed by Höfer and Engler, as to petroleum being of animal origin, whilst natural gas is a secondary product of the same decomposition, the reader cannot help the conviction that there are many cases in which a vegetable or even inorganic origin might have caused the deposits.

The fifth section will be considered by many readers one of the most important in the work, dealing as it does with the methods adopted for winning the crude oil, and much of the practical information as to the methods employed in the American, Canadian, Russian, and other oil fields is founded on the author's own experience.

The important subject of refining the oil, which occupies the next section, covers not only the general methods employed, but also the details of the methods of manufacture adopted in America, Russia, and elsewhere, and is enriched by numerous references and extracts from the work of Engler and other Continental authorities too little known in England.

The shale oil industry, being of British origin, claims a large amount of interest, and the struggles of James Young in founding it on its present basis form a fitting introduction to the seventh section, dealing with shale oil and allied industries, whilst an able section on the transport, storage, and distribution of petroleum ends the first volume of the book.

To the chemist the second volume is even more interesting than the first, as the reader is at once plunged into the methods adopted for the testing of crude petroleum and the many products obtained from it, and especially interesting is the historical account of the early legislation with regard to the flash point, and the part played by Sir Frederick Abel and the author in fixing the flash point at its present value. This section also contains a full account of the beautiful method of testing for petrol vapour and other inflammable vapours in air devised by Prof. Clowes and the author, which depends on the fact that a hydrogen flame of fixed dimensions burning in air containing a small proportion of inflammable gas or vapour is seen to be surmounted by a small cap or halo, the size of which indicates the amount of in-

flammable vapour present in the air long before the mixture becomes itself inflammable.

In these days, when petroleum spirit is so largely stored and used for motor purposes, and when so many steamers are engaged in the oil trade, tests capable of revealing any dangerous leakage of vapour are of the greatest importance, and the "flame cap" offers a certain method of detection.

The tenth section of the work deals with the uses of petroleum and its products, and commences with a full description of the various types of oil lamp fitted for the consumption of mineral oils, and a full discussion of the dangers due to them. A careful study of this portion of the section would do much to disabuse the minds of that portion of the British public which has been lately clamouring for an increase in the flash point, with the idea that this would minimise the danger of the oil lamp, and especially may the following paragraph be recommended to its notice :—

"Experiments have demonstrated that the burning of an oil of comparatively high flashing point is more likely to cause heating of the lamp than the use of an oil of comparatively low flashing point, in consequence of the higher temperature developed by the former, and of the greater difficulty with which some oils of that description are conveyed to the flame by the wick. It therefore follows that safety in the use of mineral oil lamps is not to be secured simply by the employment of oils of comparatively high flashing point (or low volatility), and that the use of such oils may even in certain cases give rise to dangers, which are small, if not entirely absent, with oils of comparatively low flashing point."

The use of oil in spray lamps, the so-called "air gas," the enrichment of coal gas by carburetting, carburetted water gas, oil gas, and natural gas are here all described and discussed, whilst the use of liquid fuel leads to a full description of the various methods which have been employed, but unfortunately the author's position as leading adviser on petroleum to the Admiralty has prevented his giving any extended notice of the advances which have made the liquid fuel installations of the British Navy the finest and most successful in the world. The section closes with a short account of the principles upon which petroleum engines are constructed, but, as the author points out, the motor-car industry and consequent development of petrol engines has assumed such vast proportions that it now possesses a voluminous literature of its own, which has far exceeded the scope of the present work.

A section on the statutory, municipal, and other regulations affecting petroleum and its products brings the work to a close, whilst a voluminous appendix and excellent index add to its value. So full are the references to all original memoirs noticed in the book that a bibliography of the subject at first seemed hardly necessary, but Messrs. W. H. and L. V. Dalton have compiled one which will rejoice the heart of every student of the subject.

The petroleum industry is indeed fortunate in possessing such a work of reference, and Sir Boverton Redwood has done the world a great service in providing it.

RECENT ADVANCES IN PHYSIOLOGY.

Mercers' Company Lectures on Recent Advances in the Physiology of Digestion. By Prof. Ernest H. Starling, F.R.S. Pp. x+156. (London : Archibald Constable and Co., Ltd., 1906.) Price 6*s.* net.

As time advances it becomes ever clearer to many of those whose business it is to consider the manner in which university teaching should be carried on that the usual systematic course of lectures on the whole range of any of the larger divisions of human knowledge is an anachronism surviving from the time when there were no good text-books, and knowledge had to be conveyed directly from lecturer to student.

In all the medical schools of the country at the present day, professors or lecturers hold appointments which entail upon them the duties of lecturing over the whole of such subjects as systematic medicine, systematic surgery, physiology, or pathology and bacteriology. It is to be hoped that within the progress of a single generation such appointments may have ceased to exist, and that the student of the future may be able to give to the laboratory or the clinique that large section of his time which is at present misspent in the lecture-room. What applies to the long lecture course, too often extending over two whole winter sessions, applies with equal or greater force to the text-book written upon the whole range of a large subject.

The present volume forms a delightful and refreshing contrast to any such wearisome compilation; it consists of a short course of ten lectures given by a master worker to his students, chiefly upon the work done in his own laboratory by himself and his colleagues. This appears to the writer to be the ideal of what a lecture course should be, namely, something stimulating to enthusiasm and capable of sending the listener into the laboratory with the desire to work and learn more—a contrast in every sense to the mechanical lecture, which must wade monotonously through everything, and, gramophone like, repeat from year to year the phrases and the stereotyped long-dead thoughts of text-books devised on the same mechanical system. It is to be hoped that such special courses of lectures and specially written text-books, given and written by those in living touch with the subject in hand, may soon replace the universal lecturer and universal text-book.

Naturally, in order to present in intelligible form the work of any one laboratory, it is necessary to place it in its appropriate setting to the work of others which has preceded it and led up to it, and to give for completeness contemporary work being done elsewhere; but such an account will be given by one who has gained a complete mastery of it at first hand for the purposes of his work, and will always be real, live, and interesting as compared with the account of one who has read it only to compile a text-book or give a course of lectures.

These ten lectures on recent advances in the physiology of digestion are an example of this, and are full of interest from start to finish, by which is not meant that one follows the author in a quiescent state of en-

joyment and contented agreement from lecture to lecture, for, otherwise, one is more inclined to be continually stopping and arguing by the way, but at the same time it is felt that one is being thoroughly instructed upon the present state of knowledge of the subject by a master worker who has himself been engaged upon the problems involved.

The book is a record of a course of lectures given in recognition of a generous gift by the Mercers' Company in aid of the work of the physiological department at University College, London; a similar course is to be delivered each year, and it is to be hoped they will also be published.

This first course treats of the foodstuffs and their changes during digestion, the mode of action of ferments, secretion of saliva, digestion in the stomach, pancreatic secretion, changes in the pancreas during secretion, the properties of the pancreatic juice, the bile, the intestinal juice, and the movements of the alimentary tract. It is the "growing border," as the author himself styles it, of these important subjects which is mainly treated of, and to take up and criticise all the new work and theories involved would occupy more space than the little volume itself.

There is, however, one view of general interest with regard to the action of ferments or catalysts which here, as elsewhere, scarcely receives the consideration it deserves, and appears to be accepted without criticism. This is the law of Ostwald, that in order that an intermediate compound may be regarded as a sufficient explanation of a catalytic process, it must be first demonstrated that the rapidity of formation of the intermediate compound, and the rapidity of its decomposition into the end-products, are *in sum* greater than the velocity of the reaction without the formation of the intermediate body.

The error in this statement is the implied supposition that these three velocities are constants, in which case the law would follow—but a reaction is not constant throughout its range, beginning with high velocity and decreasing as the equilibrium point is approached. Further, for the reaction to run, all that is necessary is a potential quantity of the intermediate body, which would tend to be formed with very high velocity, so that the necessary and sufficient condition is that the intermediate body should decompose to form the end-products with greater velocity than does the initial substance when present alone. The greater velocity is obtained because the intermediate body formed with the catalyst gives a path of less resistance, so that the same chemical potential difference leads to equilibrium in a shorter time. BENJAMIN MOORE.

SCIENCE AND ROAD-METAL.

Attrition Tests of Road-making Stones. By E. J. Lovegrove. With Petrological Descriptions by Dr. John S. Flett and J. Allen Howe. Pp. xx+80. (London: The St. Bride's Press, Ltd., n.d.) Price 5*s*.

MR. LOVEGROVE'S attrition-tests have been carried out systematically for some years past in the modest but unique museum of the Hornsey Town Council, an institution devoted to the useful arts of building-construction, sanitation, and public works in general. Here the compact machine figured on p. vii makes itself heard from time to time, when the stones undergoing the tests are lifted by the internal flanges of the three revolving cylinders, and fall a distance of eleven inches in their cast-iron prisons with painful iteration. After 8000 revolutions, what is left of them is taken out, and the chips and dust broken from them are separately estimated. The production of chips, as Mr. Lovegrove points out (p. vi), is an indication of brittleness, but may not be injurious to a road. The dust, which is determined in a dry experiment and also by one in water, is so much pure waste when formed on a road-surface or in the layer of macadam itself. The melancholy and pebble-like appearance of certain stones after they have suffered from Mr. Lovegrove's inquisition can be well seen in the Hornsey Museum, or in Figs. 77 and 78 of the present volume.

The director of the Geological Survey of Great Britain has encouraged this excellent series of experiments by forming a collection of tested stones in the Museum of Practical Geology in Jermyn Street; while Dr. Flett and Mr. Howe have supplied Mr. Lovegrove's volume with petrological descriptions and photographs from microscopic sections. Indeed, these valuable additions form the greater part of the book, though the eye is unpleasantly attracted from them to the large-type advertisements which are distributed throughout its pages. Mr. Howe's "general conclusions" will be read with special interest, and we cannot help quoting the following from them:—(P. 67) "The hardest and toughest stones combine *abundance of a hard mineral—e.g.* quartz—with a *dense fine-grained texture.* (P. 69) "The very best rocks in these tests are altered rocks, and as a general rule a certain amount of alteration of the felspars seems to be an advantage. The reason for this is that the alteration produces a *number* of mineral units where formerly only *one* existed; in other words, the texture is made finer, and often the interlocking of the grains is made more complete." (P. 70) "*Fineness of grain* makes for toughness in all classes of stone."

The alteration of basic felspars of course often results in the crystallisation of granular minerals of hardness superior to that of the original material. Mr. Howe notes, moreover (p. 60), that uralitised augite is an advantage in dolerites, while augite altered to chlorite and calcite is naturally defective. Microscopic examination probably assists more in the case of rocks of the diorite, dolerite, and diabase type than in any other series; and this alone makes the practical field of the petrologist a wide one. The engineer and the experienced user of roads will, of course, recognise other grounds for the selection of this or that stone than the results of the attrition-test alone. Flints, for instance, which stand out well in the tests, are unsuited for countries with dry summers. Well-rolled limestone, on the other hand, where dry days are liable to follow dewy nights, as in the Apennines, may provide an admirable and cement-

like surface. For ordinary moist climates, however, these tests serve as a clear condemnation of all limestones. Even the gritty Kentish Rag (p. 45) comes out badly, though, in combination with the ferruginous sandstones of our Lower Greensand, it has been known to make a road that held well together in dry seasons.

The question of composite roads would be an interesting study in itself. Materials showing great differences under the attrition-test should, of course, not be used in association; but roads made of mixed gravel taken out of streams show good results in many parts of Europe. Similar material is usefully supplied by the glacial gravels nearer home. Teachers of practical geology, as well as all county and borough surveyors, will be grateful to the three authors for providing a remarkably cheap, clear and thoughtful treatise on a subject that the whirligig of time has again made of national importance. G. A. J. C.

DYNAMO DESIGN.

Elementary Principles of Continuous Current Dynamo Design. By H. M. Hobart. Pp. x+220. (London: Whittaker and Co.) Price 7*s.* 6*d.* net.

IT is scarcely necessary at this date to recommend a book by Mr. Hobart on the design of direct current dynamo machines; it is safe to say that any production by this author will repay the study of practical men, and the present book forms no exception.

The contrast presented between a volume setting forth the results of the practical experience of a man engaged in actual work and a book evolved out of the inner consciousness of a man who has access only to the theory of the subject is very striking. Books of the former class are comparatively rare, and are correspondingly valuable.

Dealing in a general way with Mr. Hobart's work, the first point that strikes one favourably is the emphasis laid on the necessity of a large amount of application on the part of the student of the principles and methods set forth. These principles and methods must be regarded as the framework on which a designer is to build; and it is folly for him to assume that he is acquainted with the subject unless and until he has gone a long way in completing the structure by his own labour. The value of the book lies in the essential soundness of this framework, more particularly of the fundamental ideas on which it is itself based than on the framework itself. The commercial point of view is not instinctive with designers, and it is of the greatest importance that it should be acquired as soon as possible. For this reason Mr. Hobart has done well to lay stress on the necessity of judging every design by taking into account its first cost as well as its technical merits.

Regarded in this way, the book consists of a series of statements explaining the way in which a dynamo should be considered as a successful machine or the reverse, and of a short account of several methods whereby the designer may himself estimate the first cost.

After preliminary chapters on what may be called the practical theory of the continuous current dynamo, Mr. Hobart deals at length with those considerations which form the limits in the design, namely, heating, sparking, and efficiency. Numerous constants and formulæ are given, and miscellaneous information from which efficiencies can be calculated. The sparking data are, naturally, based on the method of reactance voltage, introduced some years ago by the author and Mr. Parshall, although a long list of references is given to those who have contributed to the theory in recent years. This method, or some modification thereof, is so widely used that there is no necessity to describe it here. The constants for dealing with the heating and the efficiency are, perhaps, the least praiseworthy part of the book, or rather not so much the constants as the general method. The treatment in both cases seems somewhat arbitrary; for instance, it is not absolutely certain that the rise in temperature of the armature is proportional to the total watts lost—copper plus iron loss—divided by the area of the cylindrical surface. Again, the method of estimating the iron loss in the armature is distinctly rough. This point has been debated at considerable length in the columns of the technical Press; but in the present writer's opinion there are other methods which certainly give better results. The calculation of the bearing friction and windage is referred to a single curve giving the relation between this loss and the value of D^2L at the speed of 1000 revolutions per minute; but there seems to be no indication as to how the loss varies with the speed, whether in direct proportion or as the 1.5th power of the speed.

These slight discrepancies somewhat diminish the value of the book as a work of reference; but the essential feature of the book consists, as already stated, in the enforcement of a general grasp of the whole problem, commercial as well as technical.

The book contains a large number of tables in which the various calculations are set out; some are filled in and others are left blank for the convenience of the student. It will thus be seen that this is a work which can be thoroughly recommended to the student and the designing engineer alike.

OUR BOOK SHELF.

Irrigation with Surface and Subterranean Water; and Land Drainage. By W. Gibbons Cox. Pp. viii+297; illustrated. (Sydney: Angus and Robertson, 1906.)

THE author of this book has been engaged for many years in Australia in water supply and irrigation works. There are vast areas of land in that country the soil of which is of the highest fertility, but is barren and comparatively useless because of periodical aridity. The problem of irrigation of the land from the rivers and creeks that flow at times through these districts, and form inexhaustible accumulations of underground water, is treated fully and practically according to the latest and most approved methods.

With all its natural wealth and resources Australia is subject to the great drawback of occasional droughts of greater or less severity. The consequences of one of these droughts is thus graphically described:—"The natural water supply of the dis-

trict had become exhausted by use and evaporation, and the livestock were dying, while the women and children were beseeching the conductor of the Government water train—sent for the use of the line repairers' camp—to give them water. Along the dried-up beds of creeks and lagoons, miles of bleached bones of dead cattle and sheep lay exposed to view. The poor brutes, in their intense suffering, had ventured for a drink of the last water left, and sinking down, weak and helpless, had perished in the vain attempt to quench their dying thirst. Overhead a scorching sun was shining like molten brass, and the heat waves of the atmosphere rendered the eyesight powerless to define objects at a distance; all vegetation lay withered. The birds dropped gasping from the trees. The experience of that drought was sufficient to impress any man, engineer or other, with the need of finding a remedy."

The process of sinking artesian wells for irrigation is fully and practically described, from those of shallow depth that can be sunk by hand labour, to the more extensive and deeper sinkings that penetrate to a depth of 6000 feet, and require the use of a 50 h.p. engine, and cables for raising and lowering the drills which weigh 6¼ tons; the cost running up to 8000*l*. The question of irrigation and the distribution of water, treatment of alkaline water, and drainage are dealt with in separate chapters. In the appendix the statistics are given of the public artesian borings with their depths and yield. It shows that these range from 46 feet in depth and a yield of 9000 gallons a day to 4086 feet and a yield of 1,000,000 gallons a day, the highest temperature of the water flowing out being 135° F.

This book should be of great service to colonists settled in arid districts.

Through the Telescope. By James Baikie. Pp. xv+292. (London: A. and C. Black.) Price 5*s*. net.

