THURSDAY, DECEMBER 3, 1908.

PHYSICS, OLD AND NEW.

The New Physics and its Evolution. By Lucien Poincaré. Pp. xvi+344. International Scientific Series. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1907.) Price 5*s*.

The Evolution of Forces. By Dr. Gustave Le Bon. Edited by F. Legge. Pp. xv+388. (Same series and publishers, 1908). Price 5*s*.

MR. LEGGE is to be congratulated in bringing before the English reader these two French publications, which have been translated into vigorous and idiomatic English. The value of each book is enhanced by the addition of a table of contents and an index, and of occasional notes by the translator of explanation or of recent additions to knowledge.

The work of Lucien Poincaré is a critical statement of the position of physics to-day, with especial reference to the influence of recent discovery on the older ideas. In about three hundred pages he passes in review a great variety of subjects, including a discussion of the fundamental units, the principles of physics, the various states of matter, electrolytic dissociation, wireless telegraphy, electric conduction of gases, kathode rays and radio-activity, while two chapters are devoted to the æther and the connection between æther and matter. In such a short compass it is obvious that none of these subjects can be treated in detail, but the author succeeds in every case in giving a luminous and interesting survey of the state of knowledge. Great care has evidently been taken in studying the historical development of ideas and in endeavouring to apportion the just credit to various investigators. In this the author shows himself unusually accurate and happy in his statements. There is one notable exception to which attention may be directed. In the discussion of the principle of the conservation of energy, two pages are devoted to the contributions of Mayer, but no mention is made of the classical experiments of Joule.

The judicious attitude of the author is well illustrated in his short account of the *n*-rays and in the history of wireless telegraphy. He obviously feels that it behoves him to step warily. A digression is given on the duties of the writer of contemporary science which bears quotation :—

"An invention is never, in reality, to be attributed to a single author. It is the result of many collaborators who sometimes have no acquaintance with one another, and is often the fruit of obscure labours. Public opinion, however, wilfully simple in the face of a sensational discovery, insists that the historian should also act as a judge; and it is the historian's task to disentangle the truth in the midst of the contest, and to declare infallibly to whom the acknowledgments of mankind should be paid. He must, in his capacity as skilled expert, expose piracies, detect the most carefully hidden plagiarisms, and discuss the delicate question of priority; while he must not be deluded by those who do not fear to announce, in bold accents, that they have solved problems of which they find the solution imminent, and who, the day after its final elucidation by third parties, proclaim themselves its true discoverers. He must rise above a partiality which deems itself excusable because it proceeds from national pride; and finally he must seek with patience for what has gone before. While thus retreating step by step he runs the risk of losing himself in the night of time."

Finally, after a happy if somewhat delicate treatment of the history of the subject, he concludes with the following quotation from Voltaire in the "Philosophical Dictionary" :—

"What! We wish to know what was the exact theology of Thot, of Zerdust, of Sanchuniathon, of the first Brahmins, and we are ignorant of the inventor of the shuttle! The first weaver, the first mason, the first smith, were no doubt great geniuses, but they were disregarded. Why? Because none of them invented a perfect art. The one who hollowed out an oak to cross a river never made a galley; those who piled up rough stones with girders of wood did not plan the Pyramids. Everything is made by degrees and the glory belongs to no one."

In a final chapter the author makes a few remarks on the "future of physics." He is appreciative of the great value of the electronic hypothesis, and foresees that it will lead to further developments, but is not so certain of its survival in its present form. He states :—

"The electron has conquered physics, and many adore the new idol rather blindly . . . but it is right not to lose sight of the fact that an image may be a well founded appearance, but may not be capable of being exactly superposed on the objective reality."

The book is simply and pleasantly written with an absence of all formulæ and the avoidance of technical terms as far as possible. The non-expert reader will find some of the chapters stiff reading, but he will nevertheless find much to interest and instruct. It is a scholarly production which can be confidently recommended to all who are interested in the development of physics.

The work of M. Gustave Le Bon on the "Evolution of Forces" is of a very different type. If, in reading the work of M. Poincaré, the critical faculty rests in abeyance, in the work of M. Le Bon there is an inclination to dispute the correctness of a statement on nearly every page. The work is in some respects a sequel to the "Évolution de la Matière," previously published, which gave an account of the author's views on the transformation of matter and his experiments in support of them. The present work is somewhat varied in character. The first half of the book is devoted to a discussion of the principles of physics, including the fundamental conceptions of time, space, energy, and matter, and the principle of the conservation of energy and of matter from the point of view of Le Bon's theory. This theory is engaging in its simplicity, but is in many respects very revolutionary in character. The atoms of matter, which are supposed to be enormous reservoirs of energy, are slowly undergoing spontaneous transformation into the æther. Matter represents a comparatively stable form of energy, but electricity, light, heat, &c., are unstable manifestations of the same energy, and are derived from the transformation of the atoms of matter. The terms electricity and matter

are mutually convertible, for the appearance of electricity represents a corresponding disappearance of matter. The theories of the indestructibility of matter and energy are overthrown. All matter and energy are disappearing from the universe to be ultimately converted into æther.

The second half of the book contains an account of experiments, with numerous illustrations by the author in support of his views. Some simple electrostatic experiments are described from which he draws truly astonishing conclusions. The latter part of the book is devoted to a description of his experiments on phosphorescence and "black light." This portion of the book will be found very instructive to those who are interested in the little-known subject of phosphorescence. A number of striking experiments are described, and the author has obviously taken great trouble to make the results as conclusive as possible. The general idea is that phosphorescence is a result of the transformation of atoms of matter. There still remains much to be done in this field of inquiry, but it has not yet been proved that the molecular combinations and dissociations under the influence of light are not sufficient explanation without having recourse to the transformation of atoms.

The book is full of trenchant criticisms, and neither principles nor theories are spared which do not fall in with the author's views. We gather, whether rightly or wrongly, that the author has little respect for the orthodox man of science, whom, apparently, he considers is steeped in formulæ and filled with conservatism, but yet not so conservative that he is not capable of taking the excellent views of Le Bon without giving credit for them. We are familiar with examples of our non-mathematical scientific brethren who abhor the sight of a simple equation. M. Le Bon is evidently of their opinion, as may be seen from the following quotation, which also serves as an example of his vigorous style:—

"What has finally given very great force to certain principles of physics and mechanics has been the very complicated mathematical apparatus in which they have been wrapped. Everything presented in an algebraical form at once acquires for certain minds the character of indisputable truth. The most perfect sceptic willingly attributes a mysterious virtue to equations and bows to their supposed power. They tend more and more to replace, in teaching, reason and experience. These delusive veils which now surround the most simple principles only too often serve to mark uncertainties. It is by lifting them that I have succeeded more than once in showing the frailty of scientific beliefs which for many scholars possess the authority of revealed dogmas."

Assuming the correctness of the hypotheses and statements of the author, the book forms interesting reading, and is full of original ideas. It is a different matter when one proceeds to examine the evidence in favour of his theory. Men of science are very chary, and rightly so, of hypotheses reared on a very slender foundation of fact which endeavour to account for the universe and all that it contains. Some experimental proof is required before such hypotheses are seriously entertained. It is true that the study of the radio-active bodies has led to the belief that the atoms of active matter undergo spontaneous transformation and are the seat of a large store of energy. Many are prepared to believe that the same is true of the atoms of ordinary matter. Experiment seemed at first to indicate that all matter was radio-active, and was in a state of slow transformation. Recent work, however, has cast grave doubt on this conclusion, for it is fairly certain that the greater part of the apparent activity of ordinary matter, with the exception, possibly, of potassium and its salts, can be explained without the necessity of assuming that the atoms of ordinary matter are disintegrating. The study of the internal heat of the earth shows that if ordinary matter is evolving energy due to atomic transformation, it must do so at a rate very small compared with even a weakly radio-active substance like uranium. As Strutt has pointed out, the internal heat of the earth would be much greater than it is if ordinary matter disintegrated at even one-thousandth the rate of uranium. It is probable that the transformation of the atoms of matter may be much accelerated under the influence of exceedingly high temperature and its accompanying manifestations. It seems to have been overlooked that Sir Norman Lockyer long ago advanced this idea from a study of the constitution of the stars. The astronomical evidence in support of the view that the atoms of matter undergo transformation is collected in his interesting book, "Inorganic Evolution."

One of the main hypotheses of Le Bon is that electricity is derived from the decomposition of atoms of matter. On this view, the electricity which passes through a copper wire is derived at the expense of the copper, and ultimately the latter will vanish into a quantity of intangible æther. On account of the great store of electricity in an atom of matter, this disappearance will take place very slowly. It is now generally believed that the passage of electricity through a conductor is due to the transference of charged carriers, but it is exceedingly doubtful whether there is any loss of matter in the process. There is so far not the slightest experimental evidence in favour of the assumption.

The book is clearly written, and the interest is maintained throughout. We can recommend it to readers who are interested in revolutionary ideas of physics and in the spectacle of the *débâcle* (according to Le Bon) of a large amount of scientific doctrine. We would suggest, however, that the reader need be under no obligation to consider the statements contained in it as the latest accepted scientific gospel.

BIOGRAPHY OF SPENCER.

The Life and Letters of Herbert Spencer. By Dr. David Duncan. Pp. xi+621; with seventeen illustrations. (London: Methuen and Co., n.d.) Price 15*s*.

IT is not long since we had Mr. Herbert Spencer's voluminous "Autobiography," and now we have his "Life and Letters"—a labour of love executed with marked success by Dr. David Duncan, who was for a time the philosopher's secretary and collabo-

rateur. With his characteristic deliberateness, Mr. Spencer arranged for this "Life" some twenty-eight years ago, and he confirmed the arrangement in his will. He felt that an autobiography is from the nature of the case likely to give a partial picture of the man, and this is borne out by reading the "Life." Although Herbert Spencer was unusually gifted with the power of regarding himself almost impersonally as a phenomenon, the result of the "Autobiography" was to leave some false impressions, as, for instance, that he was "all brains and no heart." Besides correcting the partiality of Spencer's self-portraiture, the "Life" contains many letters of historical interest, an important document entitled "The Filiation of Ideas" (1898–9), and valuable summings up, such as the chapter on Spencer's views on inorganic evolution. Moreover, it is the only authoritative record of the twenty-one years that elapsed after the completion of the "Autobiography."

The biographer has done his work with great skill, welding his material into a continuous narrative, and preserving throughout a keen sense of perspective. One wishes that he had not hidden himself quite so much, for he had unusual opportunities of knowing Spencer; but perhaps his very objective mode of treatment is the higher art, and in any case it is peculiarly congruent with the subject.

The fine chapters at the end of the biography which deal with "Characteristics and Personal Reminiscences" and with "Spencer's Place in the History of Thought" are less objective than the rest of the book, and will be read with great interest.

Much of the "Life" necessarily covers somewhat familiar ground, and confirms impressions which the "Autobiography" gives. Again we see how the inherited strain of nonconformity and independence expressed itself consistently throughout Spencer's life in things great and small. In 1842 a friend called him "radical all over," and it was a descendant of the man who could not lift his hat without violating his principles, that would not go to Lady Derby's "At Home," either with a levee dress or without one, to have the honour of meeting His Majesty the Emperor of Russia, and who omitted the Duke of Argyll's name from a reference in one of his pamphlets lest some people should regard him as a snob. But it was the same irreconcilable dissenter who let hardly a year pass without acting as champion of some unpopular cause, who was, where principle was involved, absolutely reckless of popularity, who did not know what it was to fear the face of man.

Again, as in the "Autobiography," the reader is surprised, sometimes even startled, by some of Spencer's judgments, both as to the work of others and his own. "I have lately been reading," he writes in 1843, "Pope's 'Homer.' . . . To my taste there is but little real poetry in it . . ." In 1852 he writes, "Though a Scotchman (and I have no partiality for the race) I am strongly inclined to rank Alexander Smith as the greatest poet since Shakespeare." We cannot but like the philosopher better when we find him telling his father, concerning the "Psychology," "My private opinion is that it will ultimately stand beside Newton's 'Principia,'" and then writing twelve days afterwards that it will be as well not to mention this opinion lest it may be thought "a piece of vanity." Perhaps there was in this some expression of the sense of humour which was so well concealed by the author of the "Synthetic Philosophy" that some who had opportunities of knowing him well have doubted whether it was not vestigial.

The "Life" tells us of much kindness on Spencer's part that the "Autobiography" could not, of course, mention, and the whole impression left is that of a much more human character. In referring to the idea that Spencer was all intellect and no feeling, Dr. Duncan points out that the letters to his parents furnish sufficient disproof.

"Rare indeed are the instances in which father and son have laid bare their minds so freely to one another. Rarer still are the instances in which father and son have for over thirty years carried on their correspondence on such a high level of thought and sentiment."

Of Spencer's capacity for strong friendship, the "Life" affords abundant illustration. In speaking of their old-standing friendship, Huxley wrote:—"It has been the greatest pleasure to me to see the world in general gradually turning to the opinion of you which is twenty years old in my mind"; and again:—"How odd it is to look back through the vista of years! . . . Considering what wilful tykes we both are (you particularly), I think it is a great credit to both of us that we are firmer friends now than we were then." "Wilful tykes" indeed, for this intimate friendship of nearly forty years' standing was almost wrecked by a hot controversy in 1889. This was a grief to both the veteran combatants, who, happily, were great enough, after some years, to shake hands and be friends again.

We hear not a little in the letters about the way in which readers in general and critics in particular "persisted in some absurd misapprehension or other," but we have not found any suggestion on Spencer's part that he might himself be in any way responsible for the misunderstandings which he aroused.

The "Life" does not weaken our impression of Spencer's almost morbid sensitiveness in regard to priority. Now it is some lecture, and again some text-book, that is at fault; at one time it is Henry Drummond, and at another time Charles Darwin, who uses, without sufficient acknowledgment (it is alleged), some conclusion that Spencer had arrived at. He was vexed that so many writers supposed that mental evolution was Darwin's hypothesis.

"As no one says a word in rectification, and as Darwin himself has not indicated the fact that the 'Principles of Psychology' was published five years before the 'Origin of Species,' I am obliged to gently indicate this myself."

In this connection the appendix containing Spencer's account of the filiation of his ideas is interesting, as is also the note in 1860 to the effect that the programme of the "System of Philosophy"

in its finished form was drawn up before he read the "Origin of Species."

It was doubtless Spencer's keen sense of accuracy and justice rather than any feeling of personal rights that made him so sensitive about priority, and it was perhaps his jealousy for the honour of science that led him to behave in a somewhat strange way concerning his election as a foreign correspondent of the Reale Accademia dei Lincei. It should be remembered, too, that while Spencer was unwilling that anyone should use his ideas without acknowledgment, he was even more troubled by the suggestion that he ever did anything of this sort himself. To be accused of cribbing from Comte was a serious charge, though absurd on the face of it; but it seems strange that he should have found it "very annoying" to be accused of stealing the idea of "the gospel of relaxation"—and the phrase as well—from an American writer. This was in allusion to his well-known thesis that "Life is not for learning, nor is life for working; but learning and working are for life"—"a strange maxim this," as the biographer well remarks, "to come from one who scorned delights and lived laborious days in order to complete a task he had deliberately imposed upon himself."

In curious inconsistency with Spencer's sensitiveness over questions of priority was his very small appetite—sometimes amounting to total abstinence—as regards the works of previous evolutionists, and in this connection the "Life" has some additional information that is instructive. Spencer went in for "little reading and much thinking, and thinking about facts learned at first hand."

"All along," he said, "I have looked at things through my own eyes and not through the eyes of others. I believe that it is in some measure because I have gone direct to Nature, and have escaped the warping influences of traditional beliefs, that I have reached the views I have reached."

As one would expect, the "Life" informs us that many of the things said about Spencer were untrue. He once said that he could fill a small volume with absurd stories about himself, and the trouble was that his high standard of accuracy led him to take them somewhat too seriously. Instead of recognising that it is one of the penalties of greatness to become a centre of myths, or contenting himself with docketing the canards as evidences of "the extreme untrustworthiness of human testimony," he was sometimes annoyed by them, and spent time in correcting them—for instance, in the case of the quite innocent statement which appeared in the *Aberdeen Free Press* that Spencer had once written articles on sociology for the Birmingham *Pilot*. As he lived a very quiet life, certainly not one that furnished picturesque copy, there was scope for inventiveness, and thus absurd paragraphs appeared to the effect that Spencer always wore white gaiters, invariably carried a bulky umbrella, lived chiefly on bread and coffee, and changed his occupation every ten minutes. Perhaps the only matter for real regret was that the inventiveness was of so low an order.

The biographer is nothing if not loyal to Spencer; he is inclined to rebut what seems to us just criticism. We cannot always agree, and we may give one example. At the close of his account of the Weismann controversy—the issue of which is so momentous in relation to Spencer's ætiology—Dr. Duncan says that it is not for a layman to express an opinion on a question that divides biologists into distinct schools. He goes on, as one usually does after this sort of bow, to express very decided opinions.

"Bearing in mind how frequently the charge of *a priori* reasoning has been brought against Spencer, one cannot help remarking on the hypothetical nature of Prof. Weismann's premises and the *a priori* character of his arguments. The demands he makes on one's credulity are, to say the least, not less numerous or less astounding than those made by the opposite school. Prof. Marcus Hartog's description of Prof. Weismann's work on Amphimixis, may be applied to the theory as a whole. It is 'a magnified castle built by the *a priori* method on a foundation of "facts" carefully selected, and for the most part ill known, misinterpreted, or incomplete.'"

This opinion seems to us erroneous and misleading. One may compare Weismann's theory of determinants with Spencer's theory of physiological units; both are imaginative constructions, and unverifiable in any direct way. Experts have to choose the one that seems the simpler, the more consistent with known facts, and the more useful in interpretation, or to refuse them both in favour of a third. But the real issue was not in regard to a subtlety of this sort; it was in great part a question of fact—is there evidence warranting a belief in the transmissibility of somatic modifications?—and as one result of the controversy no evolutionist can any longer make the Lamarckian assumption without some energetic attempt at justification.

Much of the truth which Spencer expounded has now passed into the framework of the scientific universe of discourse; part, perhaps, has still to be incorporated; and not a little, bound up with "use-inheritance," will probably have to be rejected altogether. But, in addition to the reverence and gratitude with which we regard Spencer as thinker and teacher, there must rise in the minds of all who read this "Life" a desire to join with the author in paying homage once more to "the high and indomitable purpose that sustained Spencer throughout these years, enabling him, in face of difficulties that seemed almost insurmountable, ever to keep sight of the goal."

"Take him for all in all," the biographer says, "he was intellectually one of the grandest and morally one of the noblest men that have ever lived. His life was devoted to a single purpose—the establishing of truth and righteousness as he understood them."

Finally, we would say that we have, on reading the "Life," a refreshment of admiration for one who, while he was an intellectual Alpine climber, and accustomed to altitudes where many find it difficult to breathe, yet was a citizen of the world who took much thought for the people. "Ein Kerl der speculirt" was how Huxley, quoting from "Faust,"

described him to Tyndall, but, as Mr. Courtney said in his impressive farewell address, "it must never be forgotten that his one overmastering and dominant purpose was practical, social, human." The cold agnostic, all intellect and no heart, often felt himself called upon "to suspend his work in order to try to convert Christians to Christianity," as Dr. Duncan well puts it. As old age crept on apace, and he was writing his last book, it was anxiety for the welfare of his country that alone disturbed his serenity as he pondered over "ultimate questions," and wondered "Shall I ever again be awakened at dawn by the song of the thrush?"

OCULAR PATHOLOGY.

The Pathology of the Eye. By J. Herbert Parsons. 4 vols. Vol. i., pp. xiii+388; vol. ii., pp. viii+389–770; vol. iii., pp. x+771–1128; vol. iv., pp. ix+1129–1427. (London: H. Frowde and Hodder and Stoughton, 1908.)

THE recent completion of this work, of which the first volume was published in 1904, marks an epoch in the literature of the pathology of the eye. In his preface the author states that "the object of this treatise is to give as complete an account of the pathology of the eye as is possible in the present state of our knowledge."

How closely the author has kept this object in view, and how nearly he has attained it, will be obvious to readers who are familiar with ocular pathology. In comprehensiveness, in fulness of detail, and in wealth of illustration, this treatise exhibits a notable superiority over all previous monographs on the subject.

As curator of the museum at Moorfields Eye Hospital, the author has enjoyed opportunities for pathological study and investigation which may be justly termed exceptional. Much credit is due to him for the excellent use he has made of these opportunities, and also to the hospital authorities for their enlightened policy in maintaining a laboratory in which such good and permanently valuable work can be carried on.

The need of a book such as Dr. Parsons has given us has often been felt by those engaged in the study of ophthalmology, and especially by those who are unfamiliar with languages other than English. Much good work has been done, and great advances have been made in ocular pathology during the last ten or fifteen years, but the records of these accomplishments are widely scattered in scientific journals, hospital reports, and elsewhere, and are often unobtainable by the student. No attempt has hitherto been made, at all events successfully, to produce a work dealing comprehensively with the pathology of the eye. Hence the treatise now before us supplies a real want, and will prove (indeed, has already proved) of great assistance to those interested in this branch of medical science.

The author has wisely divided his work into four parts, and has thereby given us volumes of convenient and easily portable size. We doubt if he has been as well advised in extending the publication of the volumes over so long a period as four years. As a result of this, his work has to suffer the disadvantage, common to all scientific books of protracted publication, that by the time the final volume is in print the earlier portion of the work requires revision to bring it up to date.

The plan adopted by the author has been to devote the first and second volumes to the "Pathological Histology" of the ocular tissues, and the third and fourth volumes to the "General Pathology" of the eye, this latter title having a very wide and inclusive character. This arrangement, although in many respects admirable, and possibly the most serviceable, has led to a certain amount of repetition, necessitated by the consideration of subjects under two headings. For example, if the reader wishes to look up the pathology of injuries, say, of the cornea, he will find the subject partly dealt with in the chapter on the cornea in vol. i., and partly in the chapter on injuries in vol. iv.

