THURSDAY, DECEMBER 25, 1902.

AGRICULTURAL SCIENCE IN ITALY.

Chimica Agraria, Campestre e Silvano. Di Italo Giglioli. Pp. xviii + 877; with 31 figures in the text. (Naples: Marghieri, 1902.)

THIS book, the work of the well-known professor of agricultural chemistry in the College at Portici, was originally projected as a treatise on agricultural chemistry, to be followed by other volumes dealing with fermentation and animal chemistry. Written, as the author tells us, with many interruptions, between 1884 and the current year, it remains but a fragment of the original scheme, for it deals only with the relations of the plant to water and to solar light and heat—questions, indeed, of fundamental importance to the agriculture of a semi-arid country like Italy. With nearly 900 pages devoted to so small a section of the subject, it will easily be imagined how vast is the scale upon which the work was planned, and this arouses a question which struck us repeatedly during the perusal of the book. Given a treatise on a technical branch of science, like agricultural chemistry, how far should the author deem it his duty to enter into a complete discussion of whatever branch of the pure science he may require to use for the explanation of some technical problem? For example, we have in the book before us some ten pages, 628–638, given up to an acconnt of the nature of exothermic and endothermic chemical reactions. Now, though it is impossible to understand the problems presented by carbon assimilation under the action of light without possessing the conception of the transfer of energy accompanying a reaction and the reversibility of the change, we hold that the reader of a book like the present will have either reached already the required knowledge of pure chemistry or else must be introduced to the new idea in a much less academic fashion. In the main, a book of this type is written for the expert and should stick very close to its text, taking something more than the elements of the pure sciences for granted.

But it is precisely in this direction that Prof. Giglioli's weakness lies, with the result that the book is cumbered and inordinately expanded with irrelevant matter, interesting enough, but not really bearing upon the point. For example, all kinds of light waves and ethereal radiations doubtless possess some action upon the living plant, but as these effects are still practically unknown, it is surely superfluous to devote fifty pages to a purely text-book account of phosphorescence and kindred phenomena, including the incandescent properties of the rare earths in the Auer lamp, Crookes's tubes, radiant matter and kathode rays; nor, again, in another section, can we see the appropriateness of a discussion of the skin vision of animals or of Prof. Poulton's experiments on the influence of coloured lights upon the larvæ of *Pieris*.

This is the most unsatisfactory portion of the book, and we cannot help feeling that, in his desire to be exhaustive, Prof. Giglioli has discharged upon us pell-mell all the references he has accumulated, without considering how far they have yet been made to bear upon his subject. It is true that the man of science who wants to go beneath the surface of things must carry in his mind all sorts of cognate facts and investigations, in the hope that some day they may supply a missing link in his own work, but he should not present the public with this raw material.

The earlier sections of the book, dealing with the relations of the plant to water, are less academic, and contain many interesting references to the author's own experiences of agriculture under the hot suns and small precipitation of Italy. He discusses at some length the development of the root, and refers to this cause the increased power of resisting drought which certain manures, particularly nitrate of soda, give to the crop. In this section, Prof. Giglioli draws freely on the results of the Rothamsted experiments, particularly on Lawes and Gilbert's paper upon the drought of 1870 and its effect upon the variously manured grass plots. This question of the action of manures upon root development is worthy of more study than it has hitherto received, for it seems to afford a clue to the explanation of the greater ease with which a plant manured with nitrate of soda will in some cases obtain its other mineral food from the soil, as compared with one receiving the same amount of nitrogen in the form of ammonium salts.

The earlier chapters of the book have not been brought so closely up to date as the later pages; in the account of the amount of water transpired by plants, we have Lawes and Gilbert's figures, but not the later work of Hellriegel, Wollny, and King of Wisconsin, and again, in the discussion of the value of tillage in conserving soil moisture, no mention is made of the valuable observations which have been accumulated in America on this point.

The reader who is interested in the effect of climate upon crop production will find that Prof. Giglioli deals repeatedly with this most intricate problem. The alteration by climate of English varieties of wheat introduced into Italy is discussed on pp. 187 and 379, a subject of interest at the present time, when efforts are being made to get into English wheats something of the "strong" character of those imported from more arid countries, and again, on p. 189, we have a correlation of the hay crops grown at Rothamsted under various systems of manuring with the rainfall of the months of April, May and June.

On p. 100, we have a reference to Frank's discovery of mycorhiza, but we have no account of the weighty generalisations contained in the later papers of Frank and of Stahl, which have shown how interesting and widespread a variant of the general course of nutrition is presented by plants with mycorhiza.