THIS handsomely illustrated volume bears the impress of having been written by a practical observer who has suffered all the little worries and difficulties inevitably encountered by the amateur astronomer in his days of inexperience and meagre instrumental equipment. Whilst treating of the sun, moon, planets, &c., in special chapters Mr. Baikie writes of things he has observed and of difficulties he has overcome.

The two opening chapters deal with the telescope, first from the historical, secondly from the practical standpoint. The latter may be heartily recommended to beginners, who by carefully digesting and mentally assimilating it may save themselves much worry and, mayhap, expense. We question, however, whether some of the advice is not a little too detailed; some things are better left to actual experience, others to common sense, *e.g.* the instruction on p. 44 for the observer to wrap up well and keep his feet warm.

The phenomena of the celestial bodies are described in plain language, interspersed with practical hints as to observing them, which cannot fail to help the beginner in "star-gazing," and, if he follows the author's advice, in the specialised study of some particular class of objects.

The historical narrative in each case is lucid and instructive, although there are notable omissions of important work. The two appendices containing the designations and brief descriptions of "lunar formations" and "double stars, clusters and nebulæ which may be fairly well seen with instruments up to 3 inches in aperture" form a valuable addition to this volume. W. E. R.

The British Journal Photographic Almanac and Photographer's Daily Companion, 1907. Edited by George E. Brown. (London: Henry Greenwood and Co., n.d.)

THIS annual is so well known to our photographic readers, that in dealing with the present issue we can say that the volume, as in former years, maintains its high position as a mine of photographic information. In fact, its presence in every studio becomes year by year more necessary, for as a book of reference on almost every photographic manipulation it is most valuable.

In the present issue one of the features which has attracted our special attention is the excellent editorial article bringing together brief summaries of the various three-colour photographic printing processes. To-day the subject of printing in colours is so absorbing the time of many ardent workers that such a survey of the various processes in use is very opportune. Another section which will be read with much profit is the epitome of progress. Here we have brought to our notice a classified summary of the advances made in the numerous branches of photography during the past twelve months. The matter is arranged under various subheads, such as "Apparatus and Equipment," "Photographing Various Subjects," "Negative Processes," "Printing Processes," and "Colour Photography," so that for purposes of reference any particular subject can be easily found. As in former years, the formulæ for the principal photographic processes and of the principal plate and paper makers, useful miscellaneous information, and numerous tables complete the volume. Very complete indices add greatly to the utility of the work.

British Flowering Plants. By W. F. Kirby. Pp. vii+215. (London: S. Appleton, 1906.) Price 5*s*. net.

THERE are many pleasing features in this small book that treats of flowering plants in a popular way. The illustrations, if a trifle over-coloured, are characteristic, and the author describes the plants in a sufficiently technical manner to permit of their identification; on the other hand, the book hardly gives an adequate idea of the importance of the different orders, and so many foreign plants are selected for illustration that the most popular method of determination is not provided for commoner British plants.

The title furnishes no indication of the most useful information in the book afforded by the numerous notes which the author has added from his own special branch of natural history, relating to the insects that frequent plants either for destruction or indirectly for construction. This information is of value alike to the botanist and the entomologist, and the observer who proceeds to verify the references to plant-visiting insects is likely to obtain a deeper insight into the structure and ways of flowers than is necessary for mere identification. The introduction is not a botanical success and requires careful revision.

The Fauna of British India, including Ceylon and Burma. Coleoptera. Vol. i. (Cerambycidæ). By C. J. Gahan. Pp. xviii+329. (London: Taylor and Francis, 1906.)

THE series to which this volume is the latest addition is being published with the authority of the Secretary of State for India in Council under the editorship of Lieut.-Colonel C. T. Bingham. The present book is only the first part of the contemplated volume; another part, which will give an account of the Lamiidæ, is to be published later. Other volumes on Indian Coleoptera will follow in due course.

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.]*

Radium and its Disintegration Products.

IN NATURE of December 6, 1906, Mr. H. S. Allen has suggested that the difficulty encountered in introducing actinium with its four α-ray products between uranium and radium can be removed by assuming that the α particle is one-half of the helium atom, and he has applied this suggestion in a table showing six α-ray changes between uranium and radium. There would appear to be two serious and insurmountable objections to this view, however, viz., (1) the continuation of the same line of reasoning would lead to the assumption of no less than seven α-ray changes between radium and its final disintegration product, lead, while but four are known; and (2) the activity of the actinium in equilibrium with radium in minerals is entirely too low to permit any such conclusion.

That lead is the final disintegration product of uranium is, I believe, conclusively shown by the fact that in unaltered *primary* minerals from the same locality the amount of lead is proportional to the amount of uranium in the mineral, and that in unaltered primary minerals from different localities the amount of lead relative to uranium is greatest in the minerals from the locality which, on the basis of geological data, is the oldest.

In the case of a non-emanating, radio-active mineral containing no thorium, in which there is reason for assuming that the elements of the uranium-radium series have reached a state of equilibrium, the activity of the mineral in extremely thin films measured in an electroscope with a large ionisation chamber is about 5·3 times as great as the activity of the uranium present in the mineral. The activity of the radium itself is about 0·52 of the activity of the uranium, and the activity of the radium products of rapid change together about 2·4 times that of the uranium. The activity of the radium F (polonium) is probably about 0·55 uranium, and is certainly not less than 0·5. The combined activity of the uranium, the radium, and the radium products is therefore about 4·5 times the activity of the uranium alone. This leaves an activity of only 0·8 that of the uranium which can be attributed to the activity of the four α-ray products of actinium. It was the knowledge of the approximate value of this factor which led Prof. Rutherford and the writer to conclude (*Amer. Jour. Sci.*, xx., 56, 1905) that actinium was not a direct product of uranium in the same sense as is radium.

The ranges of the four α particles expelled by the actinium products have been determined by Hahn, and the average range of the four is 5·6 cm. The range of the α particle from radium itself is 3·5 cm. according to Bragg and Kleeman. If the particles are similar we would expect that the average particle from the actinium products would produce about 1·6 times the ionisation of the particle from radium. Since the activity of radium itself is 0·52 times that of the uranium in the mineral, the activity of the four actinium products might be expected to be $0{\cdot}52 \times 1{\cdot}6 \times 4 = 3{\cdot}32$ uranium. The number actually found, as has been stated above, is only 0·8 uranium, or one-fourth of this number.

It will be noted in the above that the activity of the uranium is about twice that of the radium present, which is in good agreement with the conclusion of Moore and Schlundt that there are two α-ray changes in uranium, if it is assumed that the average range of the two uranium particles is about 3·5 cm.

Although speculations of this sort are of doubtful value, the following suggestion may be sufficiently interesting to warrant its intrusion:—if the two changes in uranium and the five changes in radium are each assumed to take place with the expulsion of *four* α particles, and the four changes in actinium with the expulsion of only *one* α particle each, the conditions required by the relative activities of the various substances would appear to be fulfilled, and if, moreover, the mass of each α particle be taken as 1, then the indicated atomic weights of the successive elements are in fairly good agreement with the accepted values. We have then uranium = 238·5, actinium = 230·5, radium = 226·5, and radium F (lead) = 206·5. In making this suggestion I fully appreciate that I am taking liberties with the accepted value of e/m for the α particle.

It is of further interest to note that the activity of pure radium, calculated from the relative activity of the uranium and radium in minerals and the relative quantities present (Rutherford and Boltwood, *Amer. Jour. Sci.*, xxii., 1), is indicated as about $1{\cdot}4 \times 10^6$ times that of uranium, and the activity of pure radium bromide containing the equilibrium amounts of emanation and products of rapid change as about 3×10^6 times uranium.

BERTRAM B. BOLTWOOD.

Sloane Laboratory of Yale College, New Haven, Conn., December 17, 1906.

The α Rays.

THE α rays from radium appear to start life without electric charge, and subsequently become charged owing to collisions with the gas molecules they strike in their path. It seems, therefore, worth while inquiring what their behaviour would be if they were liable to become discharged again at a later collision, and to go on repeating this cycle during the ionising portion of their path. Very possibly the α particle is capable of losing more than one electron, in which case it would seem certain that it will have a greater charge at some portions of its path than at others. Looked at in this way the problem is a statistical one of considerable complexity, but my point of view will be sufficiently well illustrated by considering the average α particle to behave as if it had the following constitution. For a distance x of its path it possesses an electric charge e. This is succeeded by a distance x', during which its electric charge is e'. This is followed by a distance x with charge e, then a distance x' with charge e', and so on, repeating indefinitely. Let the particle have a mass m and initial velocity v_0, then, confining our attention to a portion of the path so small that v_0 is not appreciably diminished by the collisions which occur, it is easy to show that the quantity measured by the electrostatic deflection as mv_0^2/e would really be $\frac{mv_0^2(x+x')}{ex+e'x'}$, whilst the quantity measured by the electromagnetic deflection as mv_0/e would be $\frac{mv_0(x+x')}{ex+e'x'}$. Thus the measurements would give v_0 correctly, but the quantity denoted by e/m would be $\frac{ex+e'x'}{m(x+x')}$. It is evident that the apparent value of e/m would be independent of the pressure at which the measurements were made, since change of pressure changes both x and x' in the same ratio.

It is interesting to see what would happen if the α particle were *uncharged* during one series of portions of its path, and carried the ordinary electrolytic unit of charge e during the alternating portions. If the alternate stretches were equal, this is what would be obtained if it were an even chance whether the α particle escaped with or without a charge after each encounter. In this case we should have $x = x'$ and $e' = 0$, and the measured e/m would really be $e/2m$. On this view Rutherford's measurements would indicate that the α particles are hydrogen atoms with the normal charge instead of helium atoms with twice that charge.

It may well be that it is a matter of chance whether the atom struck or the α particle retains the positive charge after an ionising encounter, but I do not wish to imply that this warrants the conclusion that the α particle is a hydrogen atom. If we accept this conclusion we find ourselves face to face with serious difficulty in finding a place for helium in the story of radio-active change; but even if the α particle turns out to be a helium atom it is possible that its charge might vary periodically in something like the manner indicated. In this case the average charge would have to be twice the electrolytic unit.

This kind of view has the advantage of affording a

reasonable explanation of why the α particle ceases to produce ionising and other effects at a stage when it possesses a much greater amount of energy than that which is known to be required by a positive ion to produce other ions by collision. These effects would cease when the uncharged particle was no longer able to become ionised by colliding with a neutral atom. The energy (about 10^{-6} ergs) which it then possessed would represent the minimum energy which an uncharged particle must possess in order to shake out an electron on collision with a neutral atom.

Even if these speculations are ultimately disproved by the facts, it is interesting to note that, with such a constitution for the α ray, the experiments would measure the velocity correctly, whereas the mass, and therefore the kinetic energy, would be erroneous to the extent indicated.

Princeton, N.J., U.S.A. O. W. RICHARDSON.

The Effect of Radium on the Strength of Threads.

WE have carried out some experiments with cotton threads in continuation of those described by Miss Martin and one of us in NATURE of August 17, 1905. The following is a summary of the results obtained :—

No difference in the effect was found when the emanation was continuously removed during the exposure by a current of air. The same negative result followed an experiment in which it was sought to remove oxygen and moisture from the neighbourhood of the threads by enclosing radium and threads along with phosphoric anhydride in a tube from which the air was exhausted, some metallic sodium being afterwards heated to fusion in a side tube.

When threads or a piece of filter paper, after exposure to radium, are dyed with methylene blue, the exposed part is found to take a deeper colour than the rest. This is given as a test for the presence of oxycellulose.

A series of three-day exposures was made at increasing distances from the radium. The effect was found to become inappreciable at 18 mm. distance. When the weakening produced was plotted against distance, the curve showed a corner at 9 mm., suggesting the similar feature found by Prof. Bragg and others on the ionisation curves of α rays to mark the end of the effective range of one set of rays.

A comparison under the microscope of the broken ends of exposed and unexposed threads showed that the fibres in the former case were straight up to their ends, while the unexposed fibres were curled back on themselves. This would indicate a loss of elastic quality through the action of the radium.

J. L. MCKEE.
W. B. MORTON.

Queen's College, Belfast, December 27, 1906.

The Upheaval of the Sea Coast by Earthquakes.

THE question so long discussed by geologists concerning the upheaval of the land by earthquakes has been impressively revived by recent events. In the San Francisco *Argonaut* of November 3, 1906, Prof. H. D. Curtis, of the D. O. Mills Expedition of the Lick Observatory at Santiago, Chile, reports that the harbour at Valparaiso is now 10 feet shallower than before the earthquake of August 16, 1906, and he concludes that the movement was mainly vertical. In the Bulletin of the Geological Society of America for May, 1906, Messrs. Tarr and Martin give a memoir on the changes of level at Yakutat Bay, Alaska, produced by the great earthquake of September 3–20, 1899, two of the most terrible shocks of which occurred on September 10 and 15. The investigators prove conclusively that an uplift occurred extending along the whole Yakutat coast for more than a hundred miles, the maximum movement in Disenchantment Bay being 47 feet 4 inches. Uplifts of 7 feet to 20 feet were common, while slight subsidences also occurred in a few places.

In view of these facts, how can anyone claim that the earth is entirely solid and deny the vertical movement of the land under earthquake forces, as is done by Prof. Suess in his great work on "The Face of the Earth"?

T. J. J. SEE.

U.S. Naval Observatory, Mare Island, California, December 8, 1906.

THE observations of Messrs. Tarr and Martin in Yakutat Bay undoubtedly form a valuable addition to the knowledge we possess respecting sudden adjustments in the earth's crust.

In September, 1899, a portion of the west coast of Alaska was shattered. Fault lines were created or extended, and the displacements along these lines have been measured. On January 31, 1906, off the coast of Columbia, and on April 18 of the same year in Central California, rock movements similar to those at Yakutat were recorded. Every world-shaking earthquake—and there are about sixty of these per year—is an announcement of a molar movement. We do not know the magnitude of the masses involved, but from measurements like those made by Messrs. Tarr and Martin we may estimate them as being represented by one or two million cubic miles of rocky material.

J. M.

Emerald Green Sky Colour.

THE account of the colour of the sky on December 10, 1906, sent by your correspondent from St. Moritz closely resembles an experience of a friend and myself on December 27.

We were returning from a geological ramble to the west of Crediton, in Devonshire, and were walking eastward, while behind us and gradually overtaking us there had been for several hours a thick snowstorm which later on was to envelop us. Between three and four o'clock in the afternoon we remarked the peculiar appearance of the sky; in your correspondent's phrase, there was "instead of the usual blue, a fairly large expanse of vivid emerald green." I may add that the ground was everywhere white from previous snow.

It will be seen that the conditions in Devonshire on December 27 correspond as regards time of day, point of compass, and state of atmosphere with those observed at St. Moritz on December 10.

With J. W. Noble I shall await with much interest the explanation.

F. G. COLLINS.

Exeter.

Perception of Relief by Monocular Vision.

THE following fact seems to show that the aperture of the pupil plays an important part in the perception of relief by monocular vision.

When a polyhedron made of wire is looked at through a small pin-hole pierced on a piece of card, and the pin-hole is moved about slightly, the polyhedron seems to rotate a little about an axis perpendicular to the direction of motion of the pin-hole. The effect is most remarkable by lamplight, when the pupil is more dilated than it is in broad daylight.

T. TERADA.

Science College, Imperial University, Tokyo, November 15.

THE GEOLOGY OF THE GERMAN ANTARCTIC EXPEDITION.[1]

THE most striking geographical achievement of the German Antarctic Expedition was its determination that Antarctica occurs farther north in western Wilkes Land than had been inferred by some authorities from the work of the *Challenger*. Prof. von Drygalski and his comrades have re-established faith in Wilkes's Termination Land; as from their Kaiser Wilhelm Land they saw high land to the north-east, only about one hundred miles from the site assigned by Wilkes to his Termination Land. The most fully investigated locality in the newly discovered Kaiser Wilhelm's Land is the Gaussberg, a basalt mountain on the southern shore of the bay in which the *Gauss* reached its farthest south.

1 "Deutsche Südpolar-Expedition, 1901–1903." Edited by Erich von Drygalski. II. Band, Kartographie, Geologie, Heft i. Pp. 87, 1 map, 8 plates. (1) E. von Drygalski: Der Gaussberg, seine Kartierung und seine Formen. (2) E. Philippi: Geologische Beschreibung des Gaussberges. (3) R. Reinisch: Petrographische Beschreibung der Gaussberg-Gesteine. (Berlin: G. Reimer, 1906.) Price 18 marks.

The first part of the second volume of the expedition reports is devoted to a full description of the geography and geology of the Gaussberg. It includes three memoirs. A detailed account of the geography of the mountain is given by Prof. von Drygalski, in which he describes its form, position, and glaciation. The most interesting part of von Drygalski's report deals with the glaciation and the forms of the mountain. The inland ice from Antarctica abuts against the southern slope of the Gaussberg, although as a rule its junction with the inland ice is hidden by ice of local origin. The mountain is 370 metres in height, and it was at one period completely overridden by ice from the south; and the admirable photographs which accompany Dr. Philippi's report illustrate the subdued glaciated contours of the whole mountain. Some moraines occur on it, and indicate transport from south to north.