In vols. i. and ii. the pathological histology of the eye, eyelids, and orbit (cysts and tumours) is dealt with, each component part of the eyeball, *e.g.* the cornea, iris, lens, &c., being considered separately and very fully. As introductory to the description of the morbid histology of each structure, there is a brief but sufficient account of its normal histology. This materially enhances the usefulness of the book to those engaged in microscopic work, enabling them, without loss of time, to refresh their memory of the histology of healthy tissues, or to compare the characters of their specimens with those accepted as normal.

The bacteriology of the ocular tissues, a subject of great and increasing importance, is also included in these volumes. A brief and serviceable account is given of the established relations of micro-organisms to disease of the various ocular tissues. More than this could not reasonably be desired in a work not dealing specially with bacteriology.

The scope of vols. iii. and iv. is much wider than that of the preceding volumes, and embraces more than might naturally be expected from the title, "General Pathology of the Eye."

In addition to subjects legitimately included under this heading, vol. iii. contains a lengthy account of the normal circulation of the eye, the nutrition of the eye, and the normal intra-ocular pressure. We are unable to agree with the author's view that "it is essential to give an exhaustive account of the normal circulation and nutrition of the eye" in a work on pathology. These three chapters, excellent in themselves, are much too elaborate as an introduction to the consideration of morbid conditions, and might with advantage be greatly curtailed in future editions.

Vol. iv., in addition to chapters on injuries, orbital inflammations, sympathetic ophthalmitis, &c., contains a very instructive chapter dealing with the morbid changes in symptomatic diseases of the eye, as, for example, the ocular lesions associated

with disease of the nervous and circulatory systems, the internal organs, &c.

Its concluding chapter is on heredity in diseases of the eye. As an introduction to this subject, the author has included a brief exposition of the Mendelian theory of inheritance, taken from a paper by Mr. R. C. Punnett, in the Proceedings of the Royal Society of Medicine.

This treatise, as we have already said, is the most complete work of its kind hitherto published. In our opinion it is an extremely valuable addition to ophthalmological literature, and one which is indispensable to all those engaged in the study of ocular pathology.

There are two special features of Dr. Parsons's book to which attention may be directed. One is the admirable way in which the author brings together and discusses the various theories which at different times have been brought forward in explanation of the pathology or pathogenesis of ocular disease. A good example of this is to be found in the chapter on sympathetic ophthalmitis.

The author's decisions appear to be strictly judicial, but he is perhaps rather lenient in reference to theories or statements which have been shown to be hardly worthy of support.

The other feature is the very full and most valuable list of references to literature provided throughout the book. Following the method of a well-known writer of travellers' guides, Dr. Parsons affixes an asterisk to the works which he believes to be most important, but, like the hotels in the guide, there is sometimes room for difference of opinion as to the merits of the "starred" articles.

In its general attributes, Dr. Parsons's work deserves commendation, and very little adverse criticism is called for. The author's literary style is usually clear and decisive, though it often lacks smoothness and elegance. It is no discredit to him that in the course of so extensive a work some pages should contain a few crude or cryptic sentences. There are but few printer's errors, but some of them ought not to have escaped notice, *e.g.* the printing of the word "sarcoma" for "glaucoma" in vol. iii., p. 1072.

The illustrations, which are very numerous, are, with few exceptions (*e.g.* several in the chapter on the retina), very satisfactory. The large majority are from photographs, and have, therefore, the merit of unquestioned fidelity, even if they are less explicit (especially in high-power reproductions) than drawings.

A careful index of illustrations and of subjects is given in vols. i., ii., and iii. Vol. iv. has an index of the subjects contained therein, but lacks an index of illustrations. In this volume there is also a general index of subjects in all four volumes, but, unfortunately, it is of little use. The value of a general index in a work of more than one volume is to enable the reader to ascertain quickly in which volume he will find the subject under discussion. It is no assistance to him to learn that it is on p. 1339, unless he is informed in which volume this page is to be found.

A STUDY IN SEAWEEDS.

Die Algenflora der Danziger Bucht, ein Beitrag zur Kenntnis der Ostseeflora. By Prof. Lakowitz. Pp. vii+141; 1 Vegetationskarte, 5 double plates of photographic illustrations of the plants, and 70 text-illustrations of structure. (Danzig, 1907, Kommissions verlag von W. Engelmann, Leipzig.)

THIS monograph is devoted to a most careful study of the marine flora (excluding diatoms) of a region which, though poor in species, affords problems of great scientific interest, more especially with respect to the origin of the flora and its comparison with those of other seas. The whole number of species determined with certainty amounted to only seventy-four, including four Characeæ, but to these must be added a few others met with only in too imperfect a state to allow of determination.

Only one species, belonging to the genus Goniotrichum, is regarded as new to science, but six varieties receive mention as previously unrecorded. The species and varieties are described as they exist in the Gulf of Danzig; their environment is noted, and their distribution within and beyond the Baltic Sea is quoted from the best works. While the descriptions, analytical keys, and figures make the first part of the monograph a valuable contribution to systematic botany, a more general interest attaches to the second part, in which are treated the relations of the flora to the environment within the bay, and to the floras of other regions. The physical configuration of the region is discussed, as well as the geological structure, and the elevations and depressions which can be traced as having occurred in the past.

There is evidence that the district lay under the Scandinavian ice-sheet for a time, and that, as the ice retreated northwards, the connection of this sea was with the cold northern seas, over sunk portions of what is now Sweden, Arctic Mollusca (*Yoldia arctica, Astarte borealis,* &c.) being characteristic of its fauna. The melting of the ice led to the formation of a sea with very cold water, poor in the usual marine salts. It appears to have been shut off from the present west part of the Baltic by a ridge passing through Bornholm. During this period probably the bulk of its fauna and flora arrived, about one-half of the Algæ showing an Arctic character. Subsequently, for a time, the eastern Baltic became a lake, to be afterwards again connected with the North Sea, but by a more southern outlet. The degree of salinity varied much in consequence of geological changes, which must have greatly affected the flora. Its poverty in species is very marked when compared with the 255 species recorded from the western Baltic, which has long been united with the North Sea, as at present. The less salinity has prevented the immigration of some species; and is probably the cause of physical peculiarities in others, such as the slender forms and smaller size. The Danzig algal flora tends to be characteristic of brackish water rather than of the sea. Several species are of

markedly boreal aspect, though probably immigrants, at the close of the Ice age, by way of the North Sea, over the sunk portion of Sweden. The var. *arctica*, Harv., of *Sphacelaria racemosa*, Grev., is of peculiar interest near Danzig, as it now occurs elsewhere only in the Arctic seas and on the coast of Scotland, and is not known from the south-western part of Norway or from Sweden. A full enumeration of sources of information adds to the value of an excellent piece of work.

OUR BOOK SHELF.

The Soil. An Introduction to the Scientific Study of the Growth of Crops. Second edition, revised and enlarged. By A. D. Hall. Pp. xv+311. (London: John Murray, 1908.) Price 5*s*. net.

THE fact that a second edition of this book is necessary is a welcome evidence of the increased attention which is being paid to the study of the soil and also of the undoubted value of the work. This edition has evidently been most carefully revised in the light of modern investigation, and is an accurate record of existing knowledge on the soil considered from its mechanical, chemical, and biological aspects. Ten years ago we were almost entirely indebted to American or German workers for any scientific monograph on the soil, then only considered from its physical and chemical aspects, but in this work we have in addition a most valuable chapter on the functions of bacteria and fungi in the soil, in which a well balanced judgment is pronounced on certain recently much advertised work which has not yet received the sanction of scientific opinion or even a trustworthy confirmation of its accuracy by practical men.

Mr. Hall's book is not only for the scientific student of soil problems, who can, by the use of the bibliography in the appendix, become familiar with the most important research on the subject, but the practical man will find a very considerable portion of the book of interest and value to him, and the carefully reasoned conclusions will assure him of the reliability of the recommendations. The chapter on soil analysis shows the attempts which have been made to evolve an official method, and it is to be hoped, for the sake of those who often have to compare and argue from analyses made by different workers (in which the personal element must always be an important factor), that the methods which have been selected after most careful consideration may be generally adopted. Mr. Hall has a special faculty for drawing from the almost inexhaustible store of the Rothamsted treasure-house results which illustrate or emphasise his conclusions, and he has the rare quality of clothing figures and tables with interest. The mechanical effect of fertilisers on the flocculation of clay and the consequent alteration in texture are well illustrated by both Woburn and Rothamsted results, and the theory that the "saddening" effect of such fertilisers as nitrate of soda is due to the presence of common salt and to the hygroscopic character of the nitrate of soda is shown to be only true to a limited extent, the main cause being the deflocculation of the clay aggregates.

We would also commend this book to the attention of science masters in secondary schools, for much of its contents could, with senior students, be utilised both for direct instruction and also for exemplifying, in a substance with which everyone must be more or less acquainted, many of the laws of physical and chemical science. M. J. R. D.

The Stars of the Year. By H. P. H. Pp. 23. (London: King, Sell and Olding, Ltd., *Knowledge* Office.) Price 1*s*. net.

Star Calendar for 1909. Edited by H. P. H. (London: Hirschfeld Brothers, Ltd.; Glasgow: A. Stenhouse.) Price 1*s*. net.

The Star Almanack, 1909. By H. P. H. (London: King, Sell and Olding, Ltd., *Knowledge* Office.) Price 3*d*. net.

THE first of these three publications forms a useful handbook for those people who, unacquainted with the oldest of the sciences, take some kind of interest in the stars and other celestial phenomena. A brief introduction of five pages form a *hors d'oeuvre* calculated to whet the appetite for a more serious study of astronomy, and gives a few facts relating to the constellations, stars, meteors, comets, &c. Then follow twelve circular charts showing the arrangement of the constellations in the sky at 10 p.m. about the middle of each month. These charts have a blue background with white figuring, the zenith being placed at the centre, and they are very clearly printed. Beginners should find little difficulty in locating the various groupings after studying the current chart. It should be noted that on p. 8, where the constellations of the Zodiac are given, Aquarius is wrongly placed before Capricornus.

On the "Star Calendar," consisting of four cards tied together, the charts are so combined as to give the constellations for each quarter, whilst brief notes describe the positions of the planets. The calendar is of a convenient size (15″×12″), and, being printed in colour with the conventional representations of the zodiacal signs, forms quite a decorative wall-hanging.

In addition to the four quarterly charts, the "Star Almanack" contains a deal of useful information concerning the planets, standard times, comets, meteor showers, &c., also portraits of Sir William and Lady Huggins and a reproduction of Ritchey's Andromeda nebula photograph, whilst a drawing by Mr. T. E. Heath illustrates the conception of a limited universe, ellipsoidal in form. The almanack would, no doubt, prove interesting and instructive if prominently displayed in the class-rooms of elementary schools.

In the first few copies issued of both "The Stars of the Year" (p. 7), and "The Star Almanack," there occurred a slip which gave the earth's orbital velocity as its velocity of rotation. In the later issues the latter is given correctly, and the publishers offer to exchange uncorrected copies returned to them.

W. E. ROLSTON.

Diptera Danica. Genera and Species of Flies hitherto found in Denmark. By William Lundbeck. Part ii., Asilidæ, Bombyliidæ, Therevidæ, Scenopinidæ. With 48 figures. Published at the expense of the Carlsberg Fund. (Copenhagen: G. E. C. Gad; London: W. Wesley and Son, 1908.)

THIS useful and carefully written fauna commences with a lengthy account of the structure and habits of the interesting family Asilidæ, or robber-flies, as the American entomologists call them. The author is inclined to believe that the powerful beak with which they attack their prey carries a poisonous secretion, but this remains to be proved by further observations. The systematic portion of the work is well done, the subfamilies, genera, and species being tabulated as well as described. The figures represent details, such as the head, antenna, or wing of various species, and full information is given as regards structure, habits, larvæ, distribution in Denmark and elsewhere, &c. One of the largest and handsomest of the Asilidæ, in Britain and Denmark, is *Asilus crabroniformis*, which is remarkable for its black and

yellow colour, which gives it the distant resemblance to a hornet from which it derives its name, but this is confined to its colour, for the long, tapering Asilus differs altogether in shape from a hornet.

The species of the next family, Bombyliidæ, are stout and hairy, and those of the typical genus Bombylius have a remarkable resemblance to small Bombi (humble-bees), from which, however, the two wings and the long straight proboscis at once distinguish them. The two remaining families dealt with in this volume are of small extent, and perhaps of less interest than the two first. The Diptera are a somewhat neglected order of insect, but are more studied now than formerly, and we are sure that Prof. Lundbeck's work will be found very useful to English entomologists, for whose benefit it is written in their own language. The order Diptera is probably the largest of the seven great orders of insects except the Hymenoptera, and we wish Prof. Lundbeck long life that he may be able to complete the work which he has so well begun.

Moving Loads on Railway Underbridges, including diagrams of Bending Moments and Shearing Forces, and Tables of Equivalent Uniform Live Loads. By H. Bamford. Pp. iv+78. (London: Whittaker and Co., 1907.) Price 4*s.* 6*d.* net.

THIS is a reprint in book-form, with additions, of a series of articles which appeared in *Engineering* in the autumn of 1906. Those who have had any experience of such work will know how tedious is the process, as usually conducted, of determining the maximum straining actions on a railway girder supported at the ends, due to any given type of train load, and will appreciate the methods here given, which are characterised by directness, simplicity, and comparative brevity. The author uses analytical computation with systematic tabulation, and also, as an alternative method, graphical diagrams based on a clever adaptation of the ordinary bending and shearing force diagrams. By one or other of these methods, and especially the latter, the "equivalent" uniformly spread loads for both maximum bending moments and shearing forces are quickly and easily determined. The investigation is limited to the force actions on the bridge taken as a whole, and does not consider separately the resistances offered by the platform and main girders, but so far as the subject is dealt with the author is to be congratulated on having produced a most useful and practical work.

Practical Floor Malting. By Hugh Lancaster. Pp. iv+211; with numerous illustrations. (London: *The Brewing Trade Review*, 1908.) Price 12*s.* 6*d.* net.

CONSIDERING the economic importance of floor malting in this country, it is somewhat remarkable that no work on the subject possessing any claim to thoroughness has hitherto been published. We hoped to find that the present book filled the void, but although it is a useful addition to the literature of malting, it cannot in its present form be regarded as a complete technical treatise on the subject. The author is evidently thoroughly conversant with the practice of floor malting, but owing, presumably, to lack of literary experience, he has not done justice to his knowledge, and the book is marred by many signs of hasty writing. As it stands, however, the work is distinctly a useful one, and we have nothing but praise for the ten collotype plates it contains which illustrate the differences existing between the various types of barley employed in malting. These plates are of exceptional merit, and add very much to the value of the book from a technical point of view.

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.]*

Students' Physical Laboratories.

IF a protest is not made, I see some danger of the pioneer work done towards organising physical laboratory work for students in University and King's Colleges in London being inadvertently ignored, and everything of that kind attributed to Finsbury. Probably, indeed, the sound work unobtrusively done in early days is known to very few. Allow me to say, therefore, from personal knowledge, that students were admitted to physical laboratory work in these colleges before 1872—in one of them, I believe, in 1866—and that the course of quantitative laboratory instruction through which I was myself put by Prof. Carey Foster, in topographical circumstances of some difficulty, was of high value; and, indeed, reached a standard of accuracy not readily eclipsed in any students' laboratory with which I have since become acquainted.

To take a single instance, Carey Foster described his "bridge" method in 1872, and students were regularly familiarised with it. I remember also making a series of well-designed experiments on moments of inertia, on the kinetic torsion of wires, and on determinations of *g* by falling bodies and chronograph as well as by pendulums. We also used to measure E.M.F. by the potentiometer method, then called Poggendorff's; while other practical subjects were conduction of heat, rates of cooling, specific and latent heats, on the lines of Regnault; absolute density of liquids, by weighing in them a gauged ivory sphere, density of gases, &c.; a long series on magnetic moments and terrestrial magnetism in the light of Gauss's theory; the usual optical measurements and some less usual; Siemens's pyrometer (then under test for a British Association Committee); much work with a tangent galvanometer and resistance boxes—then comparatively new—on Ohm's and Joule's laws; measurements of electrochemical equivalents, &c., &c.; all before 1875. In one of the last-mentioned determinations a platinum basin was used and a weighable deposit obtained, very much on lines afterwards rendered secure and classical by Lord Rayleigh.

Indeed, I went through most of the things done in laboratories to-day which do not involve instruments of more recent date, and in 1875 we published a joint paper, "On the Flow of Electricity in a Plane," wherein the equipotential lines were plotted by an experimental method handier and more accurate than had been possible in previous observations of the kind—a method invented entirely by Carey Foster (see *Phil. Mag.*, December, 1875, §§ 47–50, with an incomplete continuation in 1876).

It is true that in those days attention was paid to the principles of pure physics rather than to technology; and undoubtedly, as technical work became prominent, other laboratories went far ahead in such subjects as the design of practical measuring instruments and in facilities for large-scale work.

But without suggesting for a moment that a word too much has been said in praise of the energetic pioneers in the field of practical work and electrical engineering, it will, I feel sure, be admitted that to say (as on p. 74) that before 1875 only five persons had experimented in electricity in Great Britain, that the Finsbury system was radically different from anything which previously existed, and that before 1879 professors had merely shown experiments at the lecture table, is to make statements which involve a considerable amount of exaggeration, and unintentionally misrepresent the facts.

I take it that the novelty at Finsbury chiefly lay in the permanent installation of a number of ingenious appliances, whereby a crowd of evening students could be put through a useful course of practical work, such as would give them some preliminary idea of measuring physical quantities, and infuse their otherwise abstract notions with something definite and concrete, without the necessity for periodical preparation and clearing away by an impracticably large assistant staff.

But since the students to be educated at Finsbury were largely of the higher artisan class, or at any rate were already familiar with machinery, perhaps I should rather put the matter conversely, and say that the object aimed at was to coax their already too material and concrete ideas towards something more generalised and abstract, by analysing into simplicity the complex machines with which many of them in their daily life had to deal, thus assisting them to grasp something of the theoretical physical principles underlying them all.

An admirable object, excellently carried out! Not a word have I to say towards minimising it: only do not let us minimise the work of others either.

November 21. OLIVER LODGE.

Apparent Decay of Radium.

I WISH to put on record an observation relating to the amount of "electrolytic gas" obtainable from a solution of radium bromide. Some four years ago, about 172 milligrams of radium salts, of which 152 were bromide and 10 sulphate, were enclosed in four small bulbs along with water, which dissolved the bromide, and in which the sulphate was suspended. These bulbs were sealed to a small Töpler pump, and for three years the mixed oxygen and hydrogen gases were pumped off at short intervals—about four days between two extractions. With the emanation accompanying this mixture various experiments were performed, an account of which has appeared in the Proceedings of the Royal Society and the Transactions of the Chemical Society.

In November, 1907, I received from the Vienna Academy what was supposed to be 0·5 gram of pure radium bromide; I was told that that was its weight in 1905. It weighed on receipt only 0·388 gram. This substance was washed into a bulb, and sealed to the pump, along with the other bulbs. The amount of gas collected from the larger quantity, however, did not appear to be proportional to its greater weight, and as analysis of a sample showed that it consisted largely of carbonate, insoluble in water, it was resolved to convert the carbonate into bromide by introducing into the bulb with a pipette some pure hydrobromic acid. (I may mention, parenthetically, that the small sample, converted into bromide, gained in weight to such an extent as to show that the original amount must have weighed 0·4971 gram, as $RdBr_2,2H_2O$.) The gas pumped off after this addition of hydrobromic acid contained much free bromine, but after a few weeks the evolution of bromine ceased, and "electrolytic gas" was produced to the amount of about 30 c.c. a week, always mixed with a small excess of hydrogen. This regular evolution continued from February until November 11. On that day the usual 30 c.c. of gas were pumped off; I have a note that "an unusually small quantity of hydrogen remained after explosion." On November 18 the gas was again pumped off; the quantity was approximately 13 c.c. Although it appeared unlikely that the tubes and taps should have been blocked, it was still possible. On November 25 the gas was again removed; its volume was about 1·5 c.c. At this stage air was admitted into the pump and the connected bulbs, and it was proved that there had been no stoppage. Advantage was taken of this to clean the pump and the connecting tubes, and to re-grease the stop-cocks. The air was then removed completely by pumping. To-day (November 30) the gas was again pumped off; its volume was about 0·5 c.c. It still exploded, and left about half its volume of excess hydrogen.

Two alternative suppositions suggest themselves:—either the radium bromide, of which the apparatus contains 0·5071 gram, implying 0·2716 gram of metallic radium, has practically ceased to decompose water (about 25 c.c. of solution are present in the bulbs), or the reverse reaction, viz. the velocity of combination of oxygen and hydrogen to form water, has increased to such an extent as to reverse the decomposition.

It has been assumed that the life-period of radium is very long, say 2000 years, although Mr. Cameron and I, by measuring what we believe to be the true volume of the emanation, arrived at a considerably shorter period. Here, however, appears to be, on the first alternative, a proof that one of the ways in which the radium expends at least a portion of its energy has been stopped. It would be interesting to know if the other ways, say the evolution of heat or the emission of "rays," are similarly affected by time. WILLIAM RAMSAY.

University College, November 30.

Production of Helium from Uranium.