The special value of the book lies in its enthusiasm and breadth of view; we feel we are dealing, not only with a specialist, but also with one who possesses a many-sided knowledge and experience. To an Englishman, it is pleasant to see how references to English work abound; particularly it is clear that Prof. Giglioli has kept himself familiar with the experiments at Rothamsted, where so much of the pioneer work in agricultural science has been done. Prof. Giglioli contrasts Italy unfavourably in the matter of agricultural experiments, but will the English work play so large a part in any treatise of a foreign professor fifty years hence? Rothamsted stands where

it did, the monument of two great men's work, but unconnected with any organisation, either official or educational; other countries have been only too anxious to foster and develop any living starting point they could find. A. D. H.

A HIMALAYAN LOCAL FLORA.

Flora Simlensis: a Handbook of the Flowering Plants of Simla and the Neighbourhood. By the late Colonel Sir H. Collett, K.C.B., F.L.S. Pp. lxviii + 652. (Calcutta and Simla: Thacker, Spink and Co.; London: W. Thacker and Co., 1902.)

WHEN, in 1897, Sir Joseph Hooker wrote his preface to the final volume of the "Flora of British India," he gave it as one of the chief uses of his great work that it would "facilitate the compilation of local Indian floras." We believe that since that book began to issue, the handbook before us is the first general local flora that has been prepared for India, though various floras for *forest* purposes only have already appeared. Other general floras, for what are wider areas, are in course of preparation for Bengal, Bombay and the Upper Gangetic Plain; but although these floras will apply to whole provinces, or at any rate to areas as large as provinces, they will, none of them, cover so wide a vertical range, for the late Sir H. Collett's handbook practically treats of plants growing at all altitudes, from the Himalayan valleys only a little raised above sea-level to elevations of 12,000 and even of 16,000 feet. The area taken up is not one of exact geographical limits, but, as the author has said:—

"I have assigned no strictly defined limits to the 'Flora,' believing that this would answer the requirements of students better than if I were to confine it, for instance, to the territorial limits of the Simla Municipality or any other arbitrarily fixed boundaries."

It seems, however, to include every plant which a Simla botanist is likely to meet with in his rambles, and we feel sure that the book will be much appreciated, though we cannot avoid a feeling of great regret that its author has not lived to enjoy the pleasure he looked forward to of knowing that he had done something to help those who are already students of his favourite science, and perhaps to induce more of those Indian officers who want a pursuit to occupy their leisure time, to follow in his footsteps and study the plants of the forests, glens and slopes of the Simla mountains.

It has not been an uncommon thing at Simla to hear the wish expressed that someone would publish a handbook of a not too difficult scientific character, giving the names and descriptions of the chief plants; and, as the author has explained in his preface, it was with the desire of supplying this want that he commenced his work. A careful examination of the book shows that his efforts have been successful. The descriptions are concise and couched in the simplest language; the analyses lead easily to the genus and species required; while the excellent pen and ink drawings prepared by Miss M. Smith, of Kew, will be a great additional help to those who consult the work. These drawings have been judiciously selected, to illustrate, not only the chief genera and species, but also the most common and conspicuous plants to be met with in Simla and its neighbourhood.

In addition to the characters of the natural orders, genera and species, and to analyses and an account of the geographical distribution of the plants, many useful notes are given which are sure to be of interest. As a sample may be cited the brief account of the method of fertilisation of Roscoea, a genus of gingers with purple flowers, where the mechanism by which the anthers are caused to shed their pollen on the backs of the insects which visit them is shown to be similar to that of the quite different genus Salvia in Labiatæ. The derivations of the generic names have been duly explained, and wherever it has seemed of interest, reference has been made to such books as Darwin's "Origin of Species," Fritz Müller's "Fertilisation of Flowers" and Kerner's "Natural History of Plants." It is clear that Sir Henry Collett took the greatest pains to make his book as useful as possible, and it is well that the pioneer of Indian local floras will be such an excellent model for future work of the kind. To the author, as every page of his book shows, his work must indeed have been a labour of love. It will be useful to residents and visitors, not only in Simla, but in the other hill resorts in the Punjab, while even in the more easterly ones—Chakrata, Mussooree, Naini-Tál—where the flora is richer, the book will be of considerable help to those interested in plants.

Besides Sir H. Collett's own preface, the descriptive portion of the work is preceded by an "In Memoriam" notice of the author by Sir W. T. Thiselton-Dyer, K.C.M.G., F.R.S., the Director of Kew, and by an "Introduction" by Mr. W. B. Hemsley, F.R.S., the curator of the herbarium at the Royal Gardens. In his notice, Sir W. T. Thiselton-Dyer gives a brief account of the life of the author, who, during a long and distinguished career as a soldier, studied science, and especially botany, in his leisure moments, and after his retirement in 1893 commenced the present work, which he only just lived to complete. Sir William finishes his notice by saying:—