The valleys upon the flanks of the Gaussberg are not due to erosion, but are depressions between the lava streams or along lines of rapid weathering. In his description of the mountain, Prof. von Drygalski obviously writes with great restraint to prevent infringing on the geological report contributed by Dr. Philippi, whose memoir is accompanied by a series of excellent photographs of the mountain, its moraines, and its lavas. The whole mountain is composed of volcanic rocks, which are described in full petrographic detail, accompanied by analyses and illustrations, by Dr. R. Reinisch, of Leipzig. The rocks are leucite-basalts and leucite-basalt tuffs, rich in glass. The only other indigenous rocks occur as inclusions in the lava; they are nodules of olivine and fragments of pyroxene-gneiss and pyroxene-granite, which appear to indicate that a platform of plutonic rocks occurs at a comparatively slight depth below the basalts.

The age of the mountain is doubtful, but appears to be late Cainozoic. Dr. Philippi suggests that the eruptions may have begun in the Pliocene, and, in his opinion, they were either late Pliocene or Pleistocene. The local glaciers Dr. Philippi describes as comparatively unimportant in their development. Erratic blocks from the inland ice that once covered the whole mountain are scattered to its summit. The erratics include boulders of granites, gneiss, amphibolites and other crystalline schists, with some quartzites, sandstones, and conglomerates. They indicate the continental structure of the land to the south. The section of Dr. Philippi's report which is probably of most general interest discusses to which of the two coastal types this land belongs. According to Reiter's well-known suggestion, Wilkes' Land is of the Atlantic type, while Victoria Land, as the continuation of the New Zealand line, is of the Pacific type. The evidence available from Cape Adare and Kaiser Wilhelm Land suggests that all the intervening coast is of the Atlantic type. According to Dr. Philippi, Victoria Land is the same. His conclusion rests on two considerations. Firstly, Victoria Land is a plateau land, and when Suess originally distinguished the Atlantic and Pacific coast-types he regarded coastal plateaus as confined to the Atlantic type. The coast of northern Queensland is, however, in part a plateau edge, but it may be retained in the Pacific type, as its characters have probably been determined by a succession of step faults parallel to the coast, a structure which Prof. Suess describes as characteristic of the Pacific type.

No doubt these inner step-faulted coasts of the offlying seas of the Pacific are younger than the outer folded coast of the main ocean, and it may be convenient to separate them as secondary Pacific coasts. If so, then Victoria Land may be described as having a secondary Pacific coast, like the southern end of New Zealand and the eastern coasts of Australia; and the outer folded Pacific coast may then have passed from the middle of the South Island of New Zealand eastward towards Graham's Land along a line which is still unknown, and has perhaps been completely destroyed.

Unless the Pacific coast type is to be so re-defined as to assign an Atlantic structure to much of the Pacific coast, no adequate tectonic reason has been yet advanced for the removal of Victoria Land from the Pacific group. The second argument for this step is petrographic. Becke and Prior have both suggested that the Pacific and Atlantic types of coasts are characterised, not only by different tectonic structures, but by different groups of volcanic rocks. The volcanic rocks erupted along the Pacific folds are richer in silica, alumina, soda, and magnesia, and the volcanic rocks discharged from the fractures along the Atlantic shores are richer in potash, lime, and iron oxides. The characteristic volcanic rocks of the Pacific are rhyolites, dacites, andesites, and acid basalts. Those characteristic of the Atlantic are trachytes, phonolites, tephrites, and basic basalts. The affinities of the volcanic rocks of the southern end of New Zealand and of Cape Adare are with the Atlantic group. As a rule, the distribution of Becke and Prior's petrographic types coincides to a remarkable extent with Suess's two tectonic divisions of the coasts of the world; but the petrographic and tectonic features do not appear to coincide universally, and it is doubtful whether the former is as suitable a taxonomic character as the other.

The Gaussberg area, situated as it is at the western end of Wilkes Land, is of such special interest that it is unfortunate that circumstances prevented the German explorers from reaching a wider extent of land, as these memoirs show the high quality and thoroughness of their work. J. W. G.

FIG. 1.—Edge of the Inland-Ice and Moraines at the north-western corner of the Gaussberg.

COTTON CULTIVATION IN THE UNITED STATES OF AMERICA.

A RECENT event the results of which may be of far-reaching importance was the visit of the commission appointed by a number of representative cotton-spinners "to make inquiry on the spot so as to ascertain, as nearly as possible, the cost of growing cotton, and the economic conditions under which it is produced in the cotton belt of the United States of America; also to investigate the methods of ginning, baling, marketing, and transport of the product."

The report of the commissioners is of great interest as affording a critical survey of the methods of cotton cultivation practised in the United States, regarded from the standpoint of the spinner. Moreover, the fundamental problems facing cotton-growers in all parts of the world are essentially similar—to obtain the greatest quantity of good-quality cotton at the lowest cost, to keep in check pests, and to market the product in the best condition.

The lines along which these problems have been, or are being, solved in the country which at present produces some three-quarters of the world's total commercial cotton crop are of the greatest practical interest in all cotton-producing countries, actual or potential, because the average price at which American cotton can be placed on the market is the ultimate standard of comparison for their own efforts.

It is clear, in the first place, that the United States suffer no restrictions from want of suitable land. Texas alone is estimated to possess sufficient land to produce annually 30,000,000 bales[1] of cotton. The average commercial crop of the world is now about 17,000,000 bales, to which the United States contribute 10,600,000, Texas producing about 3,000,000 bales. Labour conditions in the cotton belt, as well as the recent movement in favour of "diversified farming," are opposed to great extension of the acreage under cotton, and a larger output would appear to depend on increased production per acre.

SEED SELECTION.—The first place in the practical methods proposed to attain this end is given to seed selection. To those acquainted with the work of Dr. Webber and other officers of the U.S. Department of Agriculture, and the wonderful activity of the department in disseminating agricultural literature and advice, it is somewhat surprising to find that "this is a point to which too little attention has been paid, no doubt owing to lack of knowledge," but, as is pointed out in another connection, the small negro farmer still grows a large portion of the crop, and "it is difficult adequately to describe the slip-shod and primitive methods which he employs." It must be remembered, too, that this report does not deal with "Sea Island" cotton, and that the careful work on seed selection which has made the cottons from Colonel Rivers's and other estates world famous is not under criticism.

Seed selection conducted on trial plots in an experiment station or in a nursery with a trained staff is tedious and arduous enough, but the practical difficulties are increased a hundredfold on estates with labour of a low order of intelligence. Other practical obstacles are also encountered. The first picking is generally regarded as yielding the best seed, but frequently the farmer has mortgaged his crop and sold in advance both seed and lint of the first and second pickings, and uses seed from the third and worst picking from which to raise the next year's crop. Advances have, however, been made, and two general principles are enunciated. Where labour is abundant the aim should be to select plants maturing over a comparatively long period and giving a large number of pickings. Where labour is scarce the selection should be of plants which ripen all their bolls as nearly as possible at the same time. Two examples are quoted. "Texas Oak" (said to give the greatest yield of upland cotton) gives 10 per cent. of the total yield at the first picking and 40 per cent. at each of the second and third pickings. On the other hand, the variety "King" yields 40 per cent. at the first and another 40 per cent. at the second picking only a fortnight later.

FERTILISERS.—In the eastern States (North and South Carolina, Georgia, and Alabama) of the cotton belt careful attention has been directed to the use of manures, encouraged, it is suggested, by the phosphatic deposits in the neighbourhood of Charleston. Between 1879 and 1905 the average yield per acre in these States increased by 35.2 per cent., whilst in the western States the increase during the same period was only 4.2 per cent.

CULTIVATION.—The negro farmer appears to be largely responsible for the very slow progress effected in this direction. Much land is still cultivated on the "share system," with all its consequent disadvantages. Improvements in cultural implements have been very rare, and the great desideratum is still an efficient cotton-picking machine; this operation alone costing now about 2¼ cents per lb. of lint—practically a quarter of the total cost of production.

PESTS.—The cotton boll weevil (*Anthonomus grandis*) is the most serious of all the American cotton pests. It now infests about one-third of the cotton area, is advancing at the rate of fifty miles per annum, and reduces the crop to about one-half in attacked areas. The loss due to it in Texas alone in 1904 was estimated at 22,000,000 dollars. Clean cultivation, the burning of old plants, and the establishment of early maturing and resistant varieties by seed selection work appear the most promising methods for dealing with this formidable pest.

GINNING.—The saw-gin, first invented by Whitney more than a century ago, still holds the field by virtue of its large output, although its defects are well recognised. Interesting information is afforded on other types of gins, still more or less in the experimental stage.

BALING.—The bad qualities of the American cotton bale are notorious, and the commissioners quote as "none too severe" Judge Ogden's description of it at the Washington Conference of Spinners and Planters in May last as "a dirty, damaged, disreputable, water-soaked, wasteful, slovenly, clumsy, highly inflammable, turtle-backed package."

The American bale has a density of only 22 lb. per cubic foot, as opposed to 37 lb. and 56 lb. for Egyptian and Indian bales respectively. A bale with a density of about 40 lb. per cubic foot is recommended, and other improvements advocated in regard to packing, &c., which, if carried out, would, it is estimated, result in a saving of about 1,000,000*l.* annually, chiefly in cost of freight.

The principal recommendations and criticisms contained in the report are worthy of serious consideration in all countries engaged in the cultivation of cotton. An effort may soon be made to put them into practice in the United States, as, owing to the action of the cotton growers' associations in attempting to control supplies, a proposal is under consideration for English spinners to establish plantations in the cotton belt, and a second commission has already left England to select a suitable scene of operations.

[1] The weight of a bale of cotton is taken throughout as 500 lb.

NOTES.

THE prevalence and treatment of insanity have been the subject of much consideration recently; but it appears from a letter by Prof. Clifford Allbutt in Wednesday's *Times* that though our system of public asylums is honourable and humane in intention, it is, in a scientific sense, a gigantic muddle. In fact, our management of insanity is, scientifically, a chaos. "Muddle! In England, and in England alone, we muddle with complacency. Now to muddle is to labour with effects without regard to causes. Thus it is that we strive with the 'unemployed'; thus that we strive with commercial incapacity; thus that we strive with educational failures, and so forth; 'compromise' being with us not the word for adaptations, but for supineness. . . . We pile up hospitals, sanatoriums, sick asylums, homes for incurables, colonies for epileptics and idiots, at vast cost direct and indirect, and wealthy persons make bequests, sometimes even liberal bequests, to such purposes; but what testator leaves money to an organisation of research by physicians and pathologists into the sources from which this frightful and manifold destruction pours forth with an absolutely, and perhaps with a relatively, augmenting volume? (I must not seem to forget the Lister Institute or recent gifts to the Cancer Fund; but of the general truth of my statement your own reports of bequests from day to day are sufficient testimony.) No wonder that, thus ignorant but beginning to 'wake up,' we run to the nearest plausible short cuts—to quackery and to hand-to-mouth remedies which are no remedies—rather than to the laborious investigation of origins and accelerations. If fifty years ago a tithe of the money expended upon the charities which are fighting at heavy odds with consequences had been spent upon knowledge, and this knowledge had been applied to prevention by a Ministry of Health instead of, as in its present imperfection, by a secondary department of some other office, by this time half of our expenditure on these melancholy results of our ignorance would have been saved, and the saving would be rapidly multiplying itself." Prof. Allbutt urges that hospitals should be established for research into diseases of the nervous system, certain wards or wings being provided for the insane. The staff of a hospital of this kind should consist of young physicians, intellectually mature and highly and variously trained. Only when continuous and critical observations have been made under scientific conditions will it be possible to begin to create a classification of diseases of the nervous system by pathological affinity to displace the classifications which now are admirable only or chiefly for logical and metaphysical ingenuity.

DR. N. L. BRITTON, director of the New York Botanical Garden, has been elected president of the New York Academy of Sciences.

A PAPER by the Duke of the Abruzzi upon his expedition to Mount Ruwenzori will be read at a special meeting of the Royal Geographical Society on Saturday, January 12.

MR. SYDNEY S. HOUGH, F.R.S., chief assistant in the Royal Observatory, Cape of Good Hope, has been appointed His Majesty's astronomer at that observatory on the retirement of Sir David Gill, K.C.B., F.R.S.

THE honorary treasurer of the Imperial Cancer Research Fund has received from Mr. and Mrs. Bischoffsheim the munificent donation of 40,000*l.* on the occasion of the celebration of their golden wedding.

AT the annual banquet of the Institute of Chemistry of France a few days ago, it was announced in the name of the Minister of Public Instruction that the French Government has drawn up a decree giving academic recognition to the profession of chemical engineer.

THE *Kew Bulletin* announces that Captain A. T. Gage has been appointed superintendent of the Royal Botanic Gardens, Calcutta, and director of the Botanical Survey of India. We learn from the same source that Dr. D. H. Scott, F.R.S., has relinquished his post of honorary director of the Jodrell Laboratory, Kew, which he has filled with great distinction during the past fourteen years.

A MOVEMENT has been inaugurated by the professors of the National Museum of Natural History in Paris, with the approval of the Minister of Public Instruction, for the erection of a statue of Lamarck in the Jardin des Plantes. Subscriptions to the fund which is being raised may be sent to M. Joubin, secretary to the committee, 55 rue de Buffon, Paris.

THE Aëro Club has arranged for an exhibition in connection with the International Motor-car Exhibition to be held at the Royal Agricultural Hall, London, from April 6–13 next. Prizes to the value of 250*l.* are offered by the proprietors of the *Daily Mail* for model flying machines, and full particulars as to the conditions of the competition may be obtained from Mr. Harold E. Perrin, Aëro Club, 166 Piccadilly, London, W.

IT is stated in *Engineering* of December 28, 1906, that the German Railway Union has presented to the Science Museum at Munich an exact reproduction of "Puffing Billy," the oldest locomotive in existence, now preserved in the Victoria and Albert Museum. The Munich engine is an exact counterpart of the original, and has been tested under steam, when a train load of 38½ tons was hauled at upwards of six miles per hour. The work was carried out at the central shops of the Royal Bavarian State Railways at Munich.

WE learn from *Science* that Prof. H. F. Osborn has declined the secretaryship of the Smithsonian Institution, to which he was elected by the regents on December 4, 1906. In a letter to the Chancellor of the institution, Prof. Osborn explains why he is unable to accept the post of secretary. Chief among these reasons is the fact that he is nearing the completion of several monographs and books, the prosecution of which is dependent upon the collections which he has brought together in New York and the staff of trained assistants who are working with him.

A SPECIAL report from Berlin in the *Pall Mall Gazette* of December 28, 1906, described some wireless telephony experiments which have been made by Prof. Slaby, who claims to have solved successfully the problem of wireless telephony, which has been so often attempted. The trials took place over a distance of forty kilometres between the headquarters of the Wireless Telegraph Co. in Berlin and the wireless station at Nauen. The microphone was connected to a wire rising about six metres above the roof, and both figures and a sentence of extreme phonetic difficulty were received and repeated back without error, and very clearly heard. Prof. Slaby claims that no approach to forty kilometres has ever been tried before, and that his success is due to the isolation of the microphones and the "damping" of all foreign vibrations. We do not know the greatest distance over which Mr. Paulsen has successfully conducted his wireless telephony, and we shall wait with interest to see what developments may

take place very shortly, as some marked advance may surely be expected when the results of the experiments of two such investigators as Prof. Slaby and Mr. Paulsen become fully known.

THE recent experience of the London County Council tramways under Arctic conditions has not strengthened the arguments of those sections of the public and engineers who are all for the abolition of the overhead system in favour of the underground conduit system. Granted that the conditions which caused the serious interruption of traffic last week are not usual and were not expected, it is still hard to account for the unpreparedness of those in charge of the London County Council tramways. In happy contrast to this comes the news of the capabilities of the overhead system in Liverpool, where not only was the service maintained without mishap, but the trams were of great assistance in clearing away the snow by drawing trollies of salt over the city, thus enabling the salt to be distributed rapidly, and making it easy work for the firemen to wash down the streets afterwards. Wolverhampton also suffered by not having an overhead system of tramways, and the service had to be discontinued. We have not yet heard of any case where an overhead system of tramways in England has failed owing to the recent snow, so that, at a time when the telegraph wires are being broken down by snow and by the force of the gales we have been experiencing lately, it speaks well for modern overhead tramway practice that it should have passed through the ordeal so successfully, and once again helps to prove that the supposed dangers and disadvantages of the overhead system are more fancied than real.

A CORRESPONDENT, writing from Torbay, states that on December 29, 1906 (full moon), and more particularly on December 30, from 10 p.m. to 11.30 p.m., she observed a remarkable lunar halo. The moon appeared in the centre of a pellucid patch of sky enclosed by the halo, which measured at least four times the moon's apparent diameter, and in this clear sky, as in a mirror, our correspondent saw a reflection of the moon.