IN a paper in the October number of the *Philosophical Magazine* of this year I gave a preliminary account of some attempts to detect and measure the production of helium from the primary radio-elements, on which I have been engaged since 1905. The results given were few, and referred mainly to the element thorium. The following further results, obtained since the publication of the paper, with the element uranium carry the subject a stage further. The method is described in detail in the paper referred to. By special arrangements the solutions of the substances employed can be freed absolutely from air, and maintained in this condition indefinitely. After any desired period of accumulation the gases can be completely expelled by boiling the solution in a stream of gas from a voltameter. The expelled gases are freed from water by cooling, and then subjected to the action of the vapour of calcium in a special vacuum furnace, whereby all but the inert gases are perfectly absorbed. After cooling the furnace is filled with mercury, and the residual gas, if any, compressed into the smallest possible spectrum tube of lead glass. The minimum quantity of helium detectable in a successful experiment has been found by repeated trial to be 2×10^{-10} gram. Blank tests with a similar apparatus containing sodium sulphate solution were performed, and I feel confident that the data obtained are trustworthy.

I have used two separate quantities of uranium nitrate. The first and smaller had been carefully purified by Mr. T. D. Mackenzie by extraction with ether. It contained 340 grams of the element uranium. When it became evident that the rate of production was too slow to be conveniently estimated with this quantity, a second experiment on a much larger scale was started. The cost of this and similar other large-scale experiments was defrayed by a research grant from the Carnegie trustees. Four kilograms of uranium nitrate of good commercial quality, which had been re-crystallised from water, were employed. It contained 1850 grams of uranium. The preparation of the experiment and complete removal of air were effected by August 15 of this year. The first test for helium was performed after a period of sixty-one days. Helium in several times the minimum quantity detectable by the method employed was proved to be present in the extracted gases. The second test was performed after a period of twenty-seven days. Helium was again present, this time in quantity not much, if any, greater than the minimum detectable. The next test was performed after twelve days. No helium could be detected, although the experiment was a singularly perfect one. An experiment was then performed with the smaller quantity of uranium after a period of accumulation of 128 days. Helium was clearly detected, and its quantity estimated to be not greater than 1·5 times the minimum quantity.

The production of helium from uranium may therefore be considered to be established. With regard to the rate of production, the experiments show that this cannot be far from $2\times10^{-12}(\text{year})^{-1}$. That is to say, about 2 milligrams of helium are formed per year per million kilograms of uranium. The second test referred to shows that the rate is not less than 1·5. The third test shows that it is less than 3·3. The last test with the smaller quantity shows that the rate is not less than 1·7, and probably not greater than 2·5. It is of interest to note that the theoretical rate of production I recently calculated from the disintegration theory is $2\times10^{-12}(\text{year})^{-1}$, on the assumption that one atom of uranium produced but one atom of helium. These measurements, therefore, lend no support to the view, discussed in the paper referred to, that uranium on disintegration expels two helium atoms.

I may mention that I have commenced the observation of a quantity of sylvine (potassium chloride), one of the minerals investigated by Strutt, and regarded by him as exceptional in containing helium which cannot be ascribed to known radio-active changes. The tests so far indicate that the rate of production of helium from this substance, if any, is below $2\cdot5\times10^{-12}(\text{year})^{-1}$.

University of Glasgow. FREDERICK SODDY.

An Annotated Copy of Newton's "Principia."

ON April 2 of this year (vol. lxxvii., p. 510) I contributed to your columns a short account of an interesting copy of the original edition of the above work, which I had purchased in Sydney from among a collection of old books that had remained packed up in cases for about 140 years, and had formed part of an English estate in Chancery. The most interesting feature of the book consists of several pages of manuscript corrections for a second edition, and numerous amendments of the mathematical diagrams throughout the book, which, according to a further note forming portion of the manuscript pages, were in the handwriting of Sir Isaac Newton himself.

The note in question referred to a manuscript work on "Optics," by Sir Isaac Newton, said to be deposited in the library of Trinity College, Cambridge, as affording an opportunity for comparison of the handwriting. I stated, further, in the letter referred to, that I had had the first two pages of the notes photographed, and had forwarded them to the librarian of Trinity College for the purpose of making such a comparison. Six months have now elapsed, and my inquiry has been followed by developments, some of which must afford interest to mathematical and astronomical students.

Within a few weeks of my communication with the librarian of Trinity College, that gentleman wrote to me to say that the manuscript volume of Newton's "Optics" was, as stated in the note referred to, lying in that library, but that it was in the handwriting of Dr. Roger Cotes, who had edited and supervised the printing of the second edition of the "Principia." He thought that the supposition that the handwriting in the notes was that of Newton was based on the belief that the manuscript "Optics" was in Newton's handwriting.

So the matter was left, when you forwarded to me a long and learned letter which had been sent to you by Dr. J. Bosscha, of Haarlem, in which (after reviewing my account of the volume and the manuscript notes) the following proposition is put forward and supported:—

"The copy now in the possession of Mr. Bruce Smith was indeed once owned by Newton. This illustrious author put it into the hands of 'his trusted suitor,' Nicolas Fatio de Duillier, who intended to publish the second edition of the 'Principia.'"

The letter in which this conclusion is made and supported is too long for quotation, but it enters into great detail with regard to the handwriting, expressing the opinion that the notes are written partly in Sir Isaac Newton's hand, and partly in that of Fatio.

A careful reference to the book shows that there are two distinct sets of corrections—one set being carefully noted and collected in the five blank pages at the beginning and end of the volume, the other set consisting of corrections in the margin of the text itself, and in the diagrams to which that text refers. The two sets of corrections certainly seem to have emanated from different minds, for those notes in the margins and diagrams are not referred to in the five pages of corrections, and those included in the five blank pages of the volume are not carried out in the text, suggesting, as Dr. Bosscha has conjectured, that one set had been prepared by one person, and the other by another. This fact is very suggestive of the double authorship of the notes, and of the authenticity of the volume, remembering that Dr. Bosscha has never seen the book, and depends upon historical records for his knowledge of the notes.

According to Dr. Bosscha, these corrections were well known, and formed the subject of correspondence between Fatio and Huygens, or Huyghens (the celebrated Dutch natural philosopher), in 1691, and Mr. Bosscha adds that Sir Isaac Newton adopted some of Fatio's corrections and rejected others, adding some more of his own.

These facts, sufficiently interesting by reason of Sir Isaac Newton's eminence and the epoch-making character of his work, seem to fit well with the character of the alterations in the volume in my possession, which, as I have said, Dr. Bosscha, of Haarlem, could never have seen.

BRUCE SMITH.

Parliament House, Melbourne.

The Semi-diurnal Barometric Oscillation.

WITH reference to the note in NATURE of November 12 (p. 47) upon the semi-diurnal pressure variation, it seems to me that the temperature variation is far more likely to be the result of the pressure variation than its cause. At all events, the pressure variation, however it may be produced, must of necessity lead to a temperature variation, but the converse of this proposition is by no means certain. It seems to be admitted that the atmosphere, as a whole, has a natural period of oscillation not differing greatly from twelve hours, and, that being so, a very trifling force with the same period will suffice to produce the observed phenomena. Is it possible that the earth may encounter sufficient resistance to motion in its orbit to provide this force? If we could assume the æther to act as a perfect fluid, we should have increased pressure at the front and back, using the term with regard to the direction of the orbital motion, and decreased pressure over the intermediate great circle. The direct pressure due to the resistance would have maxima at 6 a.m. and 6 p.m., whereas the barometric maxima occur about 10 a.m. and 10 p.m., but I do not think this is a serious objection.

W. H. DINES.

Watlington, Oxon, November 23.

The Fauna of the Magellan Region.

IN the very interesting review of the "Ergebnisse den Hamburger Magalhaensischen Sammelreise, 1892–3," in NATURE of November 19 (p. 82), the reviewer refers to "an interesting fresh discovery . . . of numerous brood pouches (ectodermic invaginations of the body wall) in *Condylactis georgiana*," an Antarctic actinian. I have not a copy of the report to hand, but, if I remember correctly, Carlgren here gives no figures of these "brood chambers," but describes them as of similar character to those he figured in a preliminary note on the occurrence of breeding chambers in actinians published in 1893, of specimens taken by the *Vega* expedition in Arctic seas.

Here he shows that each invagination, although at first affecting the ectoderm only, may be enlarged by the gradual growth of the embryo so as to involve all three layers of the body wall—ectoderm, mesoglœa, and endoderm. Since then I have described three other species from the *Southern Cross* and the *Discovery* Antarctic collections having "brood chambers" as distinct sacs projecting into the gastric cavity, formed by the invagination of all *three* layers of the body wall.

JOSEPH A. CLUBB.

Free Public Museums, Liverpool, November 23.

A Disclaimer.

IN NATURE of November 26 Mr. Soddy asserts, first, that his name as co-editor of *Ion* was made use of without his consent; secondly, that his first intimation of the appearance and of the contents of the journal was obtained from the advertisement in NATURE of November 12. These assertions contradict the actual facts of the case.

It is true that Mr. Soddy did not see the cover before publication; but that Mr. Soddy had not authorised the use of his name as co-editor does not tally with the fact that he made no objection to the wording of certain circulars sent him some time ago, the receipt of which he acknowledged in a letter of September 15. On these circulars he was expressly termed one of the editors. In a correspondence ranging over two months before the publication of *Ion*, Mr. Soddy wrote not a word against the wording of these circulars. Moreover, in his letter of September 25 he expressly desires that I should spare him as much of the editorial work as possible, as his time was limited. I thought I should be granting his request by not submitting to him the personal reports of prominent men of science, which, moreover, I, in my capacity as editor, should have included. I may take this opportunity of adding that Mr. Soddy never had any manner of participation in the journal. It will be evident that his secession will offer no hindrance to the continuance of the journal.

CHAS. H. WALTER

16 Heathfield Gardens, Turnham Green,
London, W., December 1.

TWO GIFT-BOOKS ON GEOLOGY.[1]

IT may be presumed that both these antedated works are intended for the Christmas season, and their print, illustrations, and binding make them highly attractive as gift-books for the young. Both, however, contain matter based on recent observation, and both will probably bring the results of research before many who have no acquaintance with scientific journals. There was a delightful book, entitled "The Wonders of the World," published somewhere about the time of the battle of Waterloo, which we used to read side by side with Brewster's "Natural Magic." It is more to the point to say that to this book Charles Darwin owed his earliest inspiration. Mr. Grew's far handsomer volume shows how far we have progressed in style and picturesqueness; but it depends equally on its fascinating appeal to what the earth is actually doing. Some of the examples of natural processes necessarily remain the same, but Lisbon and Calabria are now overshadowed by San Francisco and the Montagne Pelée. A fine series of photographic plates, mostly from Messrs. Underwood's well-known American series, has been chosen to illustrate the phenomena described. Extinct animals, mainly from Miss Woodward's skilful drawings, which were first published in Knipe's "From Nebula to Man," are used to emphasise the romance of palæontology.

Many of the chapters, such as viii., ix., x., xi., and xvi., are somewhat speculative for a work that seeks to convince the reader of the romance of ordinary things. In chapter xvi., on volcanoes and mountain formation, views are propounded that still require a great deal of thinking over, and in chapter xiv. we are not sure that the author distinguishes between volcanic accumulation and elevation of the ocean floor. Matters are clearer in the pages dealing with the long history of life upon the globe, though there is still a tendency to dwell on the uncertain rather than on the known. This is seen in the attempts to picture the geography of past geological periods; what evidence have we, for instance, for any of the statements on p. 211? Does the author really mean that Ben Nevis and the Pennine Chain, to mention two of the details, stood above the sea in late Silurian times?

The note of modernity struck in the second chapter by the introduction of the pear-shaped earth is maintained in the twenty-second chapter by the account of the rise of the proboscideans. The literary style is so direct and agreeable that few will open the book without wishing to read further, and some may be led on to borrow from a library the old classics of geology, which are less "modern," but on which we all are glad to build.

Mr. Scott Elliot's book follows aptly on that which narrates the building of the world. "The Romance of Early British Life" is cleverly written by means of a series of stories, in which the manners of successive peoples are rendered with the insight and humour of a Dutch *genre* painter, and yet with the sober references to authorities that befit a man of science. Such a book, cheerful and romantic as it is, has involved a wide extent of reading. Incidents and evidences are gathered from archæological journals, and appear quite naturally in their places as parts of a connected tale. This, like the sad fate of Bardolph, is in the true Shakespearean manner. We do not like the names, such as Eolithicus and O'Wookey, selected for primeval savages, but none of their real titles have come down to us. Mr. Jack London, whose modern seamen often realise the savage, has, of course, done far better in his vivid perception of the Stone age; we may all the more congratulate Mr. Scott Elliot on having given us an independent and convincing picture. On p. 29 he states that Eolithic man, whom he has shown as terribly individualistic, "nearly carried out, as only a society of squirrels and hedgehogs could do, the beautiful ideals of modern Socialism." This is indeed a puzzle, as is the equally unnecessary reference to the editors of radical newspapers on

Eruption of Mount Asama, Japan. From "The Romance of Modern Geology."

[1] "The Romance of Modern Geology: describing in Simple but Exact Language the Making of the Earth, with Some Account of Prehistoric Animal Life." By E. S. Grew. Pp. 308. (London: Seeley and Co., Ltd., 1909 [actually September, 1908.]) Price 5s.

"The Romance of Early British Life from the Earliest Times to the Coming of the Danes." By G. F. Scott Elliot. Pp. 358. (London: Seeley and Co., Ltd, 1909 [actually September, 1908.]) Price 5s.

p. 212. It requires a Charles Kingsley to carry such remarks off lightly. The Romans in Britain are shown in the usual colours, but we must remember that even the modern English are not loved as predominant partners and invaders. The Mediterranean race, however, here styled Picts, comes off fairly well, even when invading; but we fancy that too little credit is given to it for moulding the so-called Celtic modern Irishman.

The spirited illustrations, by Messrs. L. Speed and J. F. Campbell, will favourably attract the eyes of parents and guardians. The map of Britain opposite p. 226 contains too great a mixture of languages, and does not give a picture of any special epoch. This, however, can be remedied in school libraries, and we confess that we should like to conduct a class through Mr. Scott Elliot's volume, with the aid of a good atlas and a fortnight of excursions in the field. Those would indeed be happy days for all of us. G. A. J. C.

THE ARCHÆOLOGICAL SURVEY OF NUBIA.

THE objects of the archæological survey of Nubia which has been undertaken by the Government of Egypt are, first, to ascertain the extent and value of the historical material buried under the soil; secondly, to make this material available for the reconstruction of the early history of that country and of its relations with the Nile valley. There is reason to believe that in the pre-dynastic period Lower Nubia formed with Egypt a single region of culture, and possibly a single ethnological district. Later on the northern lands developed more rapidly, and Nubia failed to keep pace with Egypt. At any rate, when the Egyptians pushed southwards under the twelfth dynasty, some of the products of Nubian civilisation are found closely to resemble, in technique and material, products of the pre-dynastic age common to both countries. The present survey aims at reconstructing the culture development of some fifteen centuries of Nubian civilisation which at present are a blank.

The first and second Bulletins, recently issued, supply a preliminary account of investigations in the district which, owing to the re-modelling of the Aswan dam, will now be permanently submerged. This archæological material would, in default of such an inquiry, have been permanently lost to science.

The survey illustrates the variety of races and culture which prevails within this area. We have a succession of interments starting from the archaic period through post-Roman, Christian, and Moslem times. The extensive denudation which has occurred has exposed the burials of the earliest age. One group of later graves contains a number of male negro bodies, most of whom met their death by hanging or decapitation—doubtless the record of a tragedy which followed one of the local revolts so frequent during the Roman or Byzantine occupations of the country.

The survey of these cemeteries, conducted by Dr. G. A. Reisner, is supplemented by a very valuable anatomical report by Drs. Elliot Smith and F. Wood Jones, which illustrates the complexity of the ethnological materials now under detailed examination. From the earliest predynastic times down to the early dynastic, the whole region, according to Dr. Reisner, was characteristically Egyptian in culture; and the race occupying it is believed by Prof. Elliot Smith to be pure Egyptian. At a later period the population became isolated from Egyptian influence, and therefore assimilated Negroid elements. We find some contracted burials of the Egyptian predynastic period, corpses of pure and half-bred negroes, while the majority of the bodies examined conform to a quite different physical type, the origin of which we have to seek in Syria and the south-eastern shores of Europe. The remains are in most cases excellently preserved, being packed with salt and fruits of certain plants not yet identified, and then wrapped in coarse cloth. Some of these persons, even one who bore on his arm a wooden cross as the emblem of the Christian faith, had been circumcised. Other interments, again, appear from the anatomical evidence to represent family burial places, the structural identity of the occupants being remarkably apparent. In one case, that of a young woman, the cause of death was plainly appendicitis; in another, long-standing pleuritic adhesions, and in a third osteo-arthritis, so-called rheumatic gout, were identified. This is the disease which shows itself with the greatest frequency in the bodies of all periods. The older skulls show no signs of dental caries, except in the case of the "milk" teeth of three children, which is believed to be the first recorded occurrence of dental caries in an ancient Egyptian or Nubian under the age of sixteen; but this is common in the foreign Christian group. The discovery of a case of tuberculosis in the Biga cemetery is exceptionally interesting, the only other known early Egyptian instance of this disease being that of a corpse of an infant from the ancient Empire burying-ground at the Giza pyramids, which presented the typical lesion of advanced hip disease which may have been of the tubercular type. But this is not quite certain, because tubercle bacilli have not been as yet definitely traced, and Dr. A. R. Ferguson is disposed to doubt the diagnosis of tubercular lesions. The same is the case with syphilitic lesions. Dr. Elliot Smith has never observed a case in ancient Egyptian bones, and regards most of the instances hitherto reported as due to the post-mortem destruction of the bones by beetles. It is also remarkable that there is no occurrence of tattooing so common in modern times, nor of the custom of skin gashing, which is almost universal in Nubia and the Sudan at the present time.

The present Bulletin is intended merely to describe some of the facts which have been elicited in the course of a summary investigation of the great mass of ethnological material unearthed by Dr. Reisner. It will be followed by a detailed archæological and anatomical report, the appearance of which will be awaited with interest. Meanwhile the anatomical and craniometrical observations by Dr. Elliot Smith, and Dr. Wood Jones's pathological report, supply a large amount of fresh anthropological material.

The Government of Egypt deserves congratulations for the initiation of a most important survey, which will supply abundant materials from which the archæological and ethnological conditions of a hitherto unexplored region can be safely reconstructed.

HIMALAYAN PHYSIOGRAPHY.[1]

IN response to a proposal made in 1906 by the "Board of Scientific Advice" to the Survey of India that a paper should be compiled "summarising the geographical position of the Himalayas and Tibet" for the benefit of travellers in those regions, a series of papers on these parts has been issued which is not only of great scientific value in itself, but will surely answer the purpose of directing scien-

[1] "A Sketch of the Geography and Geology of the Himalayan Mountains and Tibet." By Col. S. G. Burrard, R.E., F.R.S., and H. H. Hayden. (Calcutta: Superintendent of Government Printing, 1907.) 3 Parts, price Rs. 2 each.

tific research towards the elucidation of many problems which beset the study of high altitudes.

The combination of authorship is sufficient indication of the recognition of the close intimacy which exists between geography and geology. The three parts now issued are generally geographical in their purpose; a fourth which is to follow is more strictly geological.

Part i. deals with the subject of Asiatic peaks, and is an admirable summary of existing knowledge about them. We have a most interesting series of notes on their altitude, constitution, names, distribution, and geology. "The determination of their position and heights is the first step on the ladder of geographical knowledge," says Col. Burrard, and the fundamental part which they play in the making of maps and in the evolution of a scientific conception of the configuration of mountain systems is well illustrated. In spite of the increase of local knowledge which must be the result of closer and more intimate exploration, every geographer will agree with Col. Burrard's appeal for the retention of well-known names with no unnecessary and pedantic changes of spelling, or constant correction of altitudes, in our maps. As regards the altitudes, however, it might be well to consider whether the figures finally adopted might not be reduced to round numbers. All the difficulties attending the determination of great altitudes are touched upon by Col. Burrard, and when we consider the errors which may arise from a wrong estimation of corrections due to refraction; from local deflection of the level; from the varying depths of snow overlying the peak; or even from that elusive quantity, mean sea-level; we may fairly ask whether we are justified in crystallising the height of Mount Everest, for instance, at 29,003 feet instead of rendering it in terms (so much easier to remember) of 29,000. K_2 at 28,250 is satisfactory, but Kinchinjunga at 28,146 would surely be better at 28,150. A strict adherence to the mean value deduced from all observations taken is no doubt necessary as an official record, but its introduction into the ordinary map does certainly tend towards a false impression of minute accuracy.

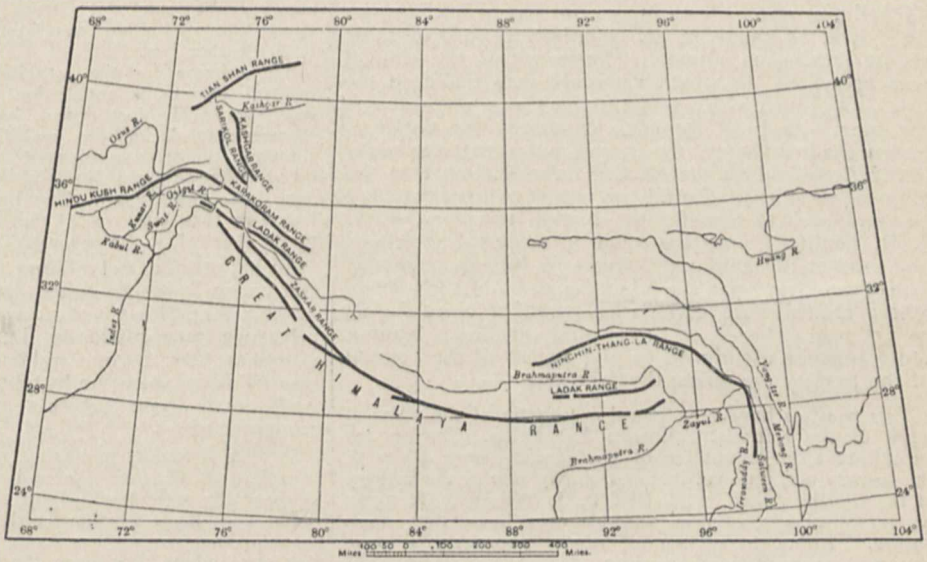

Chart to illustrate how the Great Himalaya range terminates first at the Indus, and secondly at the Brahmaputra.