WE learn from the *Pioneer Mail* that the Dooars' Planters' Association recently discussed the subject of malaria and black-water fever. The meeting viewed with great concern the alarming prevalence of malaria and black-water fever in the western Dooars, and was of opinion that all possible steps should be taken to inquire into these diseases with a view to check them. The association is convinced that the report of the commission on malaria to the Royal Society, dated 1902, goes to the root of the evil, and that the Anopheles mosquito, which is found in large numbers in the Dooars, is the cause of the prevalence of malaria and black-water fever, and that no time should be lost before tackling the question scientifically. As a preliminary, the Indian Tea Association of Calcutta and London is to be asked to move in the matter, and the association will also address the local Government and the Government of India on the subject, and the Home Government through the Tea Association.

THE most important item in the November (1906) issue of the *Victorian Naturalist* is a paper by Prof. Baldwin Spencer on emu remains from King Island, Bass Strait. Definite information as to the former existence of an emu on this island is to hand, and, since the bones recently discovered indicate a bird of smaller size than *Dromaeus ater* of Kangaroo Island, the name *D. minor* is proposed for the new species.

WE have to acknowledge the receipt of a copy of part ii. (vol. i.) of the new journal *Experimentelle Beiträge zur Morphologie*, published at Leipzig, and edited by Mr. Hermann Braus, of Heidelberg. In the first article Mr. O. Bender describes a case of "hypermelism" in an edible frog, in which the abnormality takes the form of an additional hind-limb, and discusses the morphological conclusions to be drawn therefrom. The second article, by the editor, is devoted to the mode of development of the fore-limb and operculum in the larva of the fire-bellied toad (Bombinator).

"SOME Problems of the Sea" forms the title of the presidential address delivered by Prof. Herdman to the meeting of the Liverpool Biological Society held on October 26, 1906. After alluding to the frequent periodical local variation in the constituents of the plankton and the endeavours which have been made to ascertain the actual or relative numbers of organisms inhabiting a given area in the sea, the president proceeded to institute a comparison between the littoral fauna of Ceylon and that of the Maldive Archipelago. In explanation of certain differences of these two faunas, it is suggested that it may be easier for a shallow-water, non-pelagic species to reach Australia from India by way of Malaysia rather than cross the open sea separating Ceylon from the Maldives.

THE first part of the sixth volume of *Annotationes Zoologicae Japonensis* opens with an account of a new Japanese salpeid, provisionally referred to the genus Cyclosalpa, by Mr. W. E. Ritter. Although only a single specimen, taken in Suraga Bay, is forthcoming, this is amply sufficient to demonstrate the marked distinctness of the new form. Until examples of the aggregate generation are available, the full affinities of the species cannot be determined. Its most obvious features are the straight intestine, the great number of the muscle-bands, which exceed those of all other forms except one Salpa, and the fact that many of these bands extend right round the body. In the latter respect the new form tends to minimise the differences separating the Doliolidæ from the Salpidæ. The other papers in the same issue deal respectively with Japanese butterflies, cockroaches, and ascidians.

SINCE very little is known in regard to the segmentation of the ovum among mammals, workers in embryology should welcome a paper by Mr. M. Kunsemüller in the *Zeitschrift für wissenschaftliche Zoologie*, vol. lxxxv., part i., on this stage of development in the hedgehog. Comparisons are made between the segmentation in this species and other mammals in which it has been observed. A second article in the same issue deals with the early stages in the development of the grass-snake, from the first appearance of the pro-amnion to the close of the amniotic stage. The paper ends with a *résumé* of the present state of our knowledge of snake-development, which is still very imperfect. Regeneration in polychæte worms forms the subject of the third article, by Mr. P. Ivanoff, of St. Petersburg. Apparently the article was written previous to the issue of Nusbaum's paper on regeneration in Nereis in vol. lxxix. of the same journal, but its publication was delayed by the necessity of translation. Some of the author's conclusions have thus been anticipated. Among other curious examples of regeneration, Mr. Ivanoff mentions one case in which an annelid developed a complete functional head at each extremity of the body. In the fourth article Mr. F. Vejdovsky resumes his discussion of the hæmacœle theory, as illustrated by the vascular system of worms.

WITH regard to the naming of plants of Lessonia received from the Antarctic region, Mr. and Mrs. A. Gepp note in the *Journal of Botany* (December, 1906) that anatomical investigation discloses a distinction between the specimens from Cape Adare and Coulman Island and that from the South Orkneys. The former receives the name of *Lessonia grandifolia*, the latter *L. simulans*.

IN vol. xvi. of the Transactions of the South African Philosophical Society is a paper by Mr. L. Péringuey on petroglyphs of animals and men in South Africa considered in relation to those found in northern Africa. He points out that two kinds of workmanship are found in Algeria and the Sudan—line engraving and dot engraving, the former being apparently much older, as prehistoric animals now extinct, such as *Bubalus antiquus*, are represented with great fidelity. Similar differences of technique exist in South Africa, and the author argues that they afford evidence of a pre-Bushman race akin to the aborigines of the north; but he is evidently a zoologist, not an anthropologist, and it is clear that more material is needed for comparison, as well as definite archæological data, before the views set forth in this paper can rank as

Rock engraving (chalked to show clearly) of a Gemsbok checking itself while at full speed.

more than mere conjectures. The article is well illustrated by ten figures, of which one is reproduced here; the author remarks that it represents a gemsbok checking itself at full speed before an object intended to alarm it, but it does not seem necessary to assume more than a chance connection between the figures. The petroglyphs were chalked over for photographic purposes; this introduces an element of uncertainty which it would be well to eliminate.

ON the subject of diseases of palms, Mr. E. J. Butler contributes a paper to the *Agricultural Journal of India* (vol. i., part iv.) recording three diseases that have come under his observation in India. In the first case the inflorescences of betel-nut palms were destroyed by a Phytophthora causing what is locally known as "kale roga" or black rot; in another a bud-rot disease of palmyra and cocoa-nut palms in the Godavari district was traced to a Pythium. The so-called betel-nut plague occurring in Sylhet was more difficult to diagnose, but the author refers it definitely to a fungus attacking the roots, and the clamp-connections in the mycelium point to its being a basidiomycete. Detailed descriptions are given and remedial measures suggested.

THE latest addition to the series of German pamphlets on the pedagogics of the natural sciences published by P. G. Teubner, of Leipzig, deals with the subject of a scheme for teaching nature-study in schools. The author, Dr. P. Henkler, reviews several schemes advocated by masters of pedagogy and instructors in natural history before elaborating his own syllabus. During the first stage, for small children, extending over three courses, it is suggested that interest in natural objects should be aroused by imaginative or personified presentment, and observation be coordinated with facts of everyday life. In the second stage, botany and zoology would be taught as independent subjects, the essential idea being to stimulate the faculty of inquiry by studying purpose and cause.

MR. MALCOLM BURR has written, for the Kent Coal Concessions, Ltd., a popular introduction to the study of the geology of the south-eastern coalfield. It contains in simple language a concise explanation of the principles of geology sufficient to enable shareholders to follow intelligently the significance of the various borings carried out under the auspices of the company.

IN the *Engineering Magazine* (vol. xxxii., No. 3) there is an admirably illustrated article by Mr. Frank L. Hess on the York tin region of Alaska, where lode tin was discovered in 1903. Should the lode deposits be shown to contain sufficient tin to pay for working, they will have many advantages over placer deposits, inasmuch as mining would not have to be confined to the short open season.

THE Transactions of the Institution of Engineers and Shipbuilders in Scotland (vol. l., part ii.) contains an interesting paper by Mr. Hugh Campbell on suction gas engines. The introduction of the suction gas plant, invented in 1894, is causing a greater revolution in practice than has occurred in connection with the development of large gas engines, which are mainly used at the present time in conjunction with blast-furnace gas. Its very high economy, extreme simplicity, its cleanliness, and the small amount of space it occupies are sufficient to commend it to power users.

A PAPER read by Mr. Henry Fowler before the Institution of Mechanical Engineers on December 14, 1906, dealing with the lighting of railway premises, contained much information of value to engineers generally. The lighting on a railway is chiefly provided by means of oil, gas, or electricity, gas being probably the most general illuminant. In most places it has been able to hold its position owing to the introduction of incandescent mantles. The cost of maintaining an incandescent mantle for a year to June, 1906, is shown to have been as follows:—mantles 5·20*d*., chimneys 1·27*d*., forks 0·33*d*., and wages 1*s*. 4·16*d*. per annum.

IN a recent note (p. 181) attention was directed to the recent renewal of experiments with Count Zeppelin's latest airship on the Lake of Constance. An account of these new experiments is given by Dr. Wilhelm Krebs in *Das Weltall* for December 15, 1906. The 1906 Zeppelin airship, like its forerunners, consists of eighteen separate compartments or separate balloons supported on a rigid cylindrical aluminium framework, the whole being encased in a covering of balloon silk. The rigidity being secured by the framework, the use of an internal "ballonet" is dispensed with. The whole airship is 128 metres long by 11 metres high, and each of the two cars can hold four persons, besides having a separate motor. The author states that with both motors working simultaneously a

speed of 15 metres per second, or 54 kilometres per hour, can be maintained for sixty hours with the quantity of benzene the machine will carry. With one motor alone working a speed of 11 metres per second would be maintained for 120 hours. The advantages of the Zeppelin airship are more or less counterbalanced by the present necessity of using a sheet of water for starting and landing. Apart from the uses of such a machine in warfare, its applications in time of peace to the meteorological survey of the atmosphere are contemplated.

An interesting but highly mathematical memoir by Prof. Karl Pearson and Mr. J. Blakeman on "A Mathematical Theory of Random Migration" has just been issued by Messrs. Dulau and Co. (Drapers' Co. research memoirs, biometric series, iii.). The problem dealt with is, in simple terms, the following:—given that a large number of individuals move by successive straight steps of length l in random directions, starting from one and the same point, required to find their distribution after n such steps. The solution, which is obtained in terms of Bessel functions, is applicable to such practical problems as the infiltration of mosquitoes into a cleared area, or the recovery of a habitat by a species which has been driven out owing to temporarily unfavourable conditions. Prof. Pearson obtained some assistance in the solution of the problem through a letter addressed to our correspondence columns (vol. lxxii., p. 294, July 27, 1905); Lord Rayleigh directed his attention (*ibid.*, p. 318) to the fact that when the number of steps n is very large, the problem becomes identical with a problem in sound; and Prof. Kluyver presented a memoir on the subject to the Royal Academy of Sciences of Amsterdam (Proceedings, October 25, 1905). Reference should, we think, have been made, in the introduction to the memoir, to the address delivered by Major Ross "On the Logical Basis of the Sanitary Policy of Mosquito Reduction" at the St. Louis Congress of 1904 (*British Medical Journal*, May 13, 1905). This contains the first published discussion of the problem, with especial reference to its most important practical application, and suggests a simple approximate solution in terms of the binomial series.

An investigation of the temperatures obtainable by the use of solid carbon dioxide under different pressures forms the subject of a paper by Messrs. John Zeleny and Anthony Zeleny in the *Physical Review* (vol. xxiii., No. 4). In a deep vessel of such a shape that the material is surrounded by its own vapour, the same temperature is given under any one pressure by the carbon dioxide either alone or when mixed with alcohol or ether; it is, however, more easy to maintain the temperature constant when the solid is moistened with ether. A table is given showing the temperatures obtainable by varying the pressure above the solid from 2 cm. to 84 cm. of mercury. At the former pressure the temperature is $-116°{\cdot}7$, and at the latter $-77°$ C.

Some very remarkable results have been obtained by Prof. R. W. Wood in the course of an investigation of the fluorescence and magnetic rotation spectra of sodium vapour, published in the Proceedings of the American Academy of Arts and Sciences (vol. xlii., No. 13), and also in the *Physikalische Zeitschrift* (No. 24). The fluorescence spectra were observed using monochromatic light of a definite wave-length as source of excitation. Different series of lines are seen with different exciting wave-lengths. The series are mostly of a very simple character, consisting of groups of lines separated by a constant wave-length. The same series of lines are also observed in the magnetic rotation spectrum of sodium vapour, which can thus be subjected to analysis. Certain lines, however, which occur singly in the magnetic spectrum occur as doublets in the fluorescence spectra. The detailed measurements obtained, from the comparative simplicity of the phenomena, are likely to prove of very great importance in discussing the mechanism of molecular vibration and radiation.

From the dissociation theory of solution it might be inferred that as the radiation from a radio-active substance renders a gas conducting by causing ionisation of the gaseous particles, an increase of the conductivity of aqueous solutions should follow from their exposure to radio-active influence. The effect in the latter case should, indeed, be very marked, inasmuch as partial ionisation of a salt occurs merely on dissolving it in water, whereas in the case of a gas ionisation takes place only under special influences. The conductivity of a large number of salts in aqueous solution has been measured by M. S. M. Sabat (Bulletin of the Cracow Academy of Sciences, 1906, No. 1) during their exposure to the radiation produced by 0·2 gram of Prof. Curie's most active preparation of radium bromide. After making allowance for the alteration of resistance caused by the rise of temperature due to the radiation, the conclusion is drawn that not the slightest change in conductivity can be attributed to a change in the degree of ionisation of the salt within the solution. If such a change of ionisation takes place it is so slight as to be altogether negligible.

Mr. David Nutt has published for the Folk-lore Society a "Bibliography of Folk-lore" for 1905, which has been compiled by Mr. N. W. Thomas. The price of the booklet is 1*s.* net.

Messrs. J. and A. Churchill have published a third edition of "A Handbook of Physics and Chemistry adapted to the Requirements of the First Examination of the Conjoint Examining Board of the Royal Colleges of Physicians and Surgeons and also for General Use," by Messrs. Herbert E. Corbin and Archibald M. Stewart.

We have received a copy of the report of the Meteorological Service of Canada for the year ended on December 31, 1904. In nearly four hundred foolscap pages Mr. R. F. Stupart, the director, has brought together results of observations of the temperature, pressure, rainfall, snowfall, amount of bright sunshine, and other meteorological data concerning all parts of Canada. The volume also includes the magnetic results for each month and for the year 1904.

In his work "Erkenntniss und Irrtum," reviewed in Nature of November 30, 1905 (vol. lxxiii., Supp., p. vii), Prof. E. Mach partly included three essays in which the questions of the nature, origin, and development of our concepts of space were discussed from several points of view. The English rendering of these essays, which originally appeared in the *Monist*, has now been published in volume form by Messrs. Kegan Paul and Co., Ltd., under the title "Space and Geometry in the Light of Physiological, Psychological, and Physical Inquiry."

In Nature of October 11, 1906 (vol. lxxiv., p. 594), reference was made to a paper by Prof. Kamerlingh Onnes and Dr. Heuse on the expansion of glass at very low temperatures, and attention was directed to the work of Dr. Travers on the same subject. Prof. Onnes writes to point out that the memoir referred to was a translation of a Dutch paper, published somewhat earlier than that of Dr. Travers, to which we alluded, and that in a more recent communication on the same subject he has not failed to recognise the results obtained by this investigator.

OUR ASTRONOMICAL COLUMN.

COMET 1906g (THIELE).—From observations made with the Lick Observatory 12-inch refractor, Messrs. Aitken and Fath have computed a set of parabolic elements for Thiele's comet. These elements, together with an ephemeris extending to January 19, appear in No. 103 of the Lick Observatory Bulletins, and give the time of perihelion passage as 1906 November 21. The comet is at present (January 3) about 5 m. east of 1 Draconis, and is travelling nearly due east, its brightness being about one-half that at the time of discovery (mag. 8·5).

THE LUNAR CRATER LINNÉ.—In a recent number of the *Astronomische Nachrichten* Dr. Wirtz pointed out that an apparent enlargement of the white spot surrounding Linné could be produced by interposing a shade-glass between the telescope and the eye, and from this fact he argued that the enlargement of the spot observed during a lunar eclipse might be merely a subjective phenomenon due to the diminution of light.

In No. 4141 of the same journal Prof. W. H. Pickering points out that whilst this apparent enlargement, which Dr. Wirtz describes, undoubtedly exists, its magnitude is much less than that recorded by the eclipse observers. Furthermore, the majority of the eclipse observations indicate that the white spot was decidedly larger after the passing than at the same length of time before the encroachment of the earth's shadow, whereas if the enlargement were merely a subjective effect it should not survive the re-illumination. The fact that Dr. Wirtz has observed similar results in the case of the crater Linné B is not regarded by Prof. Pickering as an argument against their reality, for if the phenomenon is due to the deposition of hoar-frost it should, *ceteris paribus*, be general over the moon's visible surface, and he has himself obtained similar results for Sulpicius Gallus A (*Astronomische Nachrichten*, No. 4141).

EPHEMERIDES OF COMETS AND PLANETS.—With the commencement of the new year the editors of the *Astronomische Nachrichten* are issuing the ephemerides of comets and planets in a separate publication called the *Ephemeriden-Zirkular der Astronomischen Nachrichten*. The annual subscription is 10 marks, and orders should be addressed directly to the "Expedition in Kiel, Niemannsweg 103."

A RÉSUMÉ OF AËROGRAPHY.—In No. 22 (1906) of the *Revue générale des Sciences*, L'Abbé Th. Moreux discusses the present state of our knowledge of Mars, especially in reference to the more recent observations of Prof. Lowell and other aërographers, although in the first part he details the work of the earlier observers, Herschel, Beer and Madler, Secchi, Lockyer, Kaiser, and others. Whilst agreeing with Lowell as to the bolder features, M. Moreux evidently entertains very grave doubts as to the objective reality of many of the fine rectilinear *canaux* of which the former observer has recorded 420, and further states that he has never seen the alleged *oases* which are said to mark their intersections.

M. Moreux also discusses the gemination of the canals at some length, and then gives in detail the results of his own observations during the opposition of 1905, giving a number of drawings and a chart to illustrate his points. From these observations he is convinced that the persistent transparency of the Martian atmosphere has been overrated in the past. To illustrate this conviction he gives instances of cloud formations blotting out the detail, locally, on the planet's surface.

JUPITER'S SATELLITES.—No. 4143 of the *Astronomische Nachrichten* contains an ephemeris for Jupiter's sixth satellite, computed by Mr. J. E. Martin, of Washington, from unpublished elements derived by Dr. Ross. The ephemeris extends to April 17, 1907, and gives the differences (Satellite–Jupiter) in α and δ, and the position angle and distance from the planet for every fifth day.

In the same journal Herr K. Graff records the observation, on September 24, 1906, of the occultation of an 8·5 magnitude star by Jupiter's third satellite.

THE CAUSES OF SOLAR PHENOMENA.—We have received from Don Horacio Bentabol y Ureta, of Madrid, a monograph dealing with the causes which produce spots, prominences, faculæ, &c., on the sun. The discussion is too lengthy to give the author's points *in extenso*, but he favours the meteoritic origin of the spots, and shows how the other solar, and the correlated meteorological, phenomena may be accounted for on this hypothesis.

PRIZES AWARDED AND PROPOSED BY THE PARIS ACADEMY OF SCIENCES.

AT the anniversary meeting of the Paris Academy of Sciences held on December 17, 1906, the president, M. H. Poincaré, announced that the prize awards for the year 1906 were as follows:—

PRIZES AWARDED.

Mathematics.—Grand prize in the mathematical sciences, divided between H. Padé (1500 francs), R. de Montessus (1000 francs), and M. Auric (500 francs), for their work on the convergence of continued algebraical fractions. The Francœur prize to Émile Lemoine, for his works on geometry. The Poncelet prize to M. Guichard, for the whole of his contributions to geometry.

Mechanics.—A Montyon prize to Georges Marié, for his study of the oscillations of railway carriages; the Boileau prize to Edmond Maillet, for his investigations on the yield of deep springs.

Navigation.—The extraordinary prize of 6000 francs, divided between MM. Daveluy, Rollet de l'Isle, J. Th. Saconney, and G. B. Girard; the Plumey prize to Prof. Stodola, for his work on steam turbines.

Astronomy.—The Pierre Guzman prize was not awarded. The Lalande prize to R. G. Aitken and W. J. Hussey, for their work on double stars; the Valz prize to J. Palisa, for the whole of his astronomical researches; the Janssen medal to A. Riccò, for his observations on the sun.

Geography.—The Tchihatchef prize to Jean Baptiste Louis Pierre; the Binoux prize to MM. Larras and E. de Larminat; the Delalande prize to L. Seurat, for his exploration of the islands near Tahiti.

Physics.—The Hébert prize to G. Gouré de Villemontée, for his researches on the conditions governing differences of contact potential; the Hughes prize to Daniel Berthelot, for his application of interference methods to the measurement of high temperatures and his researches on the compressibility of gases.

Chemistry.—The Jecker prize to M. Grignard, for his researches on the organo-magnesium compounds; the Cahours prize to M. Martine, for his work on menthone and menthol and their derivatives; a Montyon prize (unhealthy trades) to Victor Georgel, for his researches on leadless glazes.

Botany.—The Desmazières prize to Jules Cardot, for his researches on mosses; the Montagne prize to Émile Boudier, for his work on mycology; the De Coincy prize to E. G. Camus and Mlle. A. Camus, for their work on the classification and monography of the willows of Europe.

Anatomy and Zoology.—The Savigny prize to Paul Pallary, for his work on northern Africa and the Red Sea; the Thore prize to C. Houlbert, for his entomological work; the Gama Machado prize to Antoine Henri Mandoul and Pierre Stéphan (in equal parts).

Medicine and Surgery.—Montyon prizes to Paul Poirier and A. Charpy, for their work on anatomy; J. Albarran, for his work on renal functions; and Ch. Porcher, for his studies on lactosuria. Mentions are also accorded to Robert Lœwy, for his memoir on fractures; to Adolphe Javal, for his memoir on the treatment of Bright's œdema; and to MM. Guillemard and Moog, for their work on the influence of high altitudes on the general nutrition. Citations are accorded to Lucien Graux, Louis and Paul Murat, and A. Gougenheim. The Barbier prize to Adrien Lucet, for his memoirs on the bacteriology of suppuration in animals of the bovine species and on pathogenic moulds, with a mention to J. V. Detroye, for his work on cancers and tumours in animals. The Bréant prize to M. Rémy, for his quantitative studies on serums; the Godard prize to L. H. Farabeuf, for his monograph on the blood-vessels of the genito-urinary organs; the Baron Larrey prize to Dr. Morel, for his memoir on epidemic and endemic diseases in the French colonies; the Bellion prize to Georges G.

Paraf, for his work on hygiene; the Mège prize to S. Turchini, for his experimental study on the power of the X-ray tube under different conditions of use.

Physiology.—A Montyon prize to E. Meyer, for his researches in experimental physiology from 1886 to 1904, a mention being accorded to J. Sellier for his researches on digestion and the digestive ferments; the Philipeaux prize to Stéphane Leduc, for the whole of his researches in experimental physiology, M. Caubert receiving a mention; the Lallemand prize to André Léri, for his clinical and anatomical researches on tabes; the Pourat prize to Georges Bohn, for his researches on phototropism; the Martin-Damourette prize to Lucien Butte, for his researches on the physiological and therapeutical action of Guaco (*Aristolochia cymbifera*), a very honourable mention being accorded to Pierre Sée for his study of the therapeutical applications of the oxydases and the metal ferments.

Statistics.—A Montyon prize to Dr. Ausset, for his memoir on the infantile mortality in the Departement du Nord, a very honourable mention being accorded to Dr. Butte for his memoir on the statistics of syphilis in Paris, and an honourable mention to Dr. Ott for his work on infant mortality in the town of Lillebonne.

General Prizes.—The Lavoisier medal to S. M. Jörgensen, for his researches in inorganic chemistry; the Berthelot medal to S. M. Jörgensen and M. Martine; the Trémont prize to M. Frémont, for his experimental researches on metals; the Gegner prize to J. H. Fabre; the Lannelongue prize divided between Mme. Beclard and Mme. Cusco; the Jerome Ponti prize divided between M. Offret, for his work in mineralogy, and M. Gruvel, for his researches on the Cirrhipedæ; the Wilde prize divided between M. Termier, for his researches on the geological structure of the eastern Alps, and M. Massau, for his work in applied mechanics, and especially for his researches in graphical integration; the Saintour prize divided between Ant. Magnin, for his work in botanical geography, and L. Laurent, for his work in plant palæontology; the Houllevigue prize divided between G. André, for his researches in the physiological chemistry of plants, E. Bataillon, for the whole of his researches in experimental embryology, and A. Pizon, for his work on the development of the tunicates; the Cuvier prize to Dr. Raffray, for the whole of his work on insects; the Jean Reynaud prize to Pierre Curie, for his work on piezoelectricity and the properties of the radio-active bodies; the Baron de Joest prize to M. Demoulin, for his researches in infinitesimal geometry; the prize founded by the Marquise de Laplace to Paul Pierre Lévy, and the prize founded by M. Félix Rivot to MM. Lévy, Bélugou, Petit, and Lane.

Prizes Proposed.

The subjects proposed by the academy for prizes for 1908 are as follows:—

Geometry.—The grand prize of the mathematical sciences (3000 francs). The question proposed for 1908 is the following:—to realise an important progress in the study of the deformation of the general surface of the second degree; the Francœur prize (1000 francs), for discoveries or work useful to the progress of the sciences of pure and applied mathematics.

Mechanics.—A Montyon prize (700 francs), for the invention or improvement of instruments useful to the progress of agriculture, the mechanical arts or sciences; the Fourneyron prize (1000 francs), for a theoretical or experimental study of steam turbines.

Navigation.—The extraordinary prize of 6000 francs, for work tending to increase the efficacy of the French naval forces; the Plumey prize (4000 francs), for improvements in steam engines or any other invention contributing to the progress of steam navigation.

Astronomy.—The Lalande prize (540 francs), for an observation, memoir, or work most useful to the progress of astronomy; the Valz prize (460 francs), to the author of the most interesting astronomical observation made during the year; the Damoiseau prize (2000 francs), the question proposed is the theory of the planet Eros based upon known observations; the Janssen prize (a gold medal), for a discovery or work constituting an important progress in physical astronomy.

Geography.—The Gay prize (1500 francs), for geographical studies on Morocco: the Tchihatchef prize (3000 francs), for the exploration of the lesser-known regions of Asia, the work being done in any branch of science; the Binoux prize (2000 francs), for work in geography and navigation; the Delalande-Guérineau prize (1000 francs).

Physics.—The Hébert prize (1000 francs), for the best treatise or most useful discovery for the practical employment of electricity; the Hughes prize (2500 francs), for discoveries or works contributing to the progress of physics.

Chemistry.—The Jecker prize (10,000 francs), for work in organic chemistry; the Cahours prize (3000 francs), for the encouragement of young chemists; Montyon prize (a prize of 2500 francs and a mention of 1500 francs), for a discovery of a means of rendering an art or trade less unhealthy.

Mineralogy and Geology.—The Fontannes prize (2000 francs), for the best palæontological publication; the Bordin prize (3000 francs), for a study of the fossil fishes of the Paris basin.

Botany.—The Desmazières prize (1600 francs), for the best work during the current year on cryptogams; the Montagne prize (1500 francs), for work on the anatomy, physiology, development, or description of the lower cryptogams; the de Coincy prize (900 francs), for a work on phanerogams.

Anatomy and Zoology.—The Savigny prize (1300 francs), for assisting young travelling zoologists, with special reference to the invertebrate animals of Egypt and Syria; the Thore prize (200 francs), for the best work on the habits and anatomy of a species of European insect.

Medicine and Surgery.—A Montyon prize (prize of 2500 francs, mentions of 1500 francs), for work or discoveries useful in the art of healing; the Barbier prize (2000 francs), for a discovery in the surgical, medical, or pharmaceutical sciences, or in botany with reference to the art of healing; the Bréant prize (100,000 francs), for the discovery of a drug which will cure Asiatic cholera in the great majority of cases, or for indicating in an absolutely certain manner the causes of Asiatic cholera, so that by the suppression of these causes the epidemic can be stopped, or, in the alternative, for the discovery of a prophylactic treatment as certain as that of vaccination for small-pox. If the capital sum is not awarded, the interest will be given as a prize for a rigorous demonstration of the existence in the atmosphere of material taking part in the production or propagation of epidemic diseases. The Godard prize (1000 francs), for the best memoir on the anatomy, physiology, and pathology of the genito-urinary organs; the Baron Larrey prize (750 francs), for a work by an army or navy surgeon or physician treating of the subject of military medicine, surgery, or hygiene; the Bellion prize (1400 francs), for the author of works or discoveries "especially profitable to the health of man or the amelioration of the human species"; the Mège prize (10,000 francs); the Serres prize (7500 francs), for the best work dealing with general embryology applied as far as possible to physiology and medicine.

Physiology.—A Montyon prize (750 francs), for a work on experimental physiology; the Philipeaux prize (900 francs), for the same; the Lallemand prize (1800 francs), to recompense or encourage works relating to the nervous system; the Martin-Damourette prize (1400 francs), for work in therapeutical physiology; the Pourat prize (1000 francs), for a work on the immediate destination of the energy devoted to maintaining life in warm-blooded subjects.

Statistics.—A Montyon prize of 1000 francs and a mention of 500 francs.

General Prizes.—The Arago medal, the Lavoisier medal for services to chemistry, the Berthelot medal, the Trémont prize (1100 francs), the Gegner prize (3800 francs), the Lannelongue prize (2000 francs), the Wilde prize (one of 4000 francs or two of 2000 francs), the Victor Raulin prize (1500 francs), the Saintour prize (3000 francs), the prize founded by Mme. la Marquise de Laplace, the Félix Rivot prize (2500 francs), the Jerome Ponti prize (3500 francs), the Houllevigue prize (5000 francs), the Estrade-Delcros prize (8000 francs).

Of these prizes, those bearing the names of Lalande, Tchihatchef, Desmazières, Lavoisier, and Wilde are expressly stated to be free from any restriction as to nationality.

RECENT WORK OF THE AMERICAN BUREAU OF STANDARDS.

PART i. of vol. ii. of the Bulletin of the Bureau of Standards of the United States contains five papers. The first of these is by Mr. Hyde, on Talbot's law as applied to the rotating sectored disc. The law is stated by Helmholtz as follows:—"If any part of the retina is excited with intermittent light recurring periodically and regularly in the same way, and if the period is sufficiently short, a continuous impression will result, which is the same as that which would result if the total light received during each period were uniformly distributed throughout the whole period."

Much experimental work has been done on the subject leading to somewhat conflicting results. After a theoretical discussion Mr. Hyde describes his own experiments, from which he concludes:—

(1) Talbot's law is verified for white light for all total angular openings from 10° to 288° to within a possible error of 0·3 per cent.

(2) The observed deviations from the law for red, green, and blue light are of the same order as those for white light.

The two papers by Dr. Guthe and Mr. Rosa respectively deal with a new determination of the E.M.F. of the Weston and Clark cells by a Gray electrodynamometer. The construction of the instrument and the measurement of its exact dimensions are described in great detail by Dr. Guthe in the first paper, while in the second Mr. Rosa gives the complete theory of the dynamometer employed, and discusses the effects of various errors, such as inaccuracy in the measurement of the dimensions of the coils, irregularities in their winding, and the effect of the opening in the fixed coil through which the suspension of the movable coil passes. The chief results of the work are as follows:—

The E.M.F. of Guthe's "reference standard" cadmium cell, No. 813, at 21° C.=1·01884 volts, or only two parts in 100,000 higher than the value given in its Reichsanstalt certificate. The electrochemical equivalent of silver, determined by Guthe in 1904 (Bull. Bur. Stand., vol. i., part i.) in terms of a Weston cell, becomes, when re-calculated to absolute measure, 1·11773 mg. per coulomb, when the porous-pot form of coulometer is used.

In the next paper Prof. J. G. Coffin discusses the construction and calculation of inductance standards for Clark University and for the Bureau of Standards. The paper gives in great detail an account of the successive operations. One of the most interesting of these is the use for the accurate grinding of the marble cylinders of an especially fine grinding-machine on a novel principle, which will grind, if required, true cylinders up to 71 cm. diameter, more than 3 metres long, and up to ten tons in weight. The construction and winding of the cylinders presented many of the same problems as the making of the coils of the electrodynamometer referred to above, the coils in both cases being formed of a single layer of wire divided into several parts highly insulated from one another. Following the practical details comes a long mathematical discussion setting forth the methods employed for calculation to the high accuracy required of the inductances of the various parts, the two different formulæ employed giving, for the calculated self-inductance of one of the sections of the Clark University coil, values only differing by one part in four hundred thousand.

The last paper, by Messrs. Hyde and Brooks, is on an efficiency meter for electric incandescent lamps. It consists of an attachment to a photometer on which a scale of watts-per-candle can be arranged, so that the "efficiency" of the lamp to be tested can be directly read off in a very simple manner without calculation. The essential feature consists in the right design to give the desired result of a rheostat in the lamp-circuit, operated by the sliding of one of the photometer carriages. A table of results shows that for a nominal sixteen candle-power lamp over a range of from ten to twenty candles, with accompanying variation of watts-per-candle of from 4·8 to 2·4, the value for the efficiency as obtained by the instrument and that determined independently by check instruments agreed everywhere to less than 1 per cent. The value of the arrangement lies in the extreme rapidity with which a definite criterion for a large number of specimen lamps can be obtained without troublesome arithmetic.

In part ii. of vol. ii. the first paper, by Mr. Rosa, deals with the calculation of the inductance of single-layer coils. The different types of "summation" and "current-sheet" formulæ due to Rayleigh, Coffin, and Lorenz, and their suitability for use with coils of different shapes, are discussed at length. Examples are also given showing the degree of concordance obtained in definite cases. Tables of general application are calculated, from which the correction term for coils of varying number of turns, made of wire of different diameters, may readily be obtained.