Part ii. deals with mountain ranges and their conformation, and in this part we think that the geographical element has been too much subordinated to geology. Col. Burrard's theories of the original formation of the gigantic uplands and hills of Asia is beyond criticism. They have long been accepted as the fundamental explanation of mountain structure, and we welcome with thankfulness a plain and simple statement of those general principles which govern the relationship between water partings and ranges; by which mountain folds have been arranged in orderly lines, determining the main features of any great system—only to be cut to pieces and re-shaped into what appears to be haphazard irregularity by denudation and river action. But the geographer can hardly treat these latter phases of mountain construction with such scant respect as the geologist. Like the map-maker, who first defines all his river courses and then fills in the mountains between, he maintains that it is the river and valley which is of paramount economic importance; and if two rivers between them carve out a range in a direction absolutely transverse to the original tectonic folds, that such a range for all practical purposes may be vastly more important than the battered, undermined, and disintegrated granite core which formed the axis of the primeval fold, but which is now only to be recognised by the magnificence of its detached (but duly aligned) groups of gigantic peaks. To put it shortly, Col. Burrard maintains that inasmuch as the groups of highest peaks which follow an orderly curve through the length of the Himalaya indicate the main range of the system, this fact should be emphasised in topographical maps rather than main water partings or river systems. Scientifically, doubtless, this may be correct, but the travelling public for whom maps are made will, we fear, still fail to see with the eye of scientific faith, and will continue to believe the outward and visible evidence that these peaks are on spurs emanating from a main water-parting.

There is also great difficulty in determining the exact position of some of these great structural folds. Col. Burrard has apparently encountered this difficulty, for the letterpress at p. 123, part iii. (dealing with river systems), hardly tallies with Fig. 2 of chart xxi. in part ii. Assuming that Col. Burrard includes the Ghorband drainage with that of the Panjshir in the former (which we must do), the southern ridge, or fold, of the Hindu Kush trough gets mixed up with the continuation of the "Kailas" fold as depicted in the latter. Nor can we accept the statement as altogether proven that the Hari Rud valley represents a primeval tectonic trough and not the result of subsequent erosion. Col. Talbot (who surveyed the valley) believed it to be the latter, and there is certainly no trace of a crystalline core to the ranges north and south of the Hari Rud. It is not altogether out of place to note that the assumption of a double range for the Hindu Kush may lead to serious political complications. If this double range exists, what becomes of our boundary (at present

undemarcated except by nature) with Afghanistan? It is defined by the main water parting of the Hindu Kush. Which is to be the main water parting?

One more small criticism must be permitted ere we close a sketchy notice of a work so valuable as to require serious and well-considered analysis. The use of a publication of this sort to the ordinary traveller is largely limited by its portability. In its present form it would hardly serve the purpose of the mountaineer, who must before all things consider size, weight, and general handiness; and yet it is specially written for the mountaineer. Most of the illustrations (which probably govern the size of the issue) could be reduced to one-quarter their present size, and the rest could be folded in a separate pocket. It is much to be hoped that this treatise will have a wide circulation, but there is too much of the regular official "Survey of India" type of publication about it for general use in its present form. T. H. H.

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held as usual on St. Andrew's Day, November 30, at Burlington House. The report of the council was presented, in which reference was made to the chief subjects to which attention had been given during the year. As Lord Rayleigh expressed the desire to resign the presidency, the council submitted the name of Sir Archibald Geikie, K.C.B., for election into the office of president. To fill the vacancy thus created it was proposed to transfer the foreign secretary, Prof. J. R. Bradford, into the office of principal secretary, and to elect Sir William Crookes as foreign secretary. The officers, and also the other members of the council whose names were given in NATURE of November 5 (p. 15), were elected at the annual meeting. Among other matters mentioned in the report of the council of the Society we notice the following :—

Two volumes have been issued descriptive of the physical work of the National Antarctic Expedition. During the expedition a large number of photographs were taken of the scenery and physical features, partly also of the biology of the regions visited, while Mr. E. A. Wilson made many careful drawings of the various coast-lines that were passed. Although certain of these photographs have already been reproduced in some of the reports and other works descriptive of the expedition, it was decided to publish an ample and thoroughly illustrative series of both the photographs and the sketches, accompanied with maps which should show the precise position of each spot from which a panoramic photograph or sketch had been taken. Future explorers will thus be helped to note any changes which may affect the snow-fields, glaciers, ice-barriers, or other features, while the general public will be put in possession of a remarkably striking series of views of Antarctic scenery and life. Accordingly, an Antarctic album and portfolio have been prepared by Mr. Wilson under the supervision of the committee, and are now nearly ready for publication.

Within the last few weeks Dr. Mond has directed the attention of the officers of the society to the desirability of further acceleration of the catalogue of scientific papers. As the result of conferences with the officers and the director of the catalogue, he has undertaken to increase his previous generous subventions by a sum of 2000*l.* on condition that the society fall in with his suggestion that additional expert assistance be employed to deal with the arrangement of the material for the subject indexes, and an effort be thus made to finish the index volumes for mechanics, physics, and chemistry within two or three years.

In April a letter was received from the Home Office on the subject of the disease known as glass-workers' cataract, inquiring whether elucidation of the cause of the disease and its remedy, in the light of the physical and physiological problems involved, could be made the subject of an inquiry by a committee of the Royal Society. After full consideration the council appointed a committee to inquire into and report on this subject.

Changes have been made in the regulations as to grants for scientific investigations. In order that applicants may be informed earlier in the year of the decisions of the Government Grant Committee with regard to grants, the regulations now provide that applications shall be received not later than January 1, and it is therefore hoped that it may be possible for the general committee to meet at some time before the end of March instead of in May.

In 1870 the society placed in the hands of Sir William Huggins, on loan, an equatorial mounting and twin telescopes, purchased by means of the Oliveira bequest, which was to be expended on a telescope. As was announced in last week's NATURE (p. 114), Sir William Huggins is unable now to make such use of the instruments as would justify him in retaining them. A new home for the instruments has been found, therefore, at the University of Cambridge.

At the end of last year a letter was received from the Colonial Office asking the society to advise in detail as to means for carrying out the further researches recommended by the tropical diseases committee, as specified in the last report to the council. At the invitation of the committee Colonel Sir David Bruce has undertaken the supervision of further investigations in Uganda, and sailed in September last.

The scheme for the establishment of an International Central Bureau in connection with sleeping sickness, referred to in the last report, having fallen through, H.M. Government decided to establish a National Bureau in London, to be administered on similar lines, the cost being defrayed from Imperial funds, including a contribution from the Sudan. The bureau was definitely established in June last, one of the society's rooms being placed at its disposal at the request of the Colonial Office.

In his presidential address Lord Rayleigh referred to the heavy losses by death sustained by the Society among its fellows and foreign members. Particular reference was made to Lord Kelvin, Sir Richard Strachey, Dr. Sorby, and Sir John Evans as having passed away since the last anniversary meeting. These and other main subjects of the address are here summarised :—

We are fortunate in having secured for our Proceedings a review of Kelvin's life and work, written by one who is especially well qualified for the difficult task. I do not doubt that Prof. Larmor is right in placing in the forefront of that work those fundamental advances in thermodynamics which date from the middle of the last century. It was Kelvin who first grasped the full scope of the principle known as the second law, a law which may indeed well be considered to stand first in order of importance, regarded from the point of view of man's needs and opportunities.

My acquaintance with Kelvin was limited, until about 1880, a time when I was occupied with measurements relating to the electrical units, and received much appreciated encouragement. From then onwards until his death I enjoyed the privilege of intimacy and, needless to say, profited continually from his conversation, as I had done before from his writings.

Dr. Sorby belonged to a class on whom England has special reason to congratulate herself, men who pursue science unprofessionally. The names of Cavendish, Young, Joule, and Darwin at once suggest themselves. It is to be feared that specialisation and the increasing cost and complication of experimental appliances are having a prejudicial effect in this regard. On the other hand, the amateur is not without advantages which compensate to some extent. Certainly, no one who has the root of the matter in him should be deterred by fears of such difficulties, and the example of Sorby suffices to show how much is open to ingenuity unaided by elaborate appliances.

On the foreign list also the losses are heavy. We have especially to condole with our colleagues in France upon the havoc caused by death within the last year or two. Janssen and Mascart, who was much missed at the recent

Electrical Conference, had reached a full age; but Becquerel was in the full tide of life, and we had hoped to learn much more from him. As the discoverer of radio-activity, he had opened up inquiries the significance of which seems ever on the increase. Science has lost a leader; his friends and the world a charming personality.

During the time that I was secretary, and so concerned with the passing of mathematical papers through the press, I was much struck with the carelessness of authors in the arrangement of their manuscript. It is frequently forgotten that a line of print in the Transactions and in the new form of the Proceedings will hold much more than a line of ordinary manuscript, unless, indeed, the handwriting is exceptionally small. Unless the authors' indications were supplemented, it frequently occurred that several lines of print were occupied by what might equally well, and in my judgment much better, be contained in one line. Even practised writers would do well, when they regard their manuscript as complete so far as regards matter and phrasing, to go over it again entirely from the point of view of the printing. In this way much expense and space would be spared, and the appearance of the printed page improved.

Apart from questions of printing, the choice of symbols for representing mathematical and physical quantities is of some importance, and is embarrassed by varying usages, especially in different countries. A committee now sitting is concerned with the selection of symbols for electrical and magnetic quantities, but the question is really much wider. One hesitates to suggest another international conference, and perhaps something could be done by discussion in scientific newspapers. Obviously some give and take would be necessary. When the arguments from convenience are about balanced, appeal might be made to the authority of distinguished men, especially of those who were pioneers in the definition and use of the quantity to be represented. As an example of the difficulties to be faced, I may instance the important case of a symbol for refractive index. In English writings the symbol is usually μ, and on the Continent n. By the early optical writers it would seem that no particular symbol was appropriated. in 1815 (Phil. Trans., 1815) Brewster has m. The earliest use of μ that I have come across is by Sir John Herschel (Phil. Trans., 1821, p. 230), and the same symbol was used by Coddington (1829) and by Hamilton (1830), both distinguished workers in optics. On the other hand, n was employed by Fraunhofer (1815), and his authority must be reckoned very high. As regards convenience, I should suppose that the balance of advantage would incline to μ, since n is wanted so frequently in other senses. Another case in which there may be difficulties in obtaining a much-to-be-desired uniformity is the symbol for electrical resistance.

On a former occasion I indulged in comment upon the tendency of some recent mathematics, which were doubtless understood as the mild grumbling of an elderly man who does not like to see himself left too far behind. In the same spirit I am inclined to complain of what seem unnecessary changes in mathematical nomenclature. In my youth, by a natural extension of a long-established usage relative to equations, we spoke of the *roots* of a function, meaning thereby those values of the argument which cause the *function* to vanish. In many modern writings I read of the *zeroes* of a function in the same sense. There may be reasons for this change; but the new expression seems to need precaution in its use, otherwise we are led to such flowers of speech as "zeroes with real part positive," which I recently came across (Proc. Math. Soc., vol. xxxi., p. 266). But though I may use a little my privilege of grumbling over details, I hope I shall not be misunderstood as undervaluing the progress made in recent years, which, indeed, seems to me to be very remarkable and satisfactory, regarded from the scientific point of view. On the other hand, I cannot help feeling misgivings as to the suitability of the highly specialised mathematics of the present day for a general intellectual training, and I hope that a careful watch may be maintained to check, in good time, any evil tendencies that may become apparent.

Among the notable advances of the present year is the liquefaction of helium by Prof. Onnes, of Leyden. It is but a few years since Sir J. Dewar opened up a new field of temperature by his liquefaction of hydrogen, and now a further extension is made which, if reckoned merely in difference of temperature, may appear inconsiderable, but seen from the proper thermodynamical standpoint is recognised to be far-reaching. The exploration of this new field can hardly fail to afford valuable guidance for our ideas concerning the general properties and constitution of matter. Prof. Onnes's success is the reward of labours well directed and protracted over many years.

The discovery and application by Rutherford and Geiger of an electrical method of counting the number of α particles from radio-active substances constitutes an important step, and one that appears to afford better determinations than hitherto of various fundamental quantities. It would be of interest to learn what interpretation is put upon these results by those who still desire to regard matter as homogeneous.

Another very interesting observation published during the year is that of Hale upon the Zeeman effect in sunspots, tending to show that the spots are fields of intense magnetic force. Anything which promises a clue as to the nature of these mysterious peculiarities of the solar surface is especially welcome. Until we understand better than we do these solar processes, on which our very existence depends, we may do well to cultivate a humbler frame of mind than that indulged in by some of our colleagues.

A theoretical question of importance is raised by the observations of Nordmann and Tikhoff showing a small chromatic displacement of the phase of minimum brightness in the case of certain variable stars. The absence of such an effect has been hitherto the principal argument on the experimental side for assuming a velocity of propagation in vacuum independent of frequency or wave-length. The tendency of the observations would be to suggest a dispersion in the same direction as in ordinary matter, but of almost infinitesimal amount, in view of the immense distances over which the propagation takes place. Lebedew has pointed out that this conclusion may be evaded by assuming an asymmetry involving colour in the process by which the variability is brought about, and he remarks that although the dispersions indicated by Nordmann and Tikhoff are in the same direction, the amounts calculated from the best available values of the parallaxes differ in the ratio of 30 to 1. In view of this discrepancy and of the extreme minuteness of the dispersion that would be indicated, the probabilities seem at the moment to lie on the side of Lebedew's explanation; doubtless further facts will be available in the near future.

I cannot abstain from including in the achievements of the year the remarkable successes in mechanical flight attained by the brothers Wright, although the interest is rather social and practical than purely scientific. For many years, in fact ever since I became acquainted with the work of Penaud and Wenham, I have leaned to the opinion that flight was possible as a *feat*. This question is now settled, and the tendency may perhaps be to jump too quickly to the conclusion that what can be done as a feat will soon be possible for the purposes of daily life. But there is a very large gap to be bridged over; and the argument urged by Prof. Newcomb, and based on the principle of dynamical similarity, that the difficulties must increase with the scale of the machines, goes far to preclude the idea that regular ocean service will be conducted by flying machines rather than by ships; but, as the history of science and invention abundantly proves, it is rash to set limits. For special purposes, such as exploration, we may expect to see flying machines in use before many years have passed.

The report of the National Physical Laboratory for the year again indicates remarkable growth. The various new buildings, which have been erected and equipped during recent years at a cost of about 33,000*l*., are now occupied, and the result is that both researches and test work can be carried out with much greater ease and efficiency than previously. The buildings of the magnetic observatory at Eskdalemuir are now occupied, but, unfortunately, difficulty has arisen in making the magnetograph rooms, which are underground, completely water-tight, and the recording apparatus is not yet properly installed.

The progress of the "Royal Society Catalogue of Scien-

tific Papers" has advanced a definite stage during the year through the publication, by the Cambridge University Press, of the index volume of pure mathematics for the nineteenth century. Owing to the magnitude of the material to be indexed in the several sciences, it has been necessary to adopt drastic measures of compression, and the 40,000 entries involved in the present section have thus been condensed into one royal octavo volume of some 700 pages.

Through the kindness of Dr. Schuster I had the opportunity of submitting to the council, before the expiry of my term of office, a generous proposal which he makes for instituting a fund of 1500*l*., the interest of which is to be applied to pay the travelling expenses of delegates of the society to the International Association of Academies. Dr. Schuster felt that the absence of such a provision laid a burden upon delegates, and might operate to limit the choice of the society. I was empowered by the council to convey their cordial thanks to Dr. Schuster, and I have now the pleasure of making his benefaction known to the society at large.

MEDALLISTS, 1908.

COPLEY MEDAL.

The Copley medal is awarded to Dr. Alfred Russel Wallace, F.R.S.

It is now sixty years since this distinguished naturalist began his scientific career. During this long period he has been unceasingly active in the prosecution of natural-history studies. So far back as 1848 he accompanied the late Henry Walter Bates to the region of the Amazon, and remained four years there, greatly enriching zoology and botany, and laying at the same time the basis of that wide range of biological acquirement by which all his writings have been characterised. From South America he passed to the Malay Archipelago, and spent there some eight fruitful years. It was during his stay in that region that he matured those broad views regarding the geographical distribution of plants and animals which on his return to this country he was able to elaborate in his well-known classic volumes on that subject. It was there, too, amid the problems presented by the infinite variety of tropical life, that he independently conceived the idea of the theory of the origin of species by natural selection which Charles Darwin had already been working out for years before. His claims to the admiration of all men of science were recognised by the Royal Society forty years ago, when, in 1868, a Royal medal was awarded to him. Again, when in 1890 the Darwin medal was founded, he was chosen as its first recipient.

RUMFORD MEDAL.

The Rumford medal is awarded to Prof. Hendrik Antoon Lorentz, For.Mem.R.S.

Prof. Hendrik Antoon Lorentz, of Leyden, has been distinguished during the last quarter of a century by his fundamental investigations in the principles of the theory of radiation, especially in its electric aspect. His earliest memoirs were concerned with the molecular equivalents which obtain in the refractive (and dispersive) powers of different substances; in them he arrived at formulæ that still remain the accepted mode of theoretical formulation of these phenomena. The main result, that

$$(\mu^2-1)/(\mu^2+2)$$

is proportional jointly to the density of distribution of the molecules, and to a function of the molecular free periods and the period of the radiation in question, rests essentially only on the idea of propagation in some type of elastic medium; and thus it was reached simultaneously, along different special lines, by H. A. Lorentz originally from Helmholtz's form of Maxwell's electric theory, and by L. Lorenz, of Copenhagen, from a general idea of propagation after the manner of elastic solids.

The other advance in physical science with which Prof. Lorentz's name is most closely associated is one of greater precision, the molecular development of Maxwell's theory of electrodynamics.

ROYAL MEDALS.

A Royal medal is awarded to Prof. John Milne, F.R.S., for his work on seismology. In 1875 Dr. Milne accepted the position of professor at Tokyo, which was offered to him by the Imperial Government of Japan. His attention was almost immediately attracted to the study of earthquakes, and he was led to design new forms of construction for buildings and engineering structures with the view of resisting the destructive effects of shocks. His suggestions have been largely adopted, and his designs have been very successful for the end in view. Incidentally, he studied the vibrations of locomotives, and showed how to obtain a more exact balancing of the moving parts, and thus to secure smoother running and a saving of fuel. Here again his suggestions were accepted, and his work was recognised by the Institution of Civil Engineers.

He next devoted himself to the study of artificial shocks produced by the explosion of dynamite in borings. He then studied actual shocks as observed at nine stations connected by telegraph wires. A seismic study of Tokyo, and subsequently of the whole of northern Japan, followed. In this latter work he relied on reports from fifty stations. The Government then took up the matter, increased his fifty stations to nearly 1000, and founded a chair of seismology for Mr. Milne. On his return to England in 1895 he succeeded in obtaining international cooperation, and reports are now received by him from some 200 stations furnished with trustworthy instruments, and scattered all over the world.

The work of Dr. Henry Head, on which is founded the award of the other Royal medal, forms a connected series of researches on the nervous system (made partly in conjunction with Campbell, Rivers, Sherren, and Thompson), published for the most part in *Brain* at various times since 1893 up to the present date, and constituting one of the most original and important contributions to neurological science of recent times.

His first paper ("Disturbances of Sensation with Special Reference to the Pain of Visceral Disease," 1893), founded on minute and laborious clinical investigation, established in a more precise manner than had hitherto been done the relations between the somatic and visceral systems of nerves. He confirmed from the clinical side the experimental researches of Sherrington on the distribution of the posterior roots of the spinal nerves.

DAVY MEDAL.

The Davy medal is awarded to Prof. William Augustus Tilden, F.R.S.

The researches of Prof. Tilden extend into many domains. His recent work on the specific heats of the elements in relation to their atomic weights, described to the society in the Bakerian lecture for 1900, and in two later papers published also in the Philosophical Transactions, is of high theoretical importance. The employment of liquid oxygen as an ordinary laboratory reagent, rendered possible by the researches of Dewar and others, has enabled Prof. Tilden to test the validity of Dulong and Petit's law and of Neumann's law over a much wider range of temperature than was possible before, and to give a truer estimate of the range of their validity.

In the region of organic chemistry he has carried out important researches on the terpenes, such as that on the hydrocarbons from *Pinus sylvestris*, on terpin and terpinol, and on limettin. In inorganic chemistry, his investigations on *aqua regia* and on nitrosyl chloride are especially noteworthy.

DARWIN MEDAL.

The Darwin medal is awarded to Prof. August Weismann for his contributions to the study of evolution. He was one of the early supporters of the doctrine of evolution by means of natural selection, and wrote in support of the Darwinian theory in 1868. His great series of publications from that date onward must always remain a monument of patient inquiry. In forming an estimate of his work, it does not seem essential that we should decide on the admissibility of his germ-plasm theory. It is in like manner unimportant that he was, in certain respects, forestalled by Galton, and that his own views have undergone changes. The fact remains that he has

done more than any other man to focus scientific attention on the mechanism of inheritance.

HUGHES MEDAL.