The paper by Mr. H. C. Dickinson is entitled "Heat Treatment of High-temperature Mercurial Thermometers." It begins by recapitulating the methods of construction of high-range thermometers and the properties and suitability for different ranges of the various high-temperature glasses employed. Tables of the departure of the natural scale of 16^{III} and 59^{III} glasses from the gas scale are given up to temperatures of 300° C. and 500° C. respectively. The author then describes his own experiments, which deal chiefly with the effect of initial heat treatment on various unannealed thermometers of the different glasses specially constructed for research purposes. The best methods of annealing such thermometers for rendering them as permanent as possible in after use are described. An electric furnace arranged for the purpose is also shown. The following are the more important conclusions of the paper:—

(1) Jena 59^{III} borosilicate is the best thermometric glass in use for high temperatures, but it cannot be safely used much above 500° C.

(2) Jena 16^{III} glass can be used up to 450° C.

(3) Every thermometer intended for use above 100° C. should undergo a suitable system of annealing before use. The annealing may be done before the thermometer is filled. A thorough anneal requires four to ten days at 450° C. The anneal may be followed with advantage by a period of slow cooling of from three to six days.

(4) To prevent the boiling of the mercury in a thermometer, the space above it should be filled with dry nitrogen or carbon dioxide, having a pressure of one atmosphere at 300° C., of four and a half atmospheres at 450° C., and of twenty atmospheres at 550° C.

Mr. Brooks in his paper describes a new potentiometer for E.M.F. and current measurements of intermediate accuracy. It is primarily intended for use in such work as photometry, where rapidity of reading is essential, and where the best deflection instruments give an accuracy, insufficient in most cases.

The feature of the new design is that the potentiometer method is used to balance the bulk of the electrical quantity to be measured, the remainder, perhaps 1 per cent. of the whole, being shown by a suitable deflection instrument. The design of a successful deflection potentiometer presents several difficulties. In the present case these have been surmounted in a manner similar to that adopted by Stansfield, who was the first to use this type of instrument. The greatest scale error in the new instrument described is 0·02 in 100 volts.

In a paper on spectrum lines as light sources Mr. Bates discusses the structure of the sodium D lines and the green mercury line $\lambda=546{\cdot}1\ \mu\mu$ as sources in polariscopic measurements. Sodium lines obtained in different ways show slight differences. For intense illumination the author prefers sticks of pure Na_2CO_3 fed into an oxy-hydrogen flame. An echelon spectroscope was used for the study of the lines. The position and intensity of the satellites of the green mercury line were accurately measured. The use of this line is proposed as the standard source for all accurate polariscopic work. A quartz rotation for wave-length 589·25 $\mu\mu$ may be obtained by measuring the rotation for the wave-length 546·1 $\mu\mu$, and multiplying it by the constant 0·850944.

The paper by Mr. Nutting, on polarimetric sensibility and accuracy, hardly permits of useful abstraction. It deals with the intensity and homogeneity of sources used in polarimetry. The mathematical theory of the half-shadow polarimeter is discussed, and formulæ given for calculating the sensibility of the instrument under varying

conditions. A later paper by the same author describes a pocket spectrophotometer embodying some novel features.

In the paper on the platinum-point electrolytic detector for electrical waves Mr. Austin describes the so-called "barretter" patented by Fessenden, and used by him as detector in wireless telegraphy experiments. It consists of a cell with electrodes, one a fine platinum point, the second a plate, the vessel being filled with an electrolyte giving gaseous decomposition products. When an E.M.F. is applied to such a cell polarisation ensues, so that scarcely any current passes unless the E.M.F. exceeds a certain critical value. When electric oscillations pass through the cell the resistance is decreased, and the current for the moment increases. Conflicting statements have been made by various investigators regarding the behaviour of the instrument, and the author has therefore subjected it to a thorough investigation, employing both ordinary alternating current waves and also the Hertzian waves from the station of the National Electric Signalling Company. The chief conclusions of the research are :—

(1) For the stronger alternating currents used the breaking down in resistance is approximately proportional to the square of the alternating current.

(2) Under favourable conditions and with moderate polarisation the detector is equally sensitive to alternating currents with the point electrode, anode, or kathode.

(3) The resistance of the detector for slowly alternating currents varied from 20,000 ohms to 400 ohms, according to the polarising E.M.F. employed.

(4) For electrical waves from a distance the detector is approximately equally sensitive with the point electrode, anode, or kathode, but for waves from a coil in the laboratory some cause appears to annul the sensitiveness of the kathode-point electrode.

The next paper, by Prof. Coffin, is a mathematical investigation on the influence of frequency on self-inductance, and is not capable of useful abstraction.

Messrs. Guthe and Austin then deal with experiments on the magnetic alloys discovered accidentally by Dr. Heusler, and previously investigated at the Reichsanstalt and by Messrs. Fleming and Hadfield. Curves of permeability and inductance were determined for seven different samples, the chemical analysis of which is also given. An ingenious apparatus of high sensitiveness, quite cheap and easy to construct, was designed for study of the magnetic expansion of the alloys. This was capable of detecting changes in length as small as 5×10^{-7} mm. The investigation is not complete, but the relations between the curves of magnetisation and magnetostriction and between magnetostriction and thermoelectric force are clearly shown.

The number and variety of the subjects dealt with in these two instalments of the official publication of the Bureau show that, though only established three years ago, it has already begun to make substantial additions to our knowledge of physics. J. A. HARKER.

RESEARCHES IN STELLAR PARALLAX.[1]

SOME years ago Dr. Chase, of the Yale University Observatory, communicated to the Astronomical and Astrophysical Society of America the results of a survey which he had carried out, in collaboration with Dr. Elkin, in order to detect stellar parallax. The number of stars examined was ninety-two, and these were generally selected from a list of stars having an annual proper motion of more than half a second of arc. Of these ninety-two stars, fifteen had a negative parallax, and, presuming that some of the smaller positive values were equally untrustworthy, some sixty were left which exhibited a real parallax amounting to more than 0″·05. The scheme was one that seemed worthy of further prosecution, since the method employed proved adequate for the purpose of recognising the existence of measurable parallax. Consequently, this work has been very considerably extended, and the recent publication from Yale gives the details of the discussion of no less than 163 stars, forming a contribution of the highest importance in parallactic inquiry. Some thirteen years have been devoted to the completion of this work, in which, though Dr. Elkin and Mr. Smith have taken part, the heat and burden of the day has been borne by Dr. Chase. This will be seen from the following tabular statement, which shows both the class of stars examined and the distribution of the work among the several observers :—

	Chase	Chase Elkin	Smith	Smith Elkin	Elkin
Stars with proper motion over 0″·4	117	5	13	12	10
Stars selected by De Ball on account of magnitude ...	11	—	1	1	—
β Cygni, Algol, Nova Persei..	5	—	—	—	—
Red stars for colour effect ...	6	—	—	—	—
	—	—	—	—	—
Total number of series ...	139	5	14	13	10

The inquiry has been based entirely on measures of distance made with the heliometer. As a rule, two comparison stars were selected on opposite sides of the star the distance of which was to be investigated, and in the direction of maximum displacement by parallax. These comparison stars were as nearly as possible equidistant from the principal star. When the arrangement of the stars did not permit this programme to be carried out completely, special artifices had to be adopted. On the other hand, in the case of stars of particular interest, a larger number of comparison stars was selected. The precautions which Dr. Elkin found necessary in the course of his work on the parallaxes of stars of the first magnitude were applied here, and further reference to these details is unnecessary. Finally, the observations, when collected, usually give for each star twelve complete observations, consisting of four groups of three nights each, taken at those seasons of the year when the parallactic displacement was at its maximum.

A suspicion having been aroused that the measures of distance between two stars of different colours might need an additional correction for refraction, a series of observations was made on some strongly coloured red stars taken from Kruger's "Catalog der farbigen Sterne." A term was introduced into the differential refraction correction of the form $\Delta\beta \tan z \cos(p-q)$, where p is the position, q the parallactic angle, z the zenith distance, and $\Delta\beta$ the colour effect sought. The several values of $\Delta\beta$ are as follows :—

Star	Colour Scale	Δβ	Weight
Kruger 985	6·0	... −0″·019±0″·019 ...	63·6
,, 1080	7·0	... +0″·005±0″·020 ...	64·4
,, 1078 ...	7·1	... +0″·009±0″·015 ...	16·0
,, 1181	7·8	... +0″·014±0″·018 ...	55·7
,, 1108	8·7	... +0″·046±0″·017 ...	45·2
W.B. XV, 745	—	... −0″·003±0″·021 ...	55·6

The authors contend from these figures that the mean light of the red star is apparently refracted less than that of the comparison stars. Whether this conclusion is justified or not, the quantities involved are so small that it can be safely asserted that there is no noticeable vitiation in the parallax results arising from this cause within the probable errors. The remark attributed to Sir David Gill, that the tendency of the heliometer observer is to bring the similarly coloured parts of the star's spectra into coincidence rather than the brightest parts, seems to gain additional support from this investigation.

Of the 163 stars examined, the parallaxes range from −0″·13 to +0″·20, and the number of negative parallaxes is thirty-six. Considering how wide the net has been spread to catch any star, the proximity of which might be suspected on various grounds, the chance of finding stars closer to us than those which have already been examined grows very slight. The scheme of the stellar universe, so far as the few stars nearest to us are concerned, is taking fairly definite shape, and the scale that has been adopted from measured parallax will probably need no material alteration. Such a conclusion is the more warranted, because the precision attaching to the mean value of a group of results is far greater than that of any individual determination. The authors insist upon this point, and,

[1] "Parallax Investigations on 163 Stars mainly of large Proper Motion." By Frederick L. Chase, Mason F. Smith and William L. Elkin. Transactions of the Astronomical Observatory of Yale University, vol. ii. part i. Pp. 207. (New Haven : The Observatory, 1906.)

as a matter of fact, have grouped their results in various ways, all instructive. The average values obtained from these groups are of unquestionable significance.

Seeing that the working catalogue was made to depend upon the amount of proper motion, it was most natural to arrange the final parallaxes in such a way as to show what relation existed between these quantities. The following table makes this clear :—

Range of Proper Motion	No. of Stars	Average Magnitude	Average Proper Motion	Average Parallax
" "			"	"
0·0 to 0·34 ...	21	3·8	0·14	+0·019
0·41 to 0·54 ...	39	6·3	0·49	+0·032
0·55 to 0·65 ...	45	6·7	0·59	+0·059
0·66 to 0·96 ...	46	6·5	0·77	+0·039
1·01 to 2·34 ...	22	6·2	1·50	+0·109

Notwithstanding the drop corresponding to a mean proper motion of 0″·77, a distinct connection between parallax and proper motion is manifested. This relation is the more marked when the proper motion exceeds one second. In these cases there is a uniformly positive and generally appreciable value of the parallax.

The connection between parallax and magnitude is not so marked, though fairly evident. It is, however, to be noticed that the average proper motion has progressed tolerably uniformly with the magnitude, and this progression tends to mask any effect due to magnitude alone.

Range of Magnitude	No. of Stars	Average Magnitude	Average Proper Motion	Average Parallax
" "			"	"
0·0 to 1·5 ...	10	0·8	0·61	+0·095
2·0 to 4·9 ...	29	3·8	0·53	+0·066
5·0 to 6·2 ...	33	5·6	0·63	+0·056
6·3 to 7·0 ...	34	6·7	0·73	+0·045
7·1 to 7·9 ...	31	7·6	0·68	+0·017
8·0 to 9·0 ...	36	8·3	0·80	+0·047

Other tables show the results arranged according to parallax, in order of right ascension, and according to the spectral type and classes as given in the Draper Catalogue. From the last table we may quote the following :—

—	Type I.		Type II.	
	All Stars	Rejecting Doubtful Spectra	All Stars	Rejecting Doubtful Spectra
Magnitude ...	4·0	3·5	5·3	5·4
Proper Motion	0″·42	0″·42	0″·67	0″·70
Parallax	+0·065	+0·066	+0·058	+0·056
No. of Stars ...	13	11	81	69

The exclusion of the stars with doubtful spectra affects very slightly the mean values for each type, and the authors remark that although the evidence to be drawn from Type I. is not very strong, it scarcely supports the law deduced by Kapteyn of larger parallaxes for Type II.

The authors are to be congratulated on having accomplished a valuable, long-continued series of observations, admirably planned, and carried to a successful conclusion.

W. E. P.

RUSSIAN SCIENTIFIC PUBLICATIONS.

THE work of the great N. M. Prjevalsky, the first explorer of Central Asia, has been continued by one of his pupils and lieutenants, Mr. P. K. Kosloff, whose portrait appears as frontispiece to vol. i. of the account of the expedition conducted by himself in 1899–1901 to Mongolia and Cham. This volume is dedicated to the memory of the great pioneer, who projected a fifth journey which he did not live to accomplish. As a member of former expeditions, Mr. Kosloff was well equipped for the vast undertaking which he describes. At the end of 1898 he submitted a plan for exploration of the southern or Mongolian Altai, the neighbouring central Gobi, and, if practicable, of eastern and central Tibet. The Imperial Russian Geographical Society and the Ministry of War warmly approved, invested Mr. Kosloff with powers of command and discretion, and furnished the expedition with scientific instruments. Under distinguished auspices the party made its way to the Altai station, and halted to survey the sublime snow-clad range and to collect specimens. Here the members met with a venerable member of a company of Old Believers, Rachmanoff, whose pilgrimages and adventures of more than forty years are mentioned by Prjevalsky. Having achieved satisfactory results, the expedition moved into the arid, sandy wastes of Gobi, an unattractive region. It met with a hearty welcome at the Tshortentan monastery from the lamas, whose personalities and the etiquette of their rule are described at length. Next the party proceeded to the salt-marsh district of Tsaidam. The Mongols of this region appear to have had a distinguished history, but in course of time were forced to cede territory to Chinese and Tibetans, their conquerors compelling them to destroy all documents and records of the earlier Mongol princes. There is only local tradition to depend upon, without any means of verification. A chapter is devoted to an ethnographical sketch of the Tsaidam Mongols, and in other chapters the author discusses Mongolian marriage customs and folklore. A wallet of excellent maps, showing the routes taken by Prjevalsky and other explorers, is appended to the volume.

An interesting account of exploration and observations in an uninviting region is given in Dr. W. N. Tuchoff's volume on the western shores of Kamchatka. In the preface, Mr. K. Bogdanovitch explains that the author, a medical student at Dorpat, had a strong desire to investigate the geographical conditions of Kamtchatka, and spent ten years there almost without interruption. No one but an ardent naturalist would be attracted to this vast area of volcanic ridges and tundra, of monotonous aspect. The main interest lies in the descriptions of the life and occupations of the Kamtchadals, who are exposed to a hard struggle with nature and are suspicious of foreigners. Dr. Tuchoff relies chiefly upon diaries and data collected between 1896 and 1898, and on reports of the Amur section of the Imperial Russian Geographical Society. Each chapter is devoted to the conditions of a particular district.

Although fish is the staple food of the inhabitants and their dogs, the fishers do not exercise much judgment, and lament that catches are consequently less numerous. The people are exceedingly simple and childish, as Dr. Tuchoff shows by humorous stories, and Russian officials of routine temperament sometimes fail to understand them. He devotes some space to their superstitions, *e.g.* the story of the brethren man and bear, and the divinity driven through the woods in a sledge drawn by partridges. "The bear population of Kamtchatka," he quaintly observes, "predominates over the human, and there are more chances of meeting a bear on the road and in the woods than a man," but with more numerous visits of hunters the bears retreat into the more inaccessible regions. In one district mothers quiet refractory children by threatening them with the Russians, in the same way as Border parents used the name of the "Black Douglas." Illumination of the poor dwellings is effected by means of bear or seal fat in a primitive kind of lamp, with moss or a piece of rag for a wick, the results being dismal light, much soot, and foul air. Dr. Tuchoff urges the necessity for a series of meteorological observations with a view to the agricultural prospects, and indicates sites for stations. Cattle-breeding, a feature of settled life, is more developed where there is a Russian settlement, and the author's opinion is that the Kamtchadal native is in the transition state from nomad to settled habits, and that he wants practical instruction in rearing of stock. It is unfortunate that the natives degenerate when in proximity to the Russians. The concluding chapter is devoted to the language, which varies in north and south, and appears to be dialectical. Dr. Tuchoff confesses himself unable to reproduce all the sounds of words, partly because European alphabetical resources are inadequate, and partly because the ear can only distinguish some with difficulty. The transliteration of lists of words in Russian and Latin characters is perplexing to the eye. There is an excellent index and map at the end.

Mr. N. M. Knipowitsch has compiled a volume of more than 1500 pages, embodying the results of much research, under the title of "Bases of the Hydrology of the European Ice-ocean" (*i.e.* Barents and the White Seas). The author proposes to give a full and exact picture of the physical geography of the ice-ocean, so far as that is possible at the present time, to record some deductions with regard to biology and geology, and to construct a firm groundwork for future investigations. He modestly leaves his conclusions open for future proof, but none the less must be congratulated on the accomplishment of this work, which will unquestionably be of great value to students of marine conditions. Accordingly, Mr. Knipowitsch reviews previous literature, gives lists of temperature at many points, tables indicating degrees of saltness, differences of temperature according to depths, analyses of sea-water, its clearness and colour, with chapters on hydrology, biology, and geology, a series of about sixty practical deductions, and appendices. A short abstract in German appears at the end. The author refers to other works of his own, to Scandinavian authorities, *e.g.* Nansen and Pettersson, and to men of a former generation, as Scoresby, and the Siberian explorer Middendorf.

Vol. xxviii. of the Transactions of the Novo-Rossisk Society of Naturalists, of Odessa, shows that the labours of a relatively small body have produced very important results. The work opens with an appreciation of the late president, Prof. R. A. Prendel. Botanists will delight in the exhaustive examinations during two summers by Mr. I. Okinshevitch of the forests of northern Bessarabia, which, he says, "in spite of the rich and abundant nature of this country, is very little known from the natural history point of view." The Pliocene and post-Pliocene deposits in south Bessarabia are the subject of a study by Mr. Grigorovitch-Berezovsky. Mr. M. S. Pantchenko describes the hydrological work of the late Admiral S. O. Makaroff; it was he who finally settled disputed points with regard to the navigation of the Bosphorus, after careful survey; the cruise of the *Vitiaz* round the world resulted in the collection of comparative data from different seas; but Makaroff is perhaps best generally known as the designer of the ice-breaker *Yermak*. His untimely death deprived Russia of one of her greatest practical men of science. Mr. A. Brauner writes extensively on the reptiles and amphibia in several provinces. The volume concludes with the report of the society for 1904.

The Tungus race of Siberia has been studied by Mr. S. Patkanoff, who devotes a volume to the Tunguses proper and another to the Manzhurs, Daures, Solones, and other tribes. The Russians first came into contact with the Siberian aborigines early in the seventeenth century, while the Cossacks were extending the conquests initiated by the famous Yermak in the reign of Ivan the Terrible. The Tunguses formerly occupied a large territory, but were driven northwards by the incursions of Buriats, Yakuts, and other Asiatics, as well as of Russians. The Cossacks observed that a certain amount of culture was known to the Tunguses, who wore iron helmets, shields, and chain-mail in battle. The principal occupations of these people are breeding of deer, hunting, and fishing. The pure type is now difficult to trace, owing to admixture with other races for some considerable period. Travellers have paid high tribute to their many excellent qualities in comparison with other Asiatics, especially as regards honesty. Middendorf found strong mountaineering characteristics among the Tunguses, probably survivals of an earlier period. Kastren styled them "the noblemen among Siberian tribes." Various tribes are dealt with as carefully by the same author in the second volume, which also contains notes on the languages and dialects, with specimens, a map of Siberia illustrating the distribution of Tungus tribes, and another showing their position in the Amur region. This work evinces the thoroughness with which the Russians are studying and mastering the varying conditions and populations of the vast territories owning the Tsar as sovereign.

Messrs. B. M. Zhitkov and S. A. Buturlin have compiled an interesting volume of materials for the ornithology of the Simbirsk government, though they do not claim that it is exhaustive, and have not covered all the ground. The groups dealt with comprise Pygopodes, Longipennes, Limicolæ, Alectorides, Gallinæ, Columbæ, Lamellirostres, Herodiones, and Rapaces. The area is largely broad, cleared steppe country, with a fauna such as might be expected in a corn-growing region. Oases of forest or grass land, with abundance of water at intervals, intersect the monotonous plains, and shelter corresponding forms of animal life. The authors have spent fifteen years in observation and collection of materials.

In a report on a geological investigation extending from Mukden to Liao-yang, shortly before the Russo-Japanese war, Mr. Y. S. Edelstein, a Russian explorer, writes:—"Many people consider Manchuria a country of extraordinary richness in minerals. This fame does not rest on sufficient evidence, as in the first place the question of quantities and qualities of useful minerals in Manchuria is still too little known, and in the next, even in the present condition of our knowledge of Manchuria, it is scarcely possible to doubt that many areas of Siberia, the Urals, and Europe surpass it in this respect." Auriferous sand, thanks to barbarous and primitive methods of working, loses the major part of its value in the eyes of a European contractor, and the extensive employment of modern machinery is the only way to secure advantage from working.

In his account of a botanical expedition in Ossetia and Colchis (Transactions of the Imperial Russian Geographical Society, vol. xxxviii., No. 3), Mr. V. V. Markovitch writes that the beech of the Ossetian forests, considered by botanists as being identical with the species *Fagus silvatica*, L., of western Europe, was discovered by Lipsky to be a new species, and styled by him *Fagus orientalis*, Lipsky. Lipsky based his conclusions largely upon differences in fruit. Mr. Markovitch finds that the lignine of the Caucasian beech does not resemble that of *Fagus silvatica*. The German name *Rotbuche* is due to the colouring of the lignine after hewing, which does not occur in that of the Caucasian variety, which remains white.

THE BRUSSELS SOCIOLOGICAL SOCIETY.[1]

THERE are at the present day many earnest students of sociology. It is only natural, therefore, that we should find societies for the investigation of sociological questions springing up. The publications of the Instituts Solway for 1906 are already fairly bulky, though as yet we have the output for the first half of the year only. There are seven "fascicules," the largest of which contains three hundred pages. One, possibly two, of the papers contained in them, though not to a great extent original, may be described as distinctly able. The aim of the first paper (by E. Solway) is to prove that sociology must be founded on biology. Of course, if the nature of a society is to be investigated, it is well, as a preliminary, to learn all that is to be known about the individuals of which it is composed. It is well to make this clear at the outset, but it may be doubted whether anything is gained by arguing this out elaborately and mathematically.

The second paper (by E. Waxweiler) sketches the methods of sociology. A young science must, of course, try to be ultra-scientific. It is sure to be decried as an upstart that has no right to claim admission to the pantheon of the sciences. It is bound to insist that there shall be no vagueness of terminology, and that words shall be accurately used. Our author is quite right to emphasise the importance of such matters. When he goes on to deal with evolution, we find much with which we cannot agree. The struggle for existence he seems to count almost as a myth, and he would substitute for it the idea of "an irresistible tendency towards life." Such big, vague assumptions are far more unscientific than the casual methods which our author condemns. So at least it seems to the present writer. A little further on we find living organisms divided into three classes—"vegetables, animals, and men."

The third paper (by R. Petrucci) is, like the second, a long one. It deals with the natural origin of property. The author is no doubt right when he maintains that, independently of legislation, there may be property and

1 "Instituts Solway—Travaux de l'Institut de Sociologie." Parts 1-5 and 7. (Bruxelles and Leipsig: Misch and Thron, 1906.)

ownership. When he goes on to assert that plants have property, that a plant "possesses a definite territory," he seems to be playing with words. In the organ-pipe coral he finds an example of collective ownership, the individual polype also having something in the way of private property. In animals of a higher class, *e.g.* in ants, the notion of property does undoubtedly show itself. This paper is illustrated, and some of the pictures are excellent, but a picture of the nest of *Formica rufa* does not help us to understand the subject of property.

The fourth paper (by L. Wodon) is brief, and deals trenchantly with some sociological theories, notably with those of Karl Büchner, who maintains that primitive man was a non-social being. This creature of theory lived in lands where the abundance of natural products made any large output of energy on his part quite unnecessary. Our author satisfactorily disposes of this primitive lotus-eater.

Dr. E. Houzé has contributed a distinctly able paper (fascicule No. 5) on the Aryan and anthroposociology. He has a thorough grasp of his subject, his style is clear, and he has a fine sense of humour. The wonderful theories of the comparative philologist he sends to the limbo to which such theories must sooner or later find their way. He goes rather too far when he maintains that the Aryans were the creatures of the philologists. It is true, no doubt, as he argues, that no race has ever maintained its purity for any length of time unless it happened to be geographically secluded. The pure-bred Aryan stock that we were taught to picture to ourselves ranging over great part of Asia and all of Europe is a myth. But it is difficult to believe that the people who spoke the Aryan tongue in different parts of the world had not a fairly strong strain of kindred blood in them, though they intermarried freely with the tribes and peoples among whom they found themselves. Still, far too much has been made of the Aryans as a separate type, and Dr. Houzé is right to laugh at what has been called "Anglo-Saxon pandolichocephalism," a term invented to describe "the skull which has the honour of sheltering the brain that has guided the world." M. de Lapouge, the champion of the "dolichocephalic blond Aryan," is very severely dealt with. Dr. Houzé is a strong believer in natural selection. He keeps quite clear of the untenable view that it goes on in the organic world generally, whereas among men it has somehow become a thing of the past. "When the sun has baked the grass," he remarks, "it forces innumerable troops of antelopes to migrate: is not this the same cause that drives the Germans to embark at Hamburg for America? It is a question of food." Archæology, he holds, supplies the firmest foundation for anthropology, and he speaks with great respect of such men as de Morgan, Arthur Evans, and Flinders Petrie. Anthropometry he puts in its proper place. Nothing can be more absurd, as he says, than to make size of skull alone an absolute measure of brain capacity. When he discusses existing populations and their characteristics, Dr. Houzé shows great soundness of judgment. As to the question of town and country life, he holds that the commonly held opinion that towns "devour their inhabitants with rapidity" is at any rate an exaggeration. On the modernism of Teutonic civilisation he makes some very sensible remarks. The Teutons appeared late on the stage of history, and it was only their contact with Gallo-Roman civilisation that enabled them to reduce their legends to writing.

The last of the papers we are reviewing (by R. Petrucci) takes pains to prove that animal associations were developed independently of one another. They do not form a series culminating in human communities. In tracing the descent of birds and of men from simpler forms of life, the author shows a thorough understanding of the subject. About animal societies he has much interesting information—about the sociability of reptiles, about the form the family takes among fish, birds, and mammals. Apparently he does not point out (a curious omission) the interesting fact that the pairing instinct is strong only in those species in which the energy of both parents is required for the feeding or protection of the young. We regret that we have not space to deal more fully with this last paper. Those who are interested in animal associations would do well to study it.

IS THERE DETERMINATE VARIATION?

IN an article published in *Science* of November 16, Prof. Vernon L. Kellogg, of Stanford University, discusses the question as to the existence among organisms of determinate variation, that is to say, variation in the same or a similar direction in a large number of individuals of a single species. If such a factor does exist, one of the objections to the origin of species by natural selection—namely, that small individual variations would be eliminated in a generation or two—disappears.

Prof. Kellogg's observations refer to variation occurring in the Californian flower-beetle, *Diabrotica soror*, inhabiting the Stanford University "campus." Large series of this chrysomelid beetle, varying from 500 to 1500 in number, were collected on that area in the years 1895, 1901, 1902, 1904, and 1905. Normally, the beetle shows six dark spots arranged in pairs on each wing-cover. Individuals show, however, a tendency to the transverse coalescence of the two middle or two lower spots on one or both elytra, or a longitudinal fusion of the three spots on each half of the elytron. In 1895 the majority of the beetles had twelve free spots on the two elytra, but among the variations there was a marked tendency to the transverse union of the two middle spots, either on one or both elytra, the percentage being 22·40. In the years 1901–5 a much larger percentage of this variation occurred, reaching 53·92 per cent. in one series in 1905, and 65·40 per cent. in 1904.

After adducing arguments to show that the variation is neither ontogenetic (that is, determined for each generation during development by external influences) nor the result of natural selection, Prof. Kellogg falls back on determinate variation. "If," however, he writes, "determinate variation is the explanation of this change in *Diabrotica soror* it is a determinate variation which is occurring only, apparently, in our particular locality. For in series of specimens of this beetle collected in other parts of California no such change seems to be going on, the old twelve-spots-free form being plainly the modal type. . . . Why the species should be changing on our university campus and not changing in the regions south and north of us is a mystery whose solution I do not even dare to guess at. This solution must have to do with the cause of the variation of the species on our campus. But if one asks what is this cause, what it is that is producing determinate variation in Diabrotica, or in any other species, it must be mentioned that prior to any attempt to explain how determinate variation might be produced it is advisable to attempt to determine if determinate variation really exists. Is there determinate variation?"

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LORD CURZON OF KEDLESTON, who was appointed to be the Romanes lecturer at Oxford for 1906, but was prevented from delivering the lecture, has been appointed the Romanes lecturer for this year.

MR. WILLIAM SMITH, of Geneva, has, says *Science*, given 100,000*l.* to Hobart College to endow a college for women. It is also announced that Dr. Andrew Carnegie has offered to give 20,000*l.* to Queen's University, Ontario, on condition that an additional sum of 80,000*l.* be collected.

MR. J. D. ROCKEFELLER has made a New Year's gift to Chicago University of about 600,000*l.*, which brings his total benefactions to the University up to 3,900,000*l.* The private gifts to universities and colleges in the United States, announced in these columns during last year, amounted to nearly 5,000,000*l.*

THE annual meeting of the Public School Science Masters' Association will be held at the University of London on Saturday, January 12. The president, the Rev. the Hon. E. Lyttelton, headmaster of Eton, will take the chair, and will read a paper on the place of science and of literature in a general education. Other subjects of papers upon which it is hoped discussion will take place are:—"The Internal Economy of School Science," by Mr. Thwaites, and "The Best Method of Introducing the Atomic Theory in Science," by Mr. F. R. L. Wilson.

In connection with the University of London, we notice that Mr. A. G. Tansley, assistant professor of botany and lecturer on plant anatomy at University college, will deliver a course of eight lectures on "The Evolution of the Vascular System in the Fern-phylum," beginning on January 26, at University College. At the physiological laboratory of the University, a course of eight lectures on "The Physiological Effect of Compressed Air" will be given by Mr. Leonard Hill, F.R.S., beginning on January 15. A course of five lectures on the "Structure and Classification of the Myriapoda and Arachnida" will be given at University College by Mr. R. I. Pocock, beginning on January 14.

The Paris correspondent of the *Times* reports that M. Briand, the French Minister of Education, proposes to suppress the baccalauréat, the degree conferred on a boy on his admission to a French university. Such admission is of necessity preceded by several years' school training, during which the boy is prepared in a somewhat mechanical manner for the examinations on which his admission to the university depends. The system, according to the *Times* correspondent, "is the nearest approach known in Europe to the mandarin method of China." It is very widely felt that at the end of their school careers the boys lack initiative and originality as the result of the undue appeal to their verbal memories, and it is hoped that the abolition of the baccalauréat will discourage the rigid uniformity which characterises French secondary schools, and lead to an endeavour to adapt the curriculum of a school to the particular needs of the pupils attending it.

Several substantial gifts for the advancement of higher education are recorded in recent issues of *Science*. Among these may be mentioned donations of 20,000*l*. each to Western Reserve University, Cleveland, O., by Mr. H. M. Hanna and Colonel Oliver H. Payne. The 40,000*l*. thus subscribed is to be used in establishing and endowing a laboratory of experimental medicine in the medical school. Mr. William Smith, of Geneva, N.Y., is to found a woman's college. The name of the new college will be the William Smith College for Women, and it will have an endowment of about 70,000*l*. A "Carl Schurz memorial professorship" is to be established at the University of Wisconsin as a result of the movement recently started in Milwaukee by a number of prominent German-Americans. The plan is to raise an endowment of 10,000*l*., the income of which will be used for the establishment of an annual course of lectures at the State university, to be given by prominent professors of German universities. Mr. Andrew Carnegie has offered to give Washburn College, Topeka, Kans., a second 10,000*l*. for its endowment fund, provided the total endowment reaches 40,000*l*. by January 1, 1908.

The tenth of the series of articles on "Public School Education" which is being published in the *Times* appeared on December 28, 1906. This contribution deals with laboratories and practical work in the teaching of science, and is by the Rev. T. Nicklin, of Rossall School. Mr. Nicklin says, "it would be hard to find a single public school of recognised position that has not a laboratory which, if not palatial, is yet adequately equipped for that end of science teaching that is regarded in England as educationally best." A little later the article asserts that while the masters in the public schools adhere to the theory that lectures and intellectual teaching must be the staple of the work, the English public schools have from the first made considerable use of the laboratory, and to-day that use is on a larger scale and more thorough in character than ever before. Mr. Nicklin describes the laboratories of an average public school, and indicates briefly the course of study followed. Though it would have been more satisfactory if, in addition to his generous estimate of Prof. Armstrong's work in improving English science teaching, Mr. Nicklin had insisted more upon the paramount importance of laboratory practice in the teaching of science, his article is valuable in showing the very substantial improvement made during recent years in the way in which science is regarded by public-school authorities. Many readers of Nature will remember the days when any sort of practical lesson was unknown in public schools, and to hear that every such school now has well-equipped laboratories—even if in some cases they are not used enough—is convincing proof that the labours of men of science in the direction of rationalising English public-school education have not been in vain.

SOCIETIES AND ACADEMIES.

LONDON.