The Hughes medal is awarded to Prof. Eugen Goldstein. Prof. Goldstein was one of the early workers on the modern detailed investigation of the electric discharge in rarefied gases, and by long-continued researches has contributed substantially to the systematic analysis of the complex actions presenting themselves in that field. Of these researches may be mentioned his observations of the effect of magnetic force on striations, of the phosphorescence produced by the kathode rays, and of the reflection of kathode rays.

By his discovery of the so-called Kanalstrahlen, or positive rays, he has detected an essential feature of the phenomenon, which, in his own hands and in those of other workers, has already thrown much needed light on the atomic transformations that are involved.

THE PAST AND PRESENT OF THE ROYAL SOCIETY.

At the anniversary dinner, held at the Hôtel Métropole on Monday evening, Sir Archibald Geikie presided, and a distinguished company of fellows and their guests assembled together.

Prof. Lorentz, in proposing the toast of "The Royal Society," said he availed himself of the opportunity for saying a few words about the Royal Society, the time-honoured and world-renowned institution which for two centuries and a half had pursued with untiring energy the object for which it was founded—the improvement of natural knowledge. Surely there were few things so wonderful as that society, originating in a small club of persons who met weekly in the most simple manner for the discussion of philosophical inquiries, and grown by its own force, unaided by the State, as other academies usually were, to a mighty body which extended its influence all over the globe, and the annals of which showed a long list of the very first and most illustrious of natural philosophers, from Boyle and Newton to Charles Darwin and Lord Kelvin. The most striking feature in their long history was, perhaps, the unbroken continuity between the past and the present, between the modest beginnings and the glorious onward career, a continuity that was perspicuous, not only in the constancy of their true and high scientific spirit, but also, he thought, in the outward form. The collected works of Huygens, now being published, contained about 3000 letters, and many of them were directed to or received from members of their society, the chief correspondents at the time of which he was now speaking being Moray, the first secretary, Oldenburg, and eventually their first president, Lord Brouncker. Among the subjects treated in these letters there were some very proper for illustrating the continuity of which he had spoken. For instance, Lord Brouncker devoted much of his time to pendulum experiments for the purpose of finding a universal and natural unit of length. He was careful about the material of which the pendulum should be made. It ought, he thought, to be of good silver. In these days they had seen Sir J. J. Thomson experimenting with a pendulum which consisted of much more valuable material, namely, radium, though not, of course, made entirely of radium. So in those early days they could notice a feature that seemed to him to be characteristic of British physical science, the invention of mechanical models for the purpose of illustrating natural phenomena, a method that had borne such splendid fruits in the hands of Faraday, Lord Kelvin, Maxwell, and their successors.

In responding to the toast of "The Royal Society," the newly elected president, Sir Archibald Geikie, spoke as follows:—

It is not without interest on an occasion like the present to look back for a little at the first beginnings of such an institution as the Royal Society, and to compare and contrast its present condition with that of its infancy. In the middle of the seventeenth century, amidst the first impetus given by the writings of Francis Bacon, a small company of enthusiasts for what was called the "New Philosophy," including such men as Robert Boyle, Robert Hooke, William Petty, John Evelyn, and Henry Oldenburg, met together in London, mainly for the purpose of making experiments and discussing with each other the lessons to be drawn therefrom. This select company, which some of its members knew by the name of "The Invisible College," eventually gained the sympathetic notice of Charles II. He incorporated and named them "The Royal Society," and such was his interest in their welfare that he was induced to grant them no less than three charters in the course of seven years. He is said to have suggested to them various subjects for experiment, but there is good evidence that, with his keen sense of humour, he liked sometimes to make fun of them. Pepys tells how, a few months after the society had received its first charter, the King "mightily laughed at them for spending time in weighing of ayre and doing nothing else since they sat." The Royal example was followed with less good nature by poets such as Butler, who satirised the young society; but the philosophers outlived the sarcasm. That they were in most serious earnest in their experimental inquiries was shown by their appointing and subsidising some of their number as "curators of experiments," whose duty it was to prepare experiments which were exhibited and discussed at their weekly meetings. These experimental demonstrations and the discussions arising from them, rather than the reading of set papers, were the characteristic feature of the earliest meetings of the society.

In those days the range of natural knowledge was comparatively limited, so that a fairly complete acquaintance with all its fields was not beyond the compass of any man of average intelligence and industry; but as this range widened and the boundaries of the several branches of science extended, it became in the course of years increasingly difficult to follow the original experimental arrangements for the meetings. Fully equipped laboratories had to be created outside the Royal Society, where long and intricate series of connected experiments and investigations could be carried on in the domains of physics and chemistry, and ultimately also of biology. Hence by degrees papers descriptive of these researches supplanted at the society's meetings the older practical demonstrations of the processes of experiment, and came to be, as they are now, the recognised form in which advances in science are laid before the society.

The reading of these papers, or abstracts of them, the careful consideration of them by specially appointed committees, and the ultimate publication of such of them as are approved in the Proceedings or Philosophical Transactions, form the main part of the scientific work of the Royal Society at the present time. We can point with not unjustifiable pride to our long series of published volumes as a memorable record of the advance of all branches of natural science during nearly 250 years, and of the share which the society has had in furthering this progress.

But the meetings, discussions, and publications form only a portion of the ordinary business of the Royal Society. I think it is not generally known how much additional work the society is now called upon to undertake. The confidence felt by Parliament, the Government, and the country at large in the society's capacity and judgment is shown by the multifarious tasks which have been entrusted to it, outside of what might well be regarded as its more legitimate sphere of operations. Thus it nominates a representative to the governing body of each of the great public schools, who is specially charged to watch over the interests of science in the general curriculum of instruction. It has a voice in the election of some of the scientific chairs in the two older universities. It administers the annual Parliamentary grant of 4000*l*. for the furtherance of scientific investigations. It has been entrusted with the control and supervision of the National Physical Laboratory. It takes a large share in the visitation and direction of Greenwich Observatory. It nominates nearly one-half of the Lawes trust, which has rendered such important services to the scientific development of agriculture.

Over and above these standing engagements, if one may so call them, the Royal Society is not infrequently consulted by the various public departments of the country in regard to questions wherein expert scientific knowledge

is required. In recent years these applications have had more special reference to the nature and origin of various diseases in our colonies and stations abroad, and the best means to be adopted for coping with them. As an illustration of this side of the society's activity, I may refer to our late inquiry into Malta fever—a disease which for many years so seriously disabled our naval and military establishments in the Mediterranean basin. This investigation was undertaken at the joint request of the Admiralty, War Office, and Colonial Office. Within a few months we were fortunate in discovering the source of the malady, and were able to point out the precautions to be taken in dealing with the fever. The satisfactory result has been attained of almost entirely banishing the disease from the hospitals of Malta. A more difficult and prolonged inquiry has been in progress for some years into the terrible evil of sleeping sickness. The commission sent out to Central Africa by the Royal Society soon ascertained the immediate cause of the malady, but although the investigation has been prosecuted in various directions, no certain cure or preventive has yet been found. A few weeks ago our eminent and intrepid colleague Sir David Bruce, taking with him two officers of the Army Medical Department, returned to Uganda to renew his inquiries on the spot. We have also a committee at work in London endeavouring to discover a drug that may be effectual in the treatment of trypanosome diseases. We sincerely hope that the various efforts now in vigorous operation may be ultimately successful, and thus that in wide tracts of Central Africa which have been so grievously depopulated, this fatal scourge, if not wholly exterminated, may at least be reduced alike in its area of distribution and in the seriousness of its effects. I may add that the Colonial Office recently established a national bureau for the purpose of collecting and disseminating information from all quarters regarding sleeping sickness, and that the Royal Society, at the request of that public department, has been glad to provide for the bureau such office accommodation as the limited space at Burlington House will permit.

Ever since the year 1662 the Royal Society has met on St. Andrew's Day for the purpose of electing its council and officers. This important annual function has been discharged this afternoon, with the result which is before you. The whole body of fellows must sincerely regret that our recent president, Lord Rayleigh, felt himself unable to serve the full period of his tenure of the office. We are all grateful to him for the care and attention which he constantly gave to the business, alike at the meetings of council and at those of the society, over which he presided with unfailing tact and dignity. We trust that he will return from South Africa re-invigorated for the resumption of those studies which, while placing him in the first rank of leaders in science, have reflected so much lustre on the Royal Society. The vacancy in the secretaryship has been filled by the election of Prof. Rose Bradford. Having already served for one year as foreign secretary, he has gained experience in the details of the business of the society, and he assumes his new duties with the heartiest good wishes of his brother-officers and, I am confident, also of the general body of the fellows. In our new foreign secretary, Sir William Crookes, we have a man of world-wide fame, whose election will be hailed abroad with not less approbation than it has received at home.

There was once a time when the Royal Society, so long accustomed to reign alone among the scientific institutions of the country, was disposed to look askance upon the rise of other learned societies the main object of which was the cultivation of some single department of science. Happily that time has long since passed. The most cordial relations now bind the younger offspring to their venerable mother. These special societies, which have so multiplied in our own time, have been of enormous service in advancing the progress of their several departments of inquiry. Science has grown far beyond limits that can be adequately supervised by any single organisation. Almost all the Fellows of the Royal Society belong also to one or more of these societies; but no practical inconvenience arises from any divided allegiance. While chemists, geologists, zoologists, or botanists are loyal members of their several special societies, they are happy to be included also in the ranks of the Royal Society. They are proud of its prestige, of its traditions, of the large part it has played in the history of British science, and of the high position which it holds among the academies of the world. They recognise its catholicity alike in the selection of its fellows and in the papers which it prints in its publications. They see that while other learned bodies properly concern themselves with their own special fields in the scientific domain, the Royal Society, true to the spirit of its earliest leaders, continues to welcome any worthy addition to any department of natural knowledge, not from its own fellows only, but from outside workers who are found to have something new and of real value to communicate.

In four years hence the Royal Society will complete its fifth half-century. Nevertheless, though old in years, it remains still young in energy and aspiration. With the cooperation of the other societies we look forward to a future not less distinguished and useful than our past has been.

Speeches were also made by Prof. Tilden, Dr. Head, Lord Avebury, the Italian Ambassador, and the Bishop of London.

NOTES.

THE account which we print elsewhere of the anniversary meeting and dinner of the Royal Society contains many interesting statements of work accomplished and undertaken. Of particular interest is the election of Sir Archibald Geikie as president of the society in succession to Lord Rayleigh, who is leaving England for a long visit to South Africa, and has resigned the office held by him with such distinction for the past three years. In nominating Sir Archibald Geikie to the presidency, the council complied with a desire widely expressed in the society, and his election on Monday has given satisfaction, not only to fellows of the society, but also to the wider circle of workers in many departments of intellectual activity who admire his genius both on the scientific and literary sides. As Prof. de Lapparent pointed out in an article upon Sir Archibald Geikie's work contributed to our "Scientific Worthies" series in January, 1893:—"Since nothing in the world is less common than the union of scientific insight and acuteness with a vivid appreciation of nature and a delicate feeling for style, it is not strange that Sir Archibald's fame has passed far beyond the circle of professional men." The article showed that the claims of Sir Archibald Geikie to the highest form of recognition in the scientific world are of outstanding importance. Of all British geologists he has long been acknowledged as the most distinguished, and his election to the presidential chair of the Royal Society has given universal satisfaction.

WE regret to learn that M. Albert Gaudry, foreign member of the Royal Society, died on Sunday, November 29.

WE notice with regret the announcement that Dr. E. T. Hamy, professor of anthropology at the Paris Museum of Natural History and member of the Academy of Medicine, died on November 18, in his sixty-sixth year.

THE death is announced of Dr. O. T. Mason, head curator of the department of anthropology of the U.S. National Museum.

IT is announced that the Nobel prize for physics has been awarded to Prof. M. Planck, professor of mathematical physics in the University of Berlin; and the prize for chemistry to Prof. E. Rutherford, F.R.S., Langworthy professor of physics in the University of Manchester.

PROF. R. ABEGG, of Breslau, informs us that the award of 2500 marks made to him by the Berlin Academy of Sciences was not a prize, as announced in NATURE of November 26 (p. 104), but a grant to enable him to purchase the gallium required for the physicochemical studies which he has undertaken of that substance.

THE death is reported, after a long illness, of Dr. William Keith Brooks, professor of zoology at the Johns Hopkins University, Baltimore. He was born at Cleveland, Ohio, in 1848, and had been a member of the staff of Johns Hopkins since its foundation in 1876. He was the author of "A Handbook of Invertebrate Zoology," "The Stomatopoda of H.M.S. *Challenger*," "The Foundations of Zoology," "The Oyster," and "The Report of the Maryland Oyster Commission." He was popularly known as "the father of the oyster culture." He was a member of the National Academy of Sciences and of the American Philosophical Society.

THE gold medal awarded under the Shaw Trust for Industrial Hygiene was presented to Prof. Galloway, at the Royal Society of Arts, on November 18, "In recognition of his valuable researches into the action of coal dust in colliery explosions, the outcome of which researches has been the provision of means by which the risk of such accident is materially diminished, and a consequent great saving of human life effected."

PROF. BEYERINCK, of Delft, writes to point out that the spectra of planets illustrated by Prof. P. Lowell in NATURE of November 12, p. 42, resemble the absorption spectra of chlorophyll and accompanying pigments of different plants. For instance, "The spectra of Uranus and Neptune coincide with a spectrum produced by a chlorophyll solution containing much anthocyan, or perhaps still more with the absorption spectrum of a living Porphyra."

THE annual exhibition of apparatus is to be held by the Physical Society on Friday evening, December 11 (from 7 p.m. to 10 p.m.), at the Royal College of Science, South Kensington. From the programme, of which we have received an advance proof, there appear to be many items of considerable interest to both physicists and electrical engineers. We understand that invitations have been given to the Institution of Electrical Engineers, the Faraday Society, the Optical Society, and the Röntgen Society. Admission, however, except to Fellows of the Physical Society, will be by ticket only, and therefore members of the societies just mentioned desiring to attend the exhibition should apply to the secretary of the society to which they belong.

FOR nearly a year Lieutenant E. H. Shackleton, R.N.R., and his party of explorers have been engaged in exploration in South Polar regions. The explorers were taken to their landing-place in the Far South by the *Nimrod*, which then returned to Lyttelton. Despatches from New Zealand now state that the vessel has just left again for King Edward VII. land to take on board the explorers. It is anticipated that the *Nimrod* will reach the landing-place in about six weeks. Lieutenant Shackleton and his party will, it is hoped, put in an appearance before the end of February next, after which the *Nimrod* will make her way back to Lyttelton.

WE learn from the *Times* that the Admiralty will restore Halley's grave in the old burial-ground of Lee Parish Church. Dr. E. Halley, who was the Astronomer Royal from 1721 to 1742, was given the temporary rank of a captain in the Navy, and commanded a ship of war in 1698–1701, for the purpose of making observations for magnetic variations. With Sir Isaac Newton, he was responsible for the Act of 1714 offering a reward to any person who should devise a method for the discovery of the longitude at sea. His grave was last restored by the Admiralty in 1854.

THE Academy of Natural Sciences of Philadelphia has decided to confer the Hayden memorial medal for 1908 on Mr. J. M. Clarke, State Geologist of New York, in recognition of his distinguished services to geological science. The medal is a memorial which Mrs. E. W. Hayden endowed in honour of her husband, Dr. Ferdinand V. Hayden, who was for several years director of the Geological and Geographical Surveys of the territories, remaining one of the four principal geologists to the United States Geological Survey from its organisation in 1879 until his death. Provision was at first made to confer a bronze medal and the remainder of the interest of the fund annually as a recognition of the best publication, exploration, discovery, or research in the sciences of geology or palæontology. The bronze medal was awarded annually until 1899, when the deed was modified so as to provide for the awarding of a gold medal once every three years.

A BILL for putting in force the decisions of the Berlin Wireless Telegraphy Conference of November, 1906, as embodied in an international convention, has been laid before the French Chamber. The Paris correspondent of the *Times* gives the following details of the convention:—The conference has fixed wave-lengths, one of 300 metres, the other of 600 metres, for the transmission of public messages by the wireless current. All stations must be able to produce and to receive one, at all events, of these two wave-lengths. All public correspondence must be restricted to one of these wave-lengths. A coast station, however, can use other wave-lengths for long-distance communications, or for messages other than those transmitted by the public, provided that these wave-lengths are not under 600 metres and are not more than 1600 metres. Stations on board ship must use the 300-metre wave-length. They are permitted, however, to use other wave-lengths as well, provided that these are under 600 metres. Ships of small tonnage will be allowed to use a wave-length below 300 metres.

DURING the past week two important decisions have been announced in the British Courts of Appeal as to the definition of the term mineral. The question is of both scientific and commercial interest. When a railway buys land under compulsory powers, the minerals under the surface are reserved to the landowner, and have to be subsequently purchased by the railway company if at any time the proprietor is able to mine them. The railway companies are accordingly anxious to restrict the term mineral within narrow limits. The Court of Appeal, as announced in the *Times* of November 24, has unanimously confirmed the decision by Mr. Justice Eve in the case of the Great Western Railway Company against the Carpella Mining Company, that the china clay so extensively worked in Cornwall and Devonshire is a mineral. The Upper Court in Edinburgh, on the same day, re-affirmed the decision that in Scotland sandstone is a mineral, by dismissing an appeal by the North British Railway Company in reference to the working of sandstone beside the railway station at Shettleston.

THE appointment by the Government of a commission to register ancient monuments with the view of their better protection has been widely welcomed, but the

Government might do much to protect such remains by insisting that its own officials should treat them with consideration. One of the remarkable megalithic ruins of Malta appears to have just had a narrow escape, as in order to avoid the extra cost of a slight diversion of a new wall on the Corradino outside Valetta, one of the two most accessible of the archæological treasures of Malta was to have been ruthlessly swept away. Money for the wall was not available during the current year, so its erection was postponed, and we understand that in consequence of the protests by the Maltese archæologists and the intervention of the civil authorities the Admiralty officials have agreed that the wall shall be so diverted as to leave the megalithic remains uninjured. During the recent correspondence in the *Times* on the danger to the stone circles of Dartmoor, attention was directed to the destruction of a prehistoric stone group on land which had been sold to the War Office on the understanding that the antiquities should be preserved.

THE Royal Geographical Society has received from Dr. M. A. Stein an account of the final stage of his expedition into Central Asia. From an article in the *Times*, it appears that Dr. Stein started on August 1 last on his expedition to the sources of the Yurung-kash, or Khotan river. After making his way through the gorges of Polu to the northernmost high plateau, he turned to the west and succeeded in reaching the deep-cut valley of Zailik, which drains into the Yurung-kash. Terribly rugged as the valley of Zailik is, Dr. Stein ascended from it the high spurs coming down from the main Kwen-lun range northward, and by establishing survey stations was able to map the greater portion of the region containing the Yurung-kash headwaters. On the south the party proved to be flanked by a range of snowy peaks, rising to 23,000 feet, and clad with glaciers. By crossing side spurs over passes about 18,000 feet high, and ascending the gorge of the main river, they reached after eight marches from Zailik the glacier-bound basin in which the easternmost and largest branch of the river takes its rise. Having traced the river to its head, the party turned east to high ground on the Aksai-chin plateau. The object next accomplished was to reach the valley of the Kara-kash river. For this purpose the route which leads from Polu towards the Lanak-la pass and Ladak was followed. This took them to the uppermost valley of the Keriya river, and past the line of great glaciers which form its true sources. At last the watershed of the Keriya river was left behind, and the exploration of the hitherto unsurveyed ground westwards was commenced. The area before them, which in maps had figured as a high plain called Aksai-chin desert, proved soon of a different character. High snow-covered spurs with valleys between them were found to descend here from the range flanking the Yurung-kash. After a week they reached a large salt lake which an Indian survey party appears to have sighted more than forty years ago, but which has now become dry salt marsh. Continuing the journey to the north-west of it, they struck the traces of the old route by which Haji Habibullah, ruler of Khotan, had endeavoured to establish direct communication between Ladakh and his kingdom. Crossing several side spurs of the main range to the north, they emerged at last, on September 18, in the valley of the easternmost feeder of the Kara-kash.

THE weather summaries issued by the Meteorological Office show that for the autumn season, comprised by the thirteen weeks ended November 28, the mean temperature was largely in excess of the average over the entire area of the United Kingdom. The range of temperature was excessive, amounting to 60° and upwards in the east of Scotland, the east and south-west of England, and in the Midland counties. The aggregate rainfall was largely in defect, except in the east of Scotland and the south of Ireland, in both of which districts the excess was only a few hundredths of an inch. The deficiency was upwards of 3 inches in the south-east and south-west of England and in the Channel Islands. The duration of bright sunshine was in excess of the average in most of the English districts, the excess for the season amounting to seventy-five hours in the south-east of England, or 8 per cent. of the possible duration. The aggregate rainfall since the commencement of the year is in defect of the average over the entire kingdom, except in the north-west of England and the north of Ireland. In the Channel Islands the deficiency is 8·50 inches, in the south-west of England 6·14 inches, and upwards of 3 inches in the north-east and south-east of England. The excess of sunshine since the commencement of the year amounts to 151 hours, or 4 per cent. of the average duration in the south-east of England.

To Miss Georgina Sweet we are indebted for a copy of a paper, published in vol. xxi. of the Proceedings of the Royal Society of Victoria, on anatomical variation in the Australian tree-frog, *Hyla aurea*.

WE are indebted to Mr. A. E. Shipley for a separate copy of his account of the parasites infesting grouse, reprinted from the interim report of the Grouse Disease Commission, and likewise for one of a second paper, reproduced from the second number of *Parasitology*, on a thread-worm infesting the swim-bladder of a trout.

IN their November issue, the editors of *British Birds* announce that they propose to institute further inquiries and investigations in regard to "wood-pigeon diphtheria," and for this purpose request the assistance of observers from all parts of the country, to whom schedules of queries will be supplied on application. Mr. C. B. Ticehurst will, as before, undertake the investigation. It is stated in the course of the notice that the supposed probability of this disease being communicable to man is not countenanced by Mr. Ticehurst.

A MUSEUM at Norwich, organised and maintained by Daniel Boulter, a dealer in curiosities in that city, during a part of the last quarter of the eighteenth century, forms the subject of an interesting paper (read at the Ipswich conference) by Mr. T. Southwell, published in the October number of the *Museums Journal*. To the same issue Dr. F. A. Bather contributes an account of the Lund Museum for the History of Culture, to the opening of which reference has been previously made in our columns.

IMPORTANT developments in regard to the administration of the Indian Museum, Calcutta, are foreshadowed in the report of the conference in regard to museums in India, held at Calcutta in December, 1907. There was a very representative attendance of Indian museum directors and curators (from Kashmir to Madras), and specialisation in the matter of administration was the order of the day. As regards the Indian Museum, it was decided that while the geological and palæontological section will remain, as heretofore, under the control of the director of the Geological Survey, the remaining collections will be placed under four distinct authorities. Archæology will be handed over to the director-general of archæology; the principal of the School of Art will assume control of the objects of industrial and fine art; the industrial collections will be transferred to the reporter on economic products; while

the anthropological and zoological collections are to be placed in charge of a superintendent directly responsible to the trustees. An alternative proposal to link up all the sections under the administrative control of a single director, who would likewise be inspector-general for museums in India, was decisively rejected.

WE have to acknowledge the receipt of copies of vol. xxx. of *Bericht des Westpreussischen Botanisch-zoologischen Vereins*, and of the *Schriften der Naturforschenden Gesellschaft in Danzig*, for 1908, the latter being now regarded as a supplement to the former. In the *Bericht* special interest attaches to an account, by Dr. P. Speoiser, of the distribution of the reindeer-gadfly (*Therioplectes tarandinus*) in the course of a paper on the fauna of the Barent district. The species ranges all over Siberia, northern Russia, and Scandinavia, but also occurs in a few isolated localities in north Germany, namely, in eastern Prussia near Königsberg, in western Prussia in the Tucheler Heide, as well as in Pomerania, Brandenburg, and Mecklenburg. There are also reports as to its occurrence in Austria and elsewhere. Its existence in these isolated localities may be taken as an indication that the insect has survived in such spots from the date when the reindeer inhabited a much larger area on the Continent than it does at present.

THE October number of the Journal of the Marine Biological Association (vol. viii., No. 3) contains the results of a series of experiments which have been recently conducted with regard to the food of mackerel and the movements of these fishes, with the view of assisting the western fishery. It appears that from April until June inclusive—the main fishery-time in the western districts—when mackerel collect in large shoals, they feed almost exclusively on plankton, and also that the plankton from the contents of the stomachs of the fish is identical with that taken in tow-nets in the neighbourhood of the shoals. During two years it was found that in April zooplankton was in excess of phytoplankton, and that during such times mackerel were more numerous than during the other months. Hence the abundance or paucity of zooplankton appears to be correlated with the greater or less abundance of fish, this being confirmed by the result of five years' experience. As regards the periodical migration of mackerel, it has been already suggested by previous authors that these are not so extensive as has commonly been supposed to be the case, and this is confirmed by the results of the recent observations. In accord with the observations of Cligny, it appears that mackerel return year after year at the close of the shoaling season to certain restricted areas not far distant from the spawning-grounds, and that at present only a few of these areas are known to fishermen. Further, these bottom-shoaling fish seem likewise to feed largely upon plankton. Additional observations are required before the bearing of these facts on the fishery can be fully realised.

BEARING in mind that some of the Central American species of Sapium may be found to yield latex containing a valuable percentage of rubber, Mr. H. Pittier has placed on record in the Contributions from the United States National Herbarium (vol. xii., part iv.) the identifications of nine species of the genus collected in Mexico and Central America. Of these, six species from Costa Rica are new to science. It is noted that proterandry is general, if not universal, so that the early flowers are staminate, while the latter are hermaphrodite, and it is doubtful whether any species of Sapium are ever dicœcious.

THE superintendent of the botanic station at St. Vincent announces in his report for 1907–8 an increase in the export of cotton, and a slightly larger crop during the year, but ventures the opinion that the limit of production has been approached; if this be so, a yield of 175 tons represents the amount of Sea Island cotton that may be expected from the island. The output of cacao, that has increased annually since the effects of the hurricanes, now approximates to the amount of 100 tons. Among the trees that flowered in the gardens, mention is made of *Platymiscium platystachyum*, on account of the fragrance resembling violets diffused by the flowers.

A SUMMARY provided by Mr. G. Evans of the varieties of wheat grown in the Central Provinces of India and Berar has been published by the Department of Agriculture in that territory. In the northern divisions wheat occupies about one-third of the cropped area; in other parts cotton furnishes the chief staple. The varieties are classified under the four groups of hard and soft red and hard and soft white or yellow. A soft white variety is largely grown for export, as it produces a pure white flour; a hard yellow wheat from Nagpur is also exported, principally to southern Europe, for making macaroni and semolina. The author adopts five subspecies of *Triticum sativum*, under which he classifies the fifty varieties enumerated.

WE have received from the Bureau of Entomology of the United States Department of Agriculture a series of bulletins setting forth the beneficial results obtained by spraying with Bordeaux mixture and lead arsenate for codling moth and for the grape-root worm (*Fidia viticida*, Walsh). Another bulletin gives a brief description of the national collection of scale insects (Coccidæ), while others deal respectively with the apple-tree tent caterpillar (*Malacosoma americana*, Fab.), which can be controlled by arsenical washes, and the apple maggot (*Rhagoletis pomonella*, Walsh), which cannot.

ENGLISH students of American methods of agriculture will find much to interest them in a Bulletin (No. 12) recently issued by the Purdue University Agricultural Experiment Station, describing the methods of beef production adopted in Indiana. The information on which the bulletin is based was obtained by a method not uncommon in the States—a circular was sent round containing a full and carefully drawn up list of questions that farmers were requested to answer. The method has sundry disadvantages, but it enables a broad outline to be got out which will give the student all he needs.

AN interesting question in connection with the age of the prehistoric excavations made in search of flints at Brandon, in Suffolk, known as Grime's Graves, has now been set at rest by Mr. W. A. Sturge in the November number of *Man*. These pits were examined in 1870 by Canon Greenwell, who described the results in the Journal of the Ethnological Society (N.S., vol. ii., p. 419). Among the objects found and deposited in the British Museum is an axe of polished stone. In some recent discussions on the age of these excavations it has been urged that they date from pre-Neolithic times; but to establish these conclusions the evidence of Canon Greenwell's axe must in some way or other be got rid of. Hence an attempt has been made to throw doubt on the authenticity of this implement, and it has been suggested that it was surreptitiously introduced during the excavation by one of the workmen. Canon Greenwell fortunately retains a distinct recollection of the circumstances of the find, and gives a graphic account of the incident. Before it was discovered he had noticed markings on the chalk walls of

the pit which could not have been produced by the stag-horn picks usually employed by the workmen in prehistoric times. He guessed that they were the result of blows by a stone axe, the edge of which had become blunted and battered in a peculiar way by use. When the axe was subsequently found imbedded in the chalk, it was immediately recognised to be the identical tool with which these peculiar markings had been made. There can be no question, therefore, of the genuineness of the implement, or that the mutilation of the edge is contemporaneous with the period in which the tool was made and used. It thus supplies conclusive evidence that the pit was excavated during the period when polished stone implements were in use.

THE annual report of the Transvaal Meteorological Department for the year ended June 30, 1907, shows that there is a considerable increase in the number of observers, all of which are volunteers or attached to other departments. The results of observations are arranged in appendices, as in previous reports; in many cases only means are printed, but the individual observations are available for any inquiry in case of need. In addition to the ordinary weather forecasts for the ensuing twenty-four hours, which are exhibited at every postal telegraph office, weekly forecasts have been prepared for the Agricultural Department when required; these are necessarily more indefinite than the daily forecasts. Investigations on various meteorological subjects are in such progress as the limited staff will permit; several papers have been communicated during the year to the *Meteorologische Zeitschrift* and other scientific periodicals. It may be mentioned that a new thermometer screen, constructed by Mr. D. E. Hutchins, with double laths instead of louvres, as in the Stevenson screen, has been under examination during a year. It costs less than the louvred screen, while the results obtained are practically the same.

THE first number of a new scientific monthly, entitled *Ion, a Journal of Electronics, Atomistics, Ionology, Radioactivity, and Raumchemistry*, has just appeared. It is quarto in form, and contains eighty pages, well printed, with a fair number of diagrams, some of which have, however, been prepared from very rough drawings. About fifty pages are devoted to three articles on "The Charge carried by the α Particles," by Mr. F. Soddy; "Uranium and Geology," by Prof. Joly; and "Transmission of Energy in the World of Electrons," by Dr. H. W. Julius. Fifteen pages are devoted to reports on the various fields of work covered by the periodical, and three pages to reviews of ten books. Prof. Joly's paper is evidently an address, but no indication is given as to where it was delivered, and the reports would be increased in value if references to further sources of information were added. Several of the contributions require more careful editing, as they contain expressions which convey little meaning to a reader not well versed in German, but this may be due to the journal being printed in Germany. It would be a great convenience to its readers if it could be issued with the edges of the leaves cut. Notwithstanding these minor defects, which can be easily remedied in future numbers, *Ion* provides a physicochemical journal long needed in this country.

UNTIL 1893, the conservation of mass in chemical reactions was tacitly assumed in all chemical work. In that year H. Landolt published a memoir in which the validity of this assumption was submitted to an experimental control under modern conditions; in no case were any changes in the total mass of the reacting substances observed outside the limits of experimental error. In a second paper, however, published in 1906, experiments carried out with an improved apparatus appeared to show a slight decrease in forty-two out of fifty-four observations. In a series of control experiments, carried out with vessels in which no chemical reactions were taking place, this decrease was not observed, and Landolt suggested the emission of electrons during chemical reactions as a possible cause of this loss. In last month's number of the *Zeitschrift für physikalische Chemie* the same author contributes a third paper on this subject. In this the slight losses noticed in the earlier paper are traced down to minute volume changes in the glass vessels employed, the after effects of the slight temperature changes accompanying the chemical phenomena. The final conclusion drawn from the results of all the experiments is that no change of mass can be detected as a result of chemical reactions, and the law of the conservation of mass in this case is true within the very small limits of experimental error. Apart from the interest attaching to the rigid proof of this law, universally assumed in all chemical work, the present memoir goes very fully into the effects of changes of temperature on the volume and moisture films of glass vessels, a question arising in all chemical and physical researches involving the accurate weighing of substances in glass.

A CATALOGUE of electrical novelties received from Messrs. F. Darton and Co., Clerkenwell Optical Works, London, E.C., contains descriptions of many simple and cheap motors, dynamos, coils, and other apparatus. The list should be of service in suggesting suitable Christmas presents for youths and others interested in electricity.

A LIST of microscopes and accessories just issued by Messrs. Ross, Ltd., the well-known manufacturing opticians, should be seen by everyone contemplating the purchase of a microscope for pleasure or work in various departments of science. The instruments described are of a high level of construction and efficiency, and each part has been designed with care. The catalogue also contains particulars of new photomicrographic apparatus.

OUR ASTRONOMICAL COLUMN.

MOREHOUSE'S COMET, 1908c.—Writing to the *Astronomische Nachrichten* (No. 4284, p. 194, November 21), Prof. E. C. Pickering transmits a message from Prof. Frost directing attention to the increased brightness of Morehouse's comet towards the end of October. It was easily seen, at the Yerkes Observatory, with the unaided eye, whilst with a small field-glass three or four degrees of tail became visible. With the Zeiss ultra-violet objective-prism camera three exposures on spectrum plates were made by Mr. Parkhurst and Prof. Frost, two of them each of one hour's duration. At the time of writing the measurement of the spectra was not complete, but Prof. Frost suggests that they are of the ordinary hydrocarbon type. As no continuous spectrum is perceptible, it is concluded that the radiations at the time of exposure (October 28) were, to a very large extent, intrinsic.

Prof. Pickering reports that photographs taken at the Harvard Observatory on October 30 show a tail at least nine degrees in length, much longer than on previous nights.

Further evidence of the changes which took place in the appearance of the comet, especially at the end of September and beginning of October, comes from Herr Winkler, of Jena, who observed with a 6-inch refractor. In his notes, published in No. 4280 of the *Astronomische Nachrichten* (November 6), he states that no tail was seen on October 1, although on September 28 a tail 40′ in length was observed.

Numerous measures of the comet's position are given in No. 4283 of the *Astronomische Nachrichten*, whilst in No. 4285 of the same journal M. Geelmuyden gives the positions (1900) and corrections for fifty-two comparison stars, extracted from a series of meridian observations of stars between 65° and 70° N. declination, made at the Christiania Observatory during the period 1897–1907.

From Herr Ebell's ephemeris, and Dr. Smart's continuation of it, we give the following abstract :—

Ephemeris (Greenwich midnight).

1908	R.A. h. m.	S. decl. ° ′	1908	R.A. h. m.	S. decl. ° ′
Dec. 3 ...	18 50·3 ...	8 11	Dec. 15 ...	18 50 0 ...	15 6
7 ...	18 50·2 ...	10 38	28 ...	18 49·9 ...	21 34
11 ...	18 50·0 ...	12 56			

THE CHANGE IN THE PHYSICAL CONDITION OF NOVA PERSEI.—According to the spectroscopic evidence published by Dr. Hartmann, Nova Persei changed to the nebular condition in the autumn of 1902, whilst later, in 1906, its spectrum was similar to that of the Wolf-Rayet stars.

Prof. Barnard now publishes a series of measures of the star's focus, made with the 40-inch refractor of the Yerkes Observatory between August, 1901, and September, 1903, and a number of notes regarding the Nova's appearance up to September 20 of the present year, which may throw more light on the details of the various changes.

At first the focus was that of an ordinary star, but between 1902 August 29 and October 6 it increased nearly a quarter of an inch, and became the same as that for a nebula; then from November it began to return to the stellar focus, and by the summer of 1903 the focus was essentially stellar. As no further changes were observed the focus measures were then discontinued.

Prof. Barnard also made focal measures of seven Wolf-Rayet Stars, and found that the focus generally appears to be shorter than for an ordinary star, whilst the stars are yellowish, and in some cases appear to be surrounded by a glow or halo (*Astronomische Nachrichten*, No. 4285, p. 201).

REFRACTION DUE TO JUPITER'S ATMOSPHERE.—In a recent note in the *Astronomische Nachrichten* (No. 4272), M. Chevalier published an account of an observed occultation of a star by Jupiter, and directed special attention to the fact, without offering any explanation of the phenomenon, that the star did not disappear at the point of the planet's limb to which its apparent motion, in regard to the planet, was directed some minutes before; that is to say, the star's apparent path was deflected immediately before immersion took place. In No. 4285 of the same journal (November 24, p. 206) M. E. Esclangon offers an explanation of the phenomenon. It is that the apparent deflection is caused by the horizontal refraction at the surface of Jupiter, and he finds that the observed direction and amount of the deflection are in good accordance with the theoretical value for the refraction. Although the disappearance of the star was apparently instantaneous, a diminution of light, such as might be caused by the absorption due to the planet's atmosphere, was observed.

OBSERVATIONS OF THE ZODIACAL LIGHT.—At the suggestion of Prof. Campbell, Mr. E. A. Fath made a number of observations, at the Lick Observatory, during the past summer, in order to determine, if possible, the true nature of a faint light which has for years been observed along the northern horizon from Mount Hamilton during the summer.

The observations show that it is probably due neither to twilight nor the aurora borealis—although the strong aurora line at λ 5571 was observed spectroscopically both within and without the illuminated area—but to the zodiacal light. Details of the observations are given at length, and they show that the northern boundary of the light reached an altitude of 46° (Lick Observatory Bulletin, No. 142).

L'ANNUAIRE DU BUREAU DES LONGITUDES.—This annuaire, for 1909, is now published, and contains the usual very complete series of tables for use in astronomical, meteorological, geographical, and general scientific work.

The article "Spectres des Étoiles," which used to be written by the late M. Cornu, is replaced by a most interesting *résumé* of stellar spectroscopy prepared by M. A. de Gramont. This will be found very useful for reference, as it contains a brief account of the various stellar classifications of Secchi, Pickering, Lockyer, and others, with notes on their correlation. The annuaire is published by Gauthier-Villars, Paris, at 1.50 francs.

THE CORRELATION OF THE TEACHING OF MATHEMATICS AND SCIENCE.

IT is known that for some time past the Mathematical Association has been arranging for a joint committee with the Association of Public Schools Science Masters to report on the teaching of mathematics in connection with science. In furtherance of the same object a conference was held at the Regent Street Polytechnic on Saturday, November 28, between the Mathematical Association and the Federated Association of London Non-primary Teachers, the main feature being an address by Prof. John Perry, F.R.S., bearing the title of this article.

Prof. Perry said that a certain senior wrangler had objected to the name mathematician being applied to a mathematical physicist, and he therefore confined the term to those who were enlarging the scope of pure mathematics. Mathematicians, instead of being able to devote themselves to research, were forced to teach elementary classes; they also took part in examinations, and sometimes wrote treatises on hydrostatics, which were really books on integral calculus with such terms as pressure and depth.

The consequence was that too much attention was given to so-called rigorous proofs, and boys wasted much time in learning such subjects as deductive geometry, artificial devices for solution of triangles, and drudgery with algebraic symbols. The conditions of one examination at one British university had led to the creation of 90 per cent. of elementary algebra and trigonometry in Great Britain, this unnecessary 90 per cent. being as complex and tricky as it was possible to make it. Until this sort of thing was done away with the marriage of mathematics and science was like that of December and May. He alluded to the arbitrary division of examinations into water-tight compartments headed "Algebra," "Trigonometry," "Mechanics." He maintained that students ought to learn to use logarithms, and even Fourier's theorem, long before they could prove their methods. He thought school lessons should be on the type of Sandford and Merton and Mr. Barlow. There should be no division into subjects. Boys should learn to weigh and to measure, to calculate and to find things out for themselves. The form-masters should be all-round men, not specialists. There should be one teacher to every ten boys, and that teacher should be well paid. Every master should be responsible for English composition. If a boy wrote a description of anything he had done in a laboratory or elsewhere, it should be an exercise in English. He referred to the methods of teaching adopted by Dr. Andrews, of carbonic acid fame. Continuing, it astonished him to see how little comprehension there was of the proposals of the British Association committees. They recommended some work with graphs on squared paper, and some teachers did nothing but graphs, and there were dozens of school-books to help on the craze. The surprising thing was that many teachers seemed to have no individuality, no originality, nor even the power to think for themselves at all. He asked that the changes that were taking place should go on unchecked. Mistakes would be made at first, and it was their duty to make the public believe in the necessity for better paid teachers in order to attract really able men.

Prof. Bryan, who occupied the chair, thought Prof. Perry attached too much importance to the distinction which an idealist drew between a mathematician and a mathematical physicist. Consequently, his address tended to give the impression that the man who did research in pure mathematics was at the root of all the evil. In Prof. Bryan's opinion the fault rather lay with those whose only idea of research consisted in inventing

"pretty" questions unsuitable for a three-hours' examination paper. At Bangor Mr. Lloyd George had directed attention to the need of explorers who should survey the unknown regions of science. This need was urgently felt in mathematics, both pure and applied. Thus the theory of groups was a newly explored territory which might in time become a field of wealth in the hands of colonists like Prof. Perry. The true explorer would never stand in the way of progress. It was the man who thought he had done everything when he had competed in a walking race over the measured mile of a syllabus who never became an explorer, and never produced explorers. No man who relied only on his powers of walking would ever become an explorer. We required men to be carried over the greater part of the distance by the fastest means of locomotion at our disposal to bring them to the forefront of the unknown territory, and this was in effect what Prof. Perry wished to do. The research mathematician was in reality assisting, not hindering, progress. He had exposed the futility of elementary deductive geometry by raising the foundations of geometry to the level of a very difficult and advanced subject of post-graduate study. As for Fourier's theorem, modern researches had made the proof of that theorem a subject involving years of study, thus rendering it impossible for the science man to do more than study its applications. As for examinations, Prof. Bryan was thankful he had not been debarred from conducting them, as this work had afforded him most valuable experiences, and, referring to Prof. Perry's remarks on the solution of triangles, he gave a striking illustration of the cumbersome methods adopted by examinees in finding the area of a right-angled triangle by the unnecessary use of formulæ. There was far too much teaching and far too little learning. Prof. Perry lamented the lack of individuality on the part of teachers, and at the same time condemned the specialist teacher. Prof. Bryan, on the other hand, thought that the cause was that the teachers were not sufficient specialists to develop original ideas, and that an all-round man who was put on to teach mathematics, Latin, history, geography, Welsh, and chemistry could never (except in rare instances) get beyond blindly following the text-book or the examination syllabus.

Mr. Godfrey next spoke. He said that subjects such as mechanics, hydrostatics, and optics were, as a rule, taught in one way by the mathematical master and in another by the science master. He would throw the whole teaching of these subjects, both theoretical and practical, on the mathematical master. There was no educator so good as responsibility. The mathematical master would benefit by having the experimental work thrown on his shoulders; the science master would have more time for other work.

The reference to optics might well have been dwelt on at greater length. There is no better exercise in constructive geometry than the construction of reflected and refracted rays, caustics, and images, and the subject is capable of exact experimental verification, thus differing from the study of the motion of impossible particles on equally impossible smooth curves. Mr. Godfrey further pointed out that the clock sums and problems on filling baths had plenty of counterparts in the form of questions on graphs.