Zoological Society, December 11, 1906.—Dr. H. Woodward, F.R.S., vice-president, in the chair.—An account of the ascidians of the Cape Verde marine fauna collected by Mr. Cyril Crossland: Dr. J. **Rennie** and H. **Wiseman.** The occurrence of ten species of Ascidiæ Simplices was recorded, of which three were described as new.—Variations in the arterial system of certain species of Anura: L. K. **Crawshay.**—Descriptions of fifty-three new species of African Coleoptera of the family Curculionidæ: Guy A. K. **Marshall.**—The cranial and spinal nerves of *Chlamydoselachus anguineus*: Mrs. O. A. Merritt **Hawkes.** The paper contained a description of these nerves and discussions of them from the point of view of the nerve-component theory, and showed that the nervous as well as the other systems of Chlamydoselachus combined specialised and primitive features.—Two mammals obtained by Major Powell-Cotton in the Ituri Forest: R. **Lydekker.** The author referred a dark-coloured cat's skin to a race of *Felis chrysothrix*, and also described a giant elephant-shrew as new.—The skull of a bruang, or Malay bear, from Tibet, representing a distinct race: R. **Lydekker.**—South Indian nudibranchs: Sir Charles **Eliot.** A supplementary account of the radulæ of various species based on microscopic slides prepared by Alder and Hancock, discovered in the Hancock Museum at Newcastle-on-Tyne. These slides confirmed many of the identifications suggested in the first paper, and in particular showed that *Doris glenei* was a Chromodoris, and that *Doris villosa* was *Thordisa maculigera*, Bgh.

Faraday Society, December 11, 1906.—Dr. T. M. Lowry in the chair.—Contributions to the study of strong electrolytes: Dr. A. C. C. **Cumming.** (1) *The Elimination of Potential due to Liquid Contact.*—Certain solutions have the property of reducing the potential due to the contact of two solutions, and potassium chloride has been used for this purpose. In most cases a saturated solution of potassium chloride does not remove all the diffusion potential; indeed, if the solutions in the cells be strong, it only removes a small part. This property of removing more or less of the diffusion potential depends on two factors in the connecting solution, first, the positive and negative ions must be of equal velocity, and, secondly, the concentration of the connecting solution must be high compared with the solutions in the cells. The author suggests a saturated ammonium nitrate solution as that which fulfils these two conditions better than anything else at present known, and shows by experiments with different cells that this is the case. (2) *The Potentials of Silver Nitrate Solutions.*—For silver nitrate the electromotive force gives the same measure of the ionic concentrations as is obtained from the conductivities, and therefore supports the view that the conductivity gives a true measure of the ionic concentration.—The electrochemistry of lead: Dr. A. C. C. **Cumming.** The results in general prove that lead in the tetrad form is a highly electropositive element, and also direct attention to a curious difference in the behaviour of sodium and potassium nitrates towards lead nitrate.—Storage batteries and their electrolytes: R. W. **Vicarey.** The paper deals chiefly with some of the problems involved in the manufacture of accumulators, particularly as regards the effect of nitrogen and other impurities introduced consciously or by accident in the process of manufacture.

PARIS.

Academy of Sciences, December 24, 1906.—M. H. Poincaré in the chair.—The determination of integrals of equations of the elliptic type by certain conditions at the limits: Émile **Picard.**—Differential equations of the second order at fixed critical points: Paul **Painlevé.**—Magnetic work at the town of Tananarivo and district: Ed. El-

Colin. A table is given showing the results of the magnetic observations at twenty stations, to which is appended a discussion of the perturbations.—The evolution of the Tertiary mammals: the importance of migrations. The Miocene epoch: Charles **Depéret.**—The perpetual secretary announced the death of Jean Abraham Chrétien Oudemans, correspondant of the academy for the section of geography and navigation, and of Jacques Augustin Normand, correspondant for the same section.—The nature of the atmospheres of Mercury and Venus: P. **Salet.** Details are given of the method of observation by which it has been found that the light from Mercury is not sensibly polarised. It was shown by Landerer in 1892 that the light from Venus is similarly not polarised. The author concludes that it would be premature to draw conclusions as to the nature of the atmosphere of Mercury from this result.—A formula applicable to the times of direct rotation of the planets and the sun: Émile **Belot.** The formula proposed is

$$T = \frac{23{\cdot}75}{\sqrt{a}.D^{\frac{1}{2{\cdot}7}}} + \frac{0{\cdot}61D}{\sqrt{d}},$$

where T is expressed in hours, a is the distance from the centre of the system, D the diameter of the planet in diameters of the earth, and d the density with respect to water. The times are calculated from this formula in ten cases, and the causes of the two large deviations observed, the sun and moon, discussed.—A method in the calculus of variations: M. **Hadamard.**—Partial differential equations of the second order with two independent variables admitting a group of odd order of transformations of contact: J. **Clairin.**—The extinction of friction: L. **Lecornu.** The motion is considered of a system of homogeneous spheres having their centres fixed, and which exercise given mutual pressures at their points of contact. It is shown that this system, once set in motion and left to itself, has the peculiar property that the work of friction, with respect to the unit of time, tends constantly to diminish. This theorem still holds when, for one or more of the points of contact, the sliding is replaced by a rolling.—The unsymmetrical modification of some absorption bands of a crystal under the action of a magnetic field: Jean **Becquerel.**—The variation of ferromagnetism with temperature: Pierre **Weiss.** A theory of ferromagnetism is given based on a simple hypothesis concerning the mutual actions of the molecules. Experiments have been carried out on magnetite, which previous experiments had shown to be sensibly saturated in a field of 500 Gauss, and of which the temperature corresponding to the disappearance of magnetism, 587° C., is easily accessible. The curve drawn from the theory is given, and on the same diagram ten experimental points are shown. The correspondence is very close at one temperature only, that of solid carbonic acid, there being a sensible deviation from the curve.—The negative charge at a distance of a metallic plate illuminated in an electric field: Mme. **Baudeuf.**—The cryoscopy of colloidal solutions of ferric chloride: G. **Malfitano** and L. **Michel.** The authors have shown the possibility in previous papers of using a collodion filter to separate the fine particles from the liquid in which they are suspended, and in the present paper apply this method to determine the lowering of the freezing point of the latter, considered apart from the small particles. In this way they find that the cryoscopic effect of the suspended particles is so small as to be beyond experimental measurement. In this case, at any rate, the magnitude of the suspended particles cannot be determined by cryoscopic methods.—The absolute atomic weight of dysprosium: Gustave D. **Hinrichs.** A discussion of the experimental results of G. Urbain. The atomic weight of dysprosium is assumed to be 162·5 exactly; the experimental figures and those based on this assumption are compared, and the deviations noted.—A colloidal compound of thorium with uranium: Béla **Szilard.** The compound described is obtained by heating precipitated thorium hydrate with solutions of uranium salts.—The action of alkaline silicates on soluble metallic salts: Robert **Dollfus.** A description of the phenomena observed when a crystal of ferrous sulphate is thrown into a solution of sodium or potassium silicate. The experiment has some analogies with the culture of the artificial cell described by Traube and by Stéphane Leduc.—The definite compounds formed by chromium and boron: Binet **du Jassonneix.** The ingots obtained by reducing chromium oxide by boron in the electric furnace contain two compounds, Cr_3B_2 and CrB, both of which dissolve in a medium containing less boron, and which can only be isolated in a state of purity from nearly homogeneous ingots, the composition of which nearly corresponds to the substance required.—The anhydrous protoxides of the alkaline metals: E. **Rengade.** By applying to rubidium, potassium, and sodium the method previously used to obtain the oxide of cæsium, Cs_2O, the lower oxides of these metals, possessing the general formula R_2O, have been obtained in a pure state.—Some sulphates of tetravalent vanadium: Gustave **Gain.**—The use of special steels for rivets: G. **Charpy.** A systematic study of the thermal and mechanical properties of various alloys of steel has led to the use of a chrome nickel steel for rivets, the strength of which is 2·5 times that of the metal usually employed for this purpose, and this without the need of any special precautions in practical use.—Some methods of estimating nitriles and carbamines; H. **Guillemard.**—A new method for estimating free sulphur: E. **Berger.** The sulphur is dissolved by fuming nitric acid to which a little potassium bromide has been added. This reagent acts in the cold, and in a few minutes.—The molecular weight of elaterine: A. **Berg.** The author has repeated his determinations of the molecular weight of elaterine, with the result of confirming his earlier views. The formula would appear to be $C_{28}H_{38}O_7$.—Contribution to the study of the hydroxamic acids: R. **Marquis.** Benzhydroxamic acid, treated with thionyl chloride, gives phenyl isocyanate by a kind of Beckmann transformation. Salicylhydroxamic acid behaves differently, oxycarbanil being quantitatively formed.—A new method of formation of organic compounds of phosphorus: J. **Berthaud.** White phosphorus, heated with an alcohol in a sealed tube at 250° C., after some hours completely disappears. Among the products of the reaction are phosphines, hydrogen phosphide, some phosphinic acids, and tetralkylphosphonium hydrate, the latter being the chief product.—The experimental reproduction of lithospherical folding: M. **Hirtz.** The effects of the gradual contraction of a planet are imitated by a layer of paraffin enclosed between two distended rubber spheres, the internal one being slowly deflated, and the contact of the external sphere with the paraffin being maintained by external pressure. The surfaces thus produced are compared with the surface of the moon.—The origin of helicoidal windings in crystallised bodies: Fred. **Wallerant.**—Corrosion figures: P. **Gaubert.** A study of the corrosion figures produced on phthalic acid crystals by mixtures of alcohol and water.—A new mineral species, nepouite, a hydrated silicate of nickel and manganese: E. **Glasser.** The mineral was found in New Caledonia. The analyses lead to the composition $2SiO_2,3(Ni,Mg)O,2H_2O$. The name of nepouite is proposed from the place Nepoui, the locality where it was first observed.—The experimental reproduction of the mycetoma with black seeds: E. **Pinot.**—The nature of the latent life in seeds and on the true characters of life: Paul **Becquerel.**—Luminous radiations and the richness of wheat in nitrogen: J. **Dumont.** The radiations at the blue end of the spectrum are those possessing the greatest effect in causing the migration of nitrogenous materials, especially gluten, in seeds.—The influence of the valency of metals on the toxic power of their salts: Henri **Micheels.**—The genesis of proteid materials by a pathogenic microorganism at the expense of definite chemical substances: J. **Galimard** and L. **Lacomme.**—A new species of the genus Icticyon (Speothos) coming from the equator: E. L. **Trouessart.**—The influence of the geographical situation on the development of height in man: Eugene **Pittard.** A study in the Canton Valais, Switzerland, of the effects of soil, altitude, and aspect upon the human height.—Researches on nutrition balance of nitrogen and common salt: M. **Letulle** and Mlle. M. **Pompilian.**—An apparatus for administering chloroform. The Roth-Drœger apparatus: M. **Guglielminetti.** The regular distribution of chloroform in the tissues when using an air-chloroform mixture of known proportions is based on the assumption that the breathing is regular. The apparatus

described permits of the administration of a given quantity of chloroform in a given time, whatever may be the respiratory activity.—The preservation of chloroform, and an arrangement indicating its accidental alteration: Pierre **Breteau** and Paul **Woog.** Pith tinted with Congo red is recommended as the most practical means of detecting acid alteration products in chloroform.—The physiological action of Euphorbium resin: L. **Pénières.**—The nature of vaccine virus: H. **Nicolle** and M. **Adil-Bey.**—The causes of alteration of butter. The bacteriological control of butter manufacture: M. **Mazé.**—The geological constitution of the Chézery region: Attale **Riche.**

CALCUTTA.

Asiatic Society of Bengal, December 5, 1906.—The common kestrel (*Tinnunculus alaudarius*): Lieut.-Colonel D. C. **Phillott.** Note on the breeding and distribution of this bird in India; its use in Persia as a decoy for hawks; its employment by the Arabs for training greyhound puppies destined for the sport of gazelle-hawking.—Note on the falcon (*Falco jugger*): Lieut.-Colonel D. C. **Phillott.** Note on habits, breeding, prey, and use in falconry, with a detailed description of and a figure illustrating its use as a *bārak*, or decoy with nooses, by Indian hawk-catchers.—*Swertia tongluensis*, and a new variety of *Swertia purpurascens*: I. H. **Burkill.** Records the result of observations in the field upon the difference between *Swertia tongluensis* and *Swertia Chirata*. Both plants are equally bitter. The new variety of *Swertia purpurascens* was collected in the Sikkim Himalaya. It differs from the type in several features, and the finding of it extends the range of the species to the east of Nepal.—Hunting-dogs from an Arabic manuscript of the fourth century: Lieut.-Colonel D. C. **Phillott** and R. F. **Azoo.**—A specimen of *Felis tristis*, Milne-Edwards, in the Indian Museum: N. **Annandale.** The skull of this rare cat is figured and described from a specimen of unknown *provénance*. The most characteristic feature of the dentition is the high development of the anterior præmolar.—Miniature tank worship in Bengal: A. N. **Moberly.**—The Rajmahal hill folk. The Saorias of the Rajmahal Hills: R. **Bainbridge.**—Fresh-water fauna of India, No. 11. The occurrence of the medusa, *Irene ceylonensis*, in brackish pools, together with its hydroid stage: N. **Annandale.** This medusa has been found, with its hydroid stage, in pools in the Ganges delta which probably contain about one-third of the proportion of mineral salts commonly present in sea-water.—Fresh-water fauna of India, No. 12. A preliminary note on the Polyzoa occurring in Indian fresh water and brackish pools, with the description of a new Lophopus: N. **Annandale.** *Victorella pavida* is recorded from near Calcutta, the "species" of Plumatella (*P. repens*, *P. emarginata*, and *P. allmani*) occurring in India are discussed, and a Lophopus distinguished from *L. crystallinus* by the shape of its statoblasts is described from a lake in the outer Himalayas.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 3.

ROYAL INSTITUTION, at 3.—Signalling to a Distance: the Telephone and its Working: W. Duddell.

FRIDAY, JANUARY 4.

LONDON INSTITUTION, at 4.—Earthquakes and Geysers: W. Herbert Garrison.

ROYAL GEOGRAPHICAL SOCIETY, at 3.30.—Japan and the Japanese as I saw them: Miss A. L. Murcutt.

SATURDAY, JANUARY 5.

ROYAL INSTITUTION, at 3.—Signalling to a Distance: Early Wireless Telegraphs: W. Duddell.

GEOLOGISTS' ASSOCIATION, at 8.—On a Norwegian Snowfield and its Glaciers: Horace W. Monckton.

MONDAY, JANUARY 7.

ROYAL GEOGRAPHICAL SOCIETY, at 3.30.—A Lady's Journey from the Cape to Cairo: Miss Mary Hall.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Sixth International Congress of Applied Chemistry at Rome: Walter F. Reid.

VICTORIA INSTITUTE, at 4.30.—The San Francisco and Valparaiso Earthquakes and their Causes: Dr. Warren Upham.

TUESDAY, JANUARY 8.

ROYAL INSTITUTION, at 3.—Signalling to a Distance: The Radio Telegraph: W. Duddell.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Simplon Tunnel: Francis Fox.

WEDNESDAY, JANUARY 9.

SOCIETY OF ARTS, at 5.—Perils and Adventures Underground: Bennett H. Brough.

GEOLOGICAL SOCIETY, at 8.—On the Cretaceous Formations of Bahia (Brazil), and on Vertebrate Fossils collected therein: J. Mawson and Dr. A. S. Woodward, F.R.S.—On a new Dinosaurian Reptile from the Trias of Elgin: Dr. A. S. Woodward, F.R.S.

THURSDAY, JANUARY 10.

MATHEMATICAL SOCIETY, at 5.30.—Exhibition of Four-dimensional Models: Mrs. A. Stott.—On the Uniform Convergence of Fourier's Series: Dr. E. W. Hobson.—Asymptotic Approximation to Integral Functions of Zero Order: J. E. Littlewood.—Partial Differential Equations of the Second Order having Integral Systems free from Partial Quadratures: Prof. A. R. Forsyth.—On the Singular Points of Some Classes of Power Series in Several Variables: G. H. Hardy.—The Construction of the Line drawn through a Given Point to meet Two Given Lines: Prof. W. Burnside.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—New Incandescent Lamps: J. Swinburne.

FRIDAY, JANUARY 11.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Balancing of Internal-combustion Motors applied to Marine Propulsion: A. T. Weston.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—Descriptions of New Species of Achatina from the Congo Free State: S. I. Da Costa.—Further Contributions to the Genus Chloritis, with Descriptions of Eleven New Species: G. K. Gude.—Description of a New Species of Papuina, and Illustrations of some hitherto unfigured Helicoid Land-shells: G. K. Gude.—Descriptions of new Non-marine Shells from New Zealand: Henry Suter.

SATURDAY, JANUARY 12.

ROYAL GEOGRAPHICAL SOCIETY (at The Queen's Hall, Langham Place), at 8.45.—The Duke of the Abruzzi's Expedition to Mount Ruwenzori.

PUBLIC SCHOOL SCIENCE MASTERS' ASSOCIATION (University of London), at 2.30.—The Place of Science and of Literature in a General Education: Rev. and Hon. E. Lyttelton.—The Internal Economy of School Science: Mr. Thwaites.—The best Method of Introducing the Atomic Theory in Science: F. R. L. Wilson.

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