Mr. Jackson quoted Emerson's view that education was what remained when everything learnt at school was forgotten. There was no one panacea for inaccuracy. He recommended for graphs the use of a board with invisible squares scratched on it, identical in principle with the boards used by lightning caricaturists in music halls. He referred to the great French logarithmic tables, the computation of which was done by hairdressers who had been thrown out of work by the Revolution. We wanted to make boys believe that mathematics was a useful element in daily life, and not a punishment for their sins.

Prof. Alfred Lodge thought that in the higher forms boys taking mathematics might dispense with experimental work. He suggested that lists might be drawn up of experiments suitable for illustrating mathematical principles, and, conversely, that in science text-books each chapter might be prefaced by a list of mathematical formulæ.

Mr. W. J. Dobbs put in a plea for deductive geometry, which, he contended, was really a branch of experimental physics involving properties of matter. He referred to the value of mechanics in teaching trigonometry. He pleaded for the use of simple, inexpensive home-made apparatus, and contended that a great deal of money now spent on costly apparatus should be given to the teachers. Mr. Tuckey pointed out that two subjects taught by the same teacher were not necessarily correlated.

Prof. Armstrong suggested that Prof. Perry would have to tell teachers absolutely what they ought to do. People would be glad to learn, but they were not at present competent to understand his methods. Mathematicians must take off their coats and use their hands. The majority of pupils should not be trained from the scholarship point of view. He asked if there was any particular value in any educational subject.

After Mr. Nunn had spoken the latter question was again raised by the chairman, and Prof. Perry emphasised the necessity of differentiating between subjects which were useful in themselves and subjects which were educationally useful. Every child should be fond of reading and should be good at computation. He should have an elementary knowledge of science, and be able to express his ideas clearly in English. Lord Roberts's statements regarding the incompetence of men from the public schools when on service during the South African war were quoted. Prof. Bryan urged those present of the necessity of fighting that *practical* mathematics should receive its proper importance in the training of the working citizen, and that it should not be ousted by subjects the study of which had once formed the luxury and pleasure of the now vanishing English middle classes, but had only given rise to sadness and disappointment when these classes had been forced to earn their daily bread in the world at large. A vote of thanks was finally proposed by Mr. Siddons, who gave illustrations of the reforms that had actually taken place in recent years largely at the instigation of Prof. Perry.

SCIENTIFIC INVESTIGATIONS OF FISHERIES.[1]

TO the scientific inquirer the issue of these reports is, on the one hand, interesting for statistical and other proofs of the actual condition of the British sea-fisheries, and, on the other, for a statement of the views of impartial men—especially concerning the measures, if necessary, to be adopted for the preservation and improvement of the fisheries.

In the annual report of the English fisheries for 1906 it is gratifying to find that the quantity landed exceeded that of any previous year, and, if corroboration were necessary, the report of the Scotch Board for that year, and also for 1907, tell the same tale. It is further satisfactory to observe that by the methods now adopted the report is more nearly brought into line with modern requirements, and reflects credit on the Board and its staff. It may be pointed out, however, that the terms "demersal" and "pelagic" as applied to the food-fishes (and very suitable for their ova) are not free from misinterpretation even by fisheries' authorities, and it may be that the old terms "round" and "flat" white fishes and "skate," as distinguished from "herrings, mackerel, pilchards, sprats and anchovies," would prove as useful and at the same time be in accordance with the classification adopted by the Scotch Board. It is suggestive, again, that in the south dabs are included in the "decreasing" flat fishes, whereas the Scotch Board lately considered that this abundant form was usurping the areas of the more valuable plaice. The growing scarcity of marketable plaice is anxiously recorded, yet it is a complaint of very old date, and it has not been shown that the numbers of very small plaice show any diminution. The statistics of the average catch of this fish per day during the years 1903–6 must be cautiously accepted, since there

[1] (1) Annual Report of the Board of Agriculture and Fisheries under the Acts Relating to Sea-fisheries for the Year 1906 (1908).

(2) Report of Research-work of the Same Board on the Plaice Fisheries of the North Sea, 1905–6 (1908).

(3) Report of the Committee appointed by Treasury-Minute to inquire into the Scientific and Statistical Investigations now being carried on in Relation to the Fishing Industry of the United Kingdom.

are factors not included in the reckoning, but the adoption by the Board of a chart in which the fishing-grounds of western Europe are divided into "regions" and the North Sea into "areas," according to depth, is excellent, especially in connection with plaice and other flat fishes. In briefly noticing the nature of each area, it is stated that the fishes caught in the North Sea no longer constitute the predominant quantity of a few years ago, but rather more than half the total quantity of "demersal" fishes landed by British vessels, yet the reader is left in doubt concerning the nature of the statistics of a few years ago, and as to whether the recent statistics of the International Bureau have been taken into account. It is interesting that the most prominent fish is the haddock, as in Scotland, a fish about which as many misgivings have been bruited as about the plaice.

On the whole, the report, its foreign and colonial information, and its elaborate, skilfully arranged and important tables, ought to assuage unnecessary fears as to the yield of the sea. It is true statistics are at most approximative, and need the support of scientific experience and a thorough acquaintance with the waters in, as well as adjacent to, the North Sea, both of which were absent, for instance, in the statistics laid by the Scotch Board before the Parliamentary Committee under Mr. Marjoribanks in 1893, but they are indispensable. In all probability the Board will arrange for a more expeditious issue of the report in future. The Scotch Board's report for 1907 is now in hand.

Little need be said about the special report on plaice, by Captain W. Masterman, further than that in its present stage it demonstrates the ability and infinite pains taken by its author in the methods of weighing and measuring specimens from the various "areas" of the North Sea. Four "ichthyometric" ports have been chosen, viz. Grimsby, Boston, Lowestoft, and Ramsgate, and the series of elaborate tables giving the number of large, medium, small, undistinguished and others, from each area, and also their condition as to the viscera, show that every available fact will be grasped. In future reports, no doubt, a record from each area, and from personal observation, of the captures of plaice under 19 cm. which have been thrown overboard before returning to land, will be given, for such would be invaluable in placing the whole subject before the investigator. The use of the small-meshed ground-net of St. Andrews and the various surface- and mid-water nets on each area will probably also add further information. The reported fall from 48 million kilos. in 1903 to 29 million kilos. in 1906 merits full investigation. A careful summary of the captures of plaice from the North Sea by other nations would also be useful, especially as Dr. Kyle has shown that the totals of plaice landed at all the North Sea ports were nearly doubled between 1892 and 1903, and that, ten years after Dr. Petersen had reported the gradual decline of the Danish plaice-fishery in the Cattegat, not only was it more productive, but, as if to emphasise the lesson, an entirely new plaice-fishery by the Swedes on the northern border of the same area had sprung up and was flourishing. Experience demonstrates that when much harrassed and their ranks thinned, the older plaice become, like other fishes, extremely wary, but the vast swarms of very young plaice have shown no diminution on any shore, for it was pointed out long ago (1884) that none occur in deep water. Even a small untrawlable area is of importance in such a question, and it is stated that, in regard to plaice, 17 *per cent.* of the area of the North Sea is so. Much information may also be procured by the use of plaice-nets on suitable grounds, especially if diminution is reported. Moreover, the misunderstanding of the Scotch Department in summarising the ten years' work of the *Garland* should be borne in mind. The whole question is so complex that any new facts obtained by the able scientific staff of the English Board would be very welcome.

The third and very important report is that of the committee on the scientific and statistical investigations, and the task was one which even the special experience of a long life may well have faced with diffidence; yet the fact that the secretary of the commission was the only one specially trained on the subject may have had its advantages, since unbiassed minds would thus be brought to bear on the complex question. In this brief notice, however, it is only possible to make a few general comments, and to allude to the main features of the recommendations—premising that the report, in its comprehensive nature, moderation, and fairness, is worthy of the committee.

In the interesting historical summary of scientific fisheries' work ample justice is done to England, but it is not shown with sufficient clearness that it is to Lord Dalhousie's Commission (1883–5) that the country owes the scientific and statistical initiative in the department, and that ever since such work has been as conspicuously Scotch as English. Further, that many of the recommendations in that report (1884–5) have been utilised by the Scotch, English, and Irish Boards—in some cases for many years, whilst others are again brought up in the present report. Amongst other things, it is curious that the herring-brand of the Scotch Board has apparently been thought more important than the ten years' unique work of the *Garland* and the scientific conclusions therefrom, and that the work of the recently formed Ulster Marine Biological Association is duly noted, whilst the committee appears to be unaware of the existence of the oldest marine laboratory in Britain for scientific fisheries' work. The account of the *personnel* of the British section of the international investigations and the historical summary might well have been abbreviated. In their outline of future investigations the committee has prudently followed what has previously been advised (*minus* hydrography and chemistry, both of which are somewhat expensive, whilst the results to the fisheries have been small). Artificial hatching for the stocking of the sea also is, so far as observed, an unnecessary task.

A central fisheries council, representative of the three divisions of the kingdom, as suggested, has much to recommend it, but it would be well to consider—on the score of efficiency and expense—whether one instead of two members from each division would not suffice, the Treasury appointing the other two, after consultation with the Royal Society, not the Meteorological Office. No fault can be found with the restriction of the labours of the council to researches and statistics affecting the common interests of the sea-fisheries of the United Kingdom, and to the other duties stated, provided due attention is given to uniformity of method in the annual reports of each division. Yet a further step is worthy of consideration, viz. the severance of the Fisheries' Department from agriculture and its representation in Parliament by a responsible Minister, as the minority report so far indicates. In regard to the continuance of the grant of 1000*l.* *per annum* to the Plymouth Laboratory—with the necessary reservations—no dissentient voice will be heard amongst men of science. There can be no question as to the expediency of appointing a scientific officer and scientific assistants to the English Department of Fisheries. It is difficult to explain why this has so long been delayed. Nor is there any objection to the committee's scheme for international cooperation or to the International Council on the lines indicated. The sea is the highway between nations, and to a large extent their common fishing-ground. It is to be hoped that the Government will, in the main, give effect to the committee's judicious recommendations. W. C. M.

THE EUROPEAN POPULATION OF THE UNITED STATES.

PROF. RIPLEY, in his Huxley lecture delivered recently before the Royal Anthropological Institute, on the European population of the United States, raised a number of novel and important problems, for the solution of which the evidence is at present insufficient. In contrast to Europe, where the existing races have grown up from the soil, in America they, "one may say, have dropped from the sky. They are in the land, but not yet an integral part of it. They are as yet unrelated to its physical environment." Further, the influence of environment on this diverse population is as yet little more than a matter for speculation. The day has passed for assuming that the modern American type is a reversion to that of the American Indian; but for the future of this foreign population suddenly planted among new surroundings we must

depend more upon speculation than upon prophecy, because as yet, except in the classical records of the armies recruited in the Civil War, anthropological statistics are not available.

The extent of this foreign invasion of the country is stupendous. Twenty-five million emigrants have landed since 1820, and in 1907 no fewer than one and a quarter million souls were added to the population; and, what is still more remarkable, the source of supply has completely changed in recent years. A quarter of a century ago two-thirds of the annual immigration was in origin Teutonic or Anglo-Saxon; at present less than one-sixth is derived from this source. The newcomers are now mainly south Italian, Russian, or Austro-Hungarian. "We have even tapped the political sinks of Europe, and are now drawing large numbers of Greeks, Armenians, and Syrians." Ninety per cent. of the tailors of New York are Russo-Polish Jews; all day labourers, once Irish, are now Italian; fruit-vendors, once Italian, are now Greek. Chicago is now the second Bohemian, the third Swedish, the fourth Polish, the fifth German city in the world.

The question then arises, Will these racial groups coalesce into a more or less uniform American type? In dealing with this problem, Prof. Ripley discusses the causes which promote and those which operate to prevent the union of these races. On the one hand, as tending to combination, he notices the extreme mobility of the newer industrial immigrants, and their readiness to wander into the most distant parts of the country in search of employment; the inequality of the sexes, males being in a large majority, which results in marriage of the newcomers with locally born women. In this connection, he remarks the tendency of the male as he rises in the world endeavouring to improve his social position by marrying into a class higher than his own. The main cause which checks further union of the races is the concentration or segregation of the immigrants in compact industrial colonies or in the large cities of the west. While the Teutonic races wander far afield as colonists, the Mediterranean, Slavic, and Oriental races herd in the towns.

An investigation of marriage statistics brings out many interesting facts. Even in the case of the Jews, the most exclusive of peoples, there is more intermarriage than is commonly supposed, the Jews in Boston constantly taking as wives Irish or Irish-American women. All the facts of marriage and birth-rates, however, indicate a relative submergence of the Anglo-Saxon stock in the near future. While the birth-rate among them is steadily declining, the fecundity of the foreign races newly arrived in the country shows little signs of diminishing. In Massachusetts the birth-rate of these two races is in the proportion of about one to three. This superiority will probably not be maintained, as even now the fecundity of the foreigners seems to be diminishing after the second generation; but their vitality under a favourable environment is remarkable.

As Prof. Ripley observes, this race struggle is only in its very earliest stage, and it remains to be seen whether the Anglo-Saxon will be able to preserve and transmit his characteristic culture over these hordes of foreigners.

America, including Canada, is thus confronted with a novel series of problems, racial and social, and to add to these she has to deal with a fresh set of difficulties connected with the Negro and the Filipino, with which Prof. Ripley was unable to deal in this address. He cherishes a pious hope that a satisfactory solution will be attained; but this lies in the lap of the future, and it will be well that this notable address should attract on both sides of the Atlantic the attention which it deserves.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The general board of studies recommends the appointment of an assistant to the Quick professor of biology. It is proposed that Prof. Nuttall should appoint him with the approval of the Vice-Chancellor; the appointment will terminate on the appointment of a successor to the present professor. It carries with it a stipend of 100*l*. a year.

It is suggested to increase the stipend of the curator of the botanic garden to 350*l*. a year. It is now nearly thirty years since the present curator was appointed, and the position the Cambridge Botanic Garden now occupies is largely due to Mr. Lynch's ability and devotion.

PROF. R. C. MACLAURIN, professor of mathematical physics in Columbia University, and previously professor of mathematics in the University of New Zealand, has accepted, we learn from *Science*, the offer of the presidency of the Massachusetts Institute of Technology.

THE Chelsea Secondary School for Girls was formally opened on November 20. The school was originally part of the South-Western Polytechnic, and the transfer was effected in September last. The new buildings are situated in Hortensia Road, and represent the first school building expressly designed and erected by the London County Council for the secondary education of girls. The aim of the new school is to provide a liberal education for girls up to the age of eighteen or nineteen years. The claims of science to a prominent place in the school curriculum have been duly recognised, and ample accommodation has been provided for the practical study of chemistry, physics, and botany. The home arts are to be taught, and suitable rooms have been arranged for this purpose, as well as for practical work in geography.

THE report of the principal of the Bradford Technical College for the session 1907–8 shows that the total number of students in attendance during the session was virtually the same as in the previous year; but there was, unfortunately, a fall in the number of day students from 242 to 217. The average age of these students at the commencement of the session was nineteen years, as compared with eighteen years five months at the corresponding period of 1906. We notice that a new scholarship scheme has been adopted during the session. It provides opportunity for the transference of evening students of exceptional ability to the day courses, and offers special scholarships for apprentices in works. In order to carry the specialised training to as high a point as practicable, a number of fourth-year scholarships are offered to day students who have completed their three years' course, and as a recognition of the necessity for securing the best brains and the highest possible preliminary training a certain number of entrance scholarships are awarded on merit alone. The scheme affords evidence of the desire that all sections of the community should have equal facilities, as they have an equal claim to the advantages of the college training. The scheme for building a new block for the accommodation of the department of textile industries on an adjoining site already purchased has taken definite shape; detailed plans are being prepared, and building is to be begun shortly. The staff of the department of chemistry and dyeing has been strengthened with the view of the encouragement of research work in the college. The testing laboratory of the department of textile industries has been employed to a much greater extent than previously in carrying out investigations for the trade. It is pleasing to note that the advantages offered to manufacturers and others are being more fully realised.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 13.—Dr. C. Chree, F.R.S., president, in the chair.—The photoelectric properties of potassium-sodium alloy: Dr. **Fleming**. It is well known that, under the action of ordinary and ultra-violet light, the electro-positive metals lose a negative charge of electricity, the effect being most pronounced in the case of rubidium, potassium, and the liquid alloy of potassium-sodium. Potassium and sodium are melted together and then decanted over into a chamber containing a platinum plate, so that a mass of the liquid potassium-sodium alloy having a perfectly clean surface was obtained in a glass tube, and a platinum plate was fixed above it in an inclined position.

By means of platinum wires sealed through the glass tube, a contact is made respectively with the platinum plate and the liquid alloy. When the surface of the alloy is illuminated by a powerful beam of light, and the galvanometer connected to the platinum plate and alloy, it is found that a current is produced in this circuit merely by the action of the light, and by balancing this current against a variable electromotive force it was shown that an electromotive force varying from 0·4 to 0·8 of a volt is produced in the photoelectric cell due to the action of the light. This photoelectric effect was greatly dependent on the colour of the light, and especially upon light absorbed by the alloy. It is greatly diminished by making even a feeble magnetic field parallel to the surface of the alloy. Some questions were discussed tending to show that the source of the photoelectromotive force cannot be identical with the volta-contact electromotive force in the circuit, but is due to the absorption of light by the sensitive surface. In all cases of such photoelectric action, the rays which are effective in producing it are those given out by the substance if heated or otherwise made radiant. Thus, zinc is photoelectric under the action of ultra-violet light, and ultra-violet light is largely radiated when an electric spark is taken between the zinc balls, or an electric arc between zinc poles. The photoelectric effects in the case of potassium are probably due to the absorption of the violet ray emitted by potassium when heated.—Electric splashes on photographic plates: A. W. **Porter.** The author showed, by means of transparencies, the effect of a normal magnetic field upon the patterns which appear in developing a photographic plate which is placed between two terminals between which a sudden discharge passes. This effect is confined to the main line of discharge, and consists in this line being broadened into a band of nearly constant width; a very similar result is obtained if a blast of air sweeps across the plate instead of the magnetic field being employed. This broad band is produced by the glowing gas which surrounds the spark itself. The palm-like figures and the ramifications leading up to them do not seem to be modified by the magnetic field, and the author concludes that these figures are, therefore, determined by events independent of the *motion* of the changes conveyed along them, or else that the moving charges have a very large mass associated with them.—An anomaly in the lagging of thin wires and narrow pipes: A. W. **Porter.** When thin wires and narrow pipes are covered with a lagging material, it is not possible at once to say whether the covering will keep heat in or assist it to escape. There is a critical radius equal to the ratio of the conductivity of the material to the emissivity from its surface which the outer covering must exceed before it begins to act as a lagger. Although this seems to have been recognised by Prof. Bottomley and others, the results of experiments which have previously been made would seem to indicate that the effect in practice is very small indeed. The author showed a simple lecture experiment in which a large effect is obtained.—The rate of growth of viscosity in congealing solutions: A. O. **Rankine.** The author exhibited apparatus and described experiments for the determination of the time variation at constant temperature of the viscosity of gelatin solutions of high concentration.—Note on the re-combination of ions in air: Dr. **Phillips.**

Royal Astronomical Society, November 13.—Mr. H. F. Newall, president, in the chair.—Photographs of comet *c* (Morehouse), taken at the Royal Observatory, Greenwich: **Astronomer Royal.** The first photograph was obtained on September 4, and subsequent plates showed such remarkable changes that it was arranged that the comet should be photographed at very short intervals. Mr. Davidson and Mr. Melotte had obtained a long series of negatives, often at intervals of an hour or less, and lantern slides from these were shown on the screen. They were mostly taken with the 30-inch reflector, a shorter series being obtained with a 3½-inch portrait lens. The tail exhibits a recurring series of phases, and the phase seems to bear a relation to the condition of the nucleus, which passes through cycles of alternating activity and quiescence. A series of photographs taken by Prof. Barnard with various lenses at the Yerkes Observatory was shown on the screen, and Mr. Percy Morris showed another series taken by himself. Father Cortie said that his measures of the plates showed that matter ejected from the nucleus moved with an accelerating velocity. The Astronomer Royal and the president directed attention to dark rays in some of the photographs.—Note on the number of faint stars with large proper motions: H. H. **Turner.** The number of faint stars with motions of more than 20″ per century was singularly small.—The absorption of light in its passage through interstellar space: H. H. **Turner.** If the universe is infinite, the number of stars would theoretically be four times greater for each fainter magnitude, but, as observed, it was only three times greater. The hypothesis that light is absorbed by scattered material particles would apparently explain the discrepancy, and photography with coloured screens was suggested as a crucial test.—Mr. Cookson showed Prof. **Hale's** spectroheliographs, exhibiting vortex motion on the solar surface, especially connected with sun-spots. Vortices north and south of the solar equator appeared to move in opposite directions.—The calendar dates in Aramaic papyri from Assuan: J. K. **Fotheringham.**—Note on the regnal years in the Aramaic papyri from Assuan: E. B. **Knobel.**

Zoological Society, November 17.—Prof. E. A. Minchin, vice-president, in the chair.—A new genus and species of slow-lemurs from the Lushai Hills, Assam: Dr. N. **Annandale.** The animal is known only from a photograph of two individuals taken in 1889 by Mr. T. D. La Touche, and resembles Nycticebus in appearance, but has a long, bushy tail, which distinguishes it from all known Oriental lemurs.—Contributions to the morphology of the group Neritacea of aspidobranch gastropods, part i., the Neritidæ: Prof. G. C. **Bourne.** As a result of the comparative study of the anatomy of several species of marine, estuarine, and freshwater Neritidæ, the author found that the forms hitherto classed in the genera Nerita, Neritina, and Septaria fall into three well-known groups of subgeneric value, the chief distinctive characters relating to the accessory genital organs. The investigation had been pursued by the study of sections as well as by dissections, and a number of important anatomical results were set forth.—An account of the expedition organised to collect in the Ruwenzori range of mountains in Equatorial Africa: W. R. **Ogilvie-Grant.** The results were extremely successful, amongst the specimens obtained being 404 Mammalia, 2470 Aves, 135 Reptiles and Batrachia, 31 Pisces, and a very large number of invertebrates. A number of memoirs on the zoological results of the expedition were presented to the meeting, and will be published in the Scientific Transactions of the society.

Mineralogical Society, November 17.—Prof H. A. Miers, F.R.S., president, in the chair.—Mica from North Wales and chlorite from Connemara: A. **Hutchinson** and W. Campbell **Smith.** A mica from Tan-y-bwlch, North Wales, is found in pale green scales in quartz veins, and approximates closely in composition to the variety of muscovite known as sericite. A chloritic mineral from Recess occurs in transparent hexagonal plates in the quarry whence the Connemara marble is obtained. It is nearly uniaxial and positive, and was found on analysis to have the composition of penninite.—The occurrence of the rare mineral carminite in Cornwall: A. **Russell.** This mineral, an arsenate of iron and lead, first found at Horhausen, Rhenish Prussia, and described by F. Sandberger in 1850, was discovered in Cornwall by the author in 1906. It occurs as carmine-red or brown needles on crystallised scorodite, mimetite, &c., from Hingston Down mine. This adds one more species to the already long list of rare minerals yielded by Cornwall.—Russian universal instruments and methods: T. V. **Barker.** Several of the universal instruments devised, and kindly lent, by Prof. E. Fedoroff were exhibited, and the method of working explained. Among the instruments described were the hemisphere and graduated rotatory quartz compensator of Prof. V. Nikitin, the stereographic rule, circle-ruler, graduated mica and quartz compensators, universal crystal mirror-models and globes, the microdichroscope, and the universal microscope-stage. The great utility of the latter

was demonstrated by the actual determination (using a simple projection apparatus and screen) of the optical constants, twin-law, and chemical composition of a plagioclase twin. Methods of determining birefringence and the thickness of a section were discussed, and emphasis was laid on the special usefulness of the three-legged compasses in rapid calculations by graphical methods.—The composition of the Chandakapur meteoric stone: H. E. **Clarke** and H. L. **Bowman.** This meteorite, which fell in India in 1838, is of chondritic type, with numerous chondrules of varying structure, and consists principally of olivine and bronzite, and about 5 per cent. of nickel-iron.

Geological Society, November 18.—Prof. W. J. Sollas, F.R.S., president, in the chair.—Some intrusive rocks in the neighbourhood of Eskdale (Cumberland): Dr. A. R. **Dwerryhouse.** There appear to be five well-marked groups of intrusions in this district:—(*a*) the andesitic dykes of Allen Crags and Angle Tarn; (*b*) the dykes of the spherulitic group on Yewbarrow and High Fell; (*c*) the dioritic bosses of Peers Gill, Lingmell Crag, and Bursting Knotts; (*d*) the Eskdale Granite; (*e*) the dolerite-dykes. The dykes of series (*a*) bear a petrological resemblance to the Borrowdale volcanic rocks, into which they were intruded. They appear to be of Borrowdale age, and roughly contemporaneous with the lavas and ashes into which they are intruded. The spherulitic series (*b*) are considered to be also of Borrowdale age, though probably somewhat later, and the rocks of group (*c*) to be the holocrystalline equivalents of the Borrowdale lavas, and they also are probably of Ordovician age. The Eskdale Granite (*d*) is more acid. It is undoubtedly intrusive into the Borrowdale series, but seems to be pre-Triassic. The intrusion is probably Devonian. The basic intrusions (*e*) have been examined only where they come into proximity to the granite.

Linnean Society, November 19.—Dr. D. H. Scott, F.R.S., president, in the chair.—The optical behaviour of the epidermal cells of leaves (see NATURE, November 19, p. 86): H. **Wager.**—A new species of Symphyla from the Himalayas: Prof. A. D. **Imms.**—The freshwater Crustacea of Tasmania, with remarks on their geographical distribution: G. **Smith.**

Royal Anthropological Institute, November 24.—Prof. W. Gowland, F.R.S., past-president, in the chair.—Primitive pottery and iron-working in British East Africa: W. S. **Routledge.** After explaining the method of obtaining fire by friction adopted by the natives, the author proceeded to demonstrate the method by which pots were made. No wheel is used, but the pot is most carefully worked up by hand. An interesting feature is that the pot is made in two parts. All pottery is made by the women. The interest of the description was greatly heightened by an exhibit of pottery in all the different stages of manufacture. With regard to iron working, the author explained the manner in which the iron is washed from the sand and the way in which it was smelted in a large crucible dug out of the earth. From the iron thus obtained implements are made, and a large selection of examples was exhibited. Iron wire is also drawn, and the author gave a demonstration of the manner in which this is done.

CAMBRIDGE.

Philosophical Society, October 26.—Note on Russo's attempt to show differentiation of sex in the ovarian ova of the rabbit: W. **Heape.**—A further note on the eggs of the hermaphrodite *Angiostomum nigrovenosum*: S. A. **McDowall.**—Plemelj's canonical form: J. **Mercer.**—Monotone sequences of continuous functions: Dr. **Young.**—The operator reciprocants of Sylvester's theory of reciprocants: Major P. A. **MacMahon.**

November 9.—Prof. Sedgwick, president, in the chair.—The carriers of the positive charge of electricity given off by hot metals: Sir J. J. **Thomson.** The paper contains an account of measurements e/m for the carriers of the positive electricity given off by incandescent metals. The method used was that described in a paper by the author on rays of positive electricity in the *Philosophical Magazine* for October, and is an improvement on that used by him to measure e/m for the particles given out by hot wires some years ago. The values of e/m given in the present paper, taken in conjunction with other evidence, suggest that the carriers of the positive electricity given out by hot wires are mainly molecules of carbon monoxide.—The weight of a corpuscle on the electrical theory of gravitation: Sir J. J. **Thomson.** It was shown that, on the theory that gravitation was due to slight differences between the forces between like and unlike charges of electricity, the acceleration of a corpuscle under gravity might be expected to be about one thousand times the acceleration of ordinary matter.—The distribution of electric force along the striated discharge: Sir J. J. **Thomson.** A Wehnelt hot-lime kathode was used to produce the discharge, as it was found that at low pressures the striations produced in this way were remarkably steady and bright, and in consequence made accurate measurements of the distribution of electric force much easier than with the ordinary discharge. It was found that just in front of the bright surface of a striation towards the kathode there was a reversal of the electric force. This reversal causes a great accumulation of ions in the part of the striation nearest the kathode; the re-combination of the ions in this region will therefore be much greater than elsewhere, and it is shown that a very simple explanation of the formation and behaviour of striations was given by the hypothesis that the re-combination of the ions was the source of the luminosity in the striations.—Note on the radio-activity of rubidium: N. R. **Campbell.** Measurements on rubidium have been made similar to those on potassium described in a recent communication. It is shown that the rays from rubidium are less penetrating than those from potassium, but that the total activity of the former metal is some seven times as great as that of the latter.—The free pressure in osmosis: L. **Vegard.** The work contains a series of experiments made in order to obtain some information regarding the mechanism underlying osmotic phenomena. The experiments consist in the determination of osmotic velocities developed in a membrane of copper ferrocyanide by solutions of cane sugar of different concentrations, together with the determination of the resistance of the membrane against the flow of solvent. The author concludes that in osmosis the solution is restricted to a very thin layer, and the motion in the rest of the membrane is caused by the so-called *free pressure*, which is a negative hydrostatic pressure inside the membrane produced by the osmotic activity in the layer next to the solution. It is shown that for small velocities the free pressure is equal to the osmotic pressure, and that for higher concentrations the free pressure corresponding to the stationary state is equal to the friction pressure necessary to produce a velocity equal to the osmotic velocity.—The laws of mobility and diffusion of the ions formed in gaseous media: E. M. **Wellisch.** Expressions have been deduced from the kinetic theory of gases for the mobility and coefficient of diffusion of an ion, allowance being made for the increase in collision frequency due to the polarisation of the neutral molecules by the charge associated with the ion. This charge is shown to be replaceable, so far as collisions are concerned, by an extension of the sphere of force of the ionic nucleus. The expressions given involve only known physical constants of the gas, and are therefore directly comparable with the values as determined experimentally. It is found that the observed values of the mobilities and diffusion coefficients, as well as certain deviations from the mobility-pressure law, can be approximately explained on the supposition that the ion consists of a single molecule of the gas with which is associated a charge equal to that carried by the monovalent ion in electrolysis.

MANCHESTER.

Literary and Philosophical Society, November 17.—Prof. H. B. Dixon, F.R.S., president, in the chair.—Contributions to a study of the geographical distribution of birds, part i., the genus Macronyx, Swainson: F. **Nicholson.** This paper, the first of a series embodying a mass of notes on the Motacillidæ (wagtails and pipits)

in the author's possession, the result of several years' work, deals with the genus Macronyx, and brings up to date the geographical memoranda detailed by Reichenow and Shelley. Macronyx is a purely Ethiopian genus, being confined to the African continent, where the birds are popularly known as "longclaws," from the abnormal development of their claws. They may be divided into two sections, those with a yellow or orange breast and those with a pink breast. *M. croceus*, one of the former, is the most widely distributed, being found over the greater part of Africa. The range of the others is more confined. Nine species in all were enumerated, and the range of each was shown.—The draught-inducing properties of the poker: A. H. **Gibson.** With the view of ascertaining whether there is any scientific basis for the belief that a poker, placed with its lower end against the fender and the other end reared against the bars of an ordinary fire-grate without actually touching the fire, is able to induce a recalcitrant fire to burn up or to burn less smokily, the author undertook a series of experiments, in which the velocity of inflow of air was measured at various points with and without the poker in position. The results showed that the magnitude of the effect was very remarkable. The explanation of the phenomenon appears to be that, when a current of air impinges on a fixed body, eddies are formed on its leeward side, where a region of low pressure (below that of the atmosphere) in consequence exists. There is a tendency to inward flow towards this from all surrounding regions, accompanied by a consequent inward and upward flow towards and along the under side of the poker and towards the fire, this taking place along its whole length, but particularly from its lower end, which is shielded from the direct influence of the draught.—Notes on the spawning of Eledone and on the occurrence of Eledone with the suckers in double rows: F. H. **Gravely.** The spawning of *Eledone cirrosa* was watched in the aquarium belonging to the Liverpool Marine Biological Committee at Port Erin. The female settles upon a vertical surface, to which she clings with the large suckers of the arms. The siphon directs a jet of water into the oral funnel, and then places the eggs there. They are held by the small suckers near the bases of the arms, and are arranged by these in a bunch, the free ends of their individual stalks being fastened by means of a glutinous secretion into a central cord, by which they are united together. When the bunch is completed its strength is tested by the parent, and then it is left. At first it is white throughout, but the central cord, and the disc of hardened glutinous material, by means of which this is attached to the substratum, very soon becomes green, probably through the growth of an alga. The genus Eledone can usually be distinguished from the genus Octopus by the arrangement of the suckers on each arm in one row in the former, but in two rows in the latter.

PARIS.

Academy of Sciences, November 23.—M. Bouchard in the chair.—The spectrum of the Morehouse comet: H. **Deslandres** and J. **Bosler.** This spectrum has been studied at Meudon with two different forms of apparatus, the prismatic chamber and the ordinary spectroscope with slit; the present note deals chiefly with the results obtained with the latter. Besides the principal bands of nitrogen and cyanogen, there are three bands of unknown origin, λ 456·1, 426·7, and 401·3, noticed for the first time in the Daniel comet of 1907. All these, together with two others (λ 453·1 and 470·0), have proved to be doublets. The cause of this is discussed, and the conclusion arrived at that this cannot be attributed to a Zeeman effect, the application of Doppler's principle giving the best explanation of the phenomenon.—The influence of isolated multiple points on the number of double integrals of the second species of an algebraic surface: **Émile Picard.**—A new method for determining position at sea: **E. Guyon.**—M. Bouty was elected a member of the physical section in the place of M. H. Becquerel.—Algebraic surfaces which represent pairs of points of the curve of genus three: **L. Remy.**—The geometrical applications of certain remarkable movements: **J. Haag.**—Differential equations and systems of reservoirs: **Edmond Maillet.**—The ratio of the charge to the mass of electrons. The comparison of the values deduced from the Zeeman phenomenon and recent measures on the kathode rays: A. **Cotton** and P. **Weiss.** All the lines of metals in Mendeléeff's second group, which belong to the second secondary series, have a single constant $K=\delta(\lambda)/H\lambda^2$, which completely defines the magnitude of the Zeeman phenomenon. The authors' values for zinc give $K=1{\cdot}875\times10^{-4}$, and this, applying Lorentz's calculation, leads to $e/m=2\times1{\cdot}767\times10^7$. A recent measurement by M. Classen, made with kathode rays of low velocity, gives $e/m=1{\cdot}773\times10^7$, exactly half that deduced from the Zeeman phenomenon. On the other hand, a recent study by Lohmann of the triplets formed in a magnetic field by the helium lines gives a value $e/m=1{\cdot}77\times10^7$, identical with Classen's figure. The concordance of these results with Lorentz's views affords a striking example of the power of the electron theory in connecting phenomena apparently entirely different.—The kinematographical study of the backwash and stream lines produced by the motion of an obstacle: Henri **Bénard.**—The atomic weight of silver: A. **Leduc.** A criticism of the conclusions drawn by Dubreuil in a recent note on the same subject.—The borotungstic acids: H. **Copaux.** A detailed account of the preparation and analysis of the two acids $B_2O_3.28TuO_3.62H_2O$ and $B_2O_3.24TuO_3.66H_2O$. The former has a molecular weight of 7682, possibly the highest of any known inorganic substance.—The action of antimony trichloride on nickel: Em. **Vigouroux.** These two substances interact with incandescence at 800° C., with the ultimate production of crystals of NiSb. The physical and chemical properties of NiSb are given in detail.—Study of the tartrates of the fatty and aromatic amines in the state of solution, making use of the rotatory power: J. **Minguin** and Henri **Wohlgemuth.**—The preparation of *o*-azocarboxylic acids: P. **Freundler** and M. **Sevestre.**—The theory of the preparation of methylamine by solutions of acetamide and bromine: Maurice **François.** The author holds that the bromacetamide of Hofmann does not exist in solution, and explains the formation of methylamine as the result of an oxidation of the carbonyl group in $CH_3.CO.NH_2$ by hypobromous acid or free bromine in presence of alkali.—The humic materials in coals: O. **Boudouard.** Humic acid has been isolated from various kinds of coal by treatment with aqueous potash solution, with or without previous oxidation by nitric acid. Analyses and approximate formulæ for the humic acids thus obtained are given.—Antique red porphyry: J. **Couyat.**—The quantitative control of work on chlorophyll: V. **Brdlik.**—The physiological mechanism of the coloration of red grapes and the autumnal coloration of leaves: J. **Laborde.** Tannin extracted from different parts of the vine, on exposure to the sun in solution containing small quantities of hydrochloric acid and formaldehyde, develops a deep red colour, and the author attributes the natural colour changes in both fruit and leaf to the alteration of the tannins present in these organs.—The physiological study of some alkaloids of hemlock (*Conium maculatum*): J. M. **Albahary** and K. **Löffler.**—New contribution to the study of the serum of animals after removal of the thyroid gland: L. **Launoy.**—Note on a map indicating the oceanographical distribution of marine plants in the Roscoff region: L. **Joubin.**—Studies on cancer in mice: L. **Cuénot** and L. **Mercier.**—Experimental growths, and, in particular, the production of a supplementary head in Saccocirrus: Aug. **Michel.**—The age of the iron ores of the forest of Lorges (Côtes-du-Nord): F. **Kerforne.**—The distribution of Halobia in the western Peloponnesus: Ph. **Négris.**—Continuous luminous effluvia during a storm at the island of Lifou: M. **Nicolas.**—A particular class of sea bottom near Thau: L. **Sudry.**—Earthquake shocks at Constantine: P. **Martel.**

CAPE TOWN.

Royal Society of South Africa, October 21.—Mr. S. Hough, F.R.S., president, in the chair.—Note on the structure of Tygerberg, Prince Albert: Dr. A. W. **Rogers.** In 1906 Dr. Sandberg published a paper throwing doubt on the anticlinal structure of Tygerberg as described by Mr. A. R. Sawyer and Prof. Schwarz. The present author spent a week in the country between Prince Albert and

the east end of the Tygerberg, in order to study the evidence for Dr. Sandberg's views. It seemed to him that the anticlinal structure of the range was clear, for at many places in it the Witteberg beds were seen to dip under the Dwyka on either side. The masses of quartzite in the Dwyka described by Dr. Sandberg appeared to be parts of that formation, *i.e.* originally sandy sediments with few or no pebbles, formed at the same time as part of the tillite. Similar quartzites in the Dwyka had been described from several localities in the south of the colony. An examination of Sand River valley showed not only that it was extremely unlikely that a mass of Witteberg beds underlay the surface, for those beds were not known to form valleys like that of Sand River, but that where outcrops of rock *in situ* occurred they belonged to the Ecca series. He had come to the conclusion that it was unnecessary to assume the presence of a great overturned fold to account for the appearances at Tygerberg, and that the earlier observers were quite justified in ascribing an anticlinal structure to the range.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 3.

LINNEAN SOCIETY, at 8.—Biscayan Plankton, the Ostracoda: Dr. G. Herbert Fowler.—Note on *Juniperus taxifolia*, Hook. and Arm.: Bunzō Hayata.—Mimicry in Spiders: R. I. Pocock.

RÖNTGEN SOCIETY, at 8.15.—Phenomena observed in Electrical Currents of Continuous Oscillation: Dr. H. Manders.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—The Influence of Track upon Railway and Tramway Carriages: J. S. Warner.

FRIDAY, DECEMBER 4.

GEOLOGISTS' ASSOCIATION, at 8.—Personal Experiences of the Jamaica Earthquake of 1907: Dr. Vaughan Cornish.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Design and Erection of a Plate-girder Bridge over the River Lee, at Broxbourne: L. W. Atcherley.

MONDAY, DECEMBER 7.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Cellulose and Chemical Industry: C. F. Cross and E. J. Bevan.

ROYAL SOCIETY OF ARTS, at 8.—Twenty Years' Progress in Explosives: Oscar Guttmann.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Danish North-east Greenland Expedition: Lieut. A. Trollé.

VICTORIA INSTITUTE, at 4.30.—Geneva and Chamounix of To-day as compared with half-a-century ago: Prof. Edward Hull, F.R.S.

TUESDAY, DECEMBER 8.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Notes on Early Ornament: Dr. C. H. Read.—The Lushai-Kuki Clans: Lt.-Col. J. Shakespear.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Rotherhithe Tunnel: E. H. Tabor.

WEDNESDAY, DECEMBER 9.

ROYAL SOCIETY OF ARTS, at 8.—Kinematography in Natural Colours: G. Albert Smith and Charles Urban.

THURSDAY, DECEMBER 10.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On Reciprocal Innervation of Antagonistic Muscles. XIIth Note: Proprioceptive Reflexes. XIIIth Note: On the Antagonism between Reflex Inhibition and Reflex Excitation: Prof. C. S. Sherrington, F.R.S.—Electrolytes and Colloids. The Physical State of Gluten: Prof. T. B. Wood and W. B. Hardy, F.R.S.—On the Specific Heats of Air and CO at Atmospheric Pressure by the Continuous Electric Method at 20° and 100° C.: W. F. G. Swann.—Potential Gradient in Glow Discharges from a Point to a Plane: J. W. Bispham.—The Extension of Cracks in an Isotropic Material: A. Mallock, F.R.S.—Results of Magnetic Observations at Stations on the Coasts of the British Isles, 1907: Commander L. Chetwynd, R.N.—The Rotation of the Electric Arc in a Radial Magnetic Field: J. Nicol.—On Anomalies in the Intensity in Diffracted Spectra: H. C. Pocklington, F.R.S.—The Isothermal Layer of the Atmosphere and Atmospheric Radiation: E. Gold.—Contribution to the Osmotic Theory of Solution: The Earl of Berkeley, F.R.S., and C. V. Burton.—A Comparison of the Radium Emanation Spectra obtained by Different Observers: T. Royds.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8 (*Ordinary General Meeting*).—Output and Economy Limits of Dynamo Electric Machinery: J. C. Macfarlane and H. Burge.—*Probable Paper*: Commercial Electric Heating: J. Roberts.

ROYAL SOCIETY OF ARTS, at 4.30.—The Birds of India: Douglas Dewar.

MATHEMATICAL SOCIETY, at 5.30.—On the Propagation of Sound Waves Vertically in the Atmosphere: Prof. H. Lamb.—(1) On Sir William Rowan Hamilton's Fluctuating Functions; (2) On the Representation of a Function by Series of Bessel's Functions: Dr. E. W. Hobson.—Theory of Cauchy's Principal Values (Fourth Paper): G. H. Hardy.—Solution of a Problem of Mersenne's: Dr. T. Stuart.—Note on a Continued Fraction Equivalent to the Remainder after *n* Terms of Taylor's Series: Prof. L. J. Rogers.—Solid Angles and Potentials of Plane Discs: Balak Ram.

FRIDAY, DECEMBER 11.

PHYSICAL SOCIETY, at 8.

MALACOLOGICAL SOCIETY, at 8.—On *Carelia pilsbryi*, n.sp.: E. R. Sykes.—The Radulæ of British Helicids, Pt. II.: Rev. E. W. Bowell.—New Species of Plectopylis: G. K. Gude.—A Preliminary List of Recent Middlesex Mollusca: J. E. Cowper and A. Loydell.—The Application of the Names Gomphina, Marcia, Hemitapes and Katelysia: A. J. Jukes-Browne.

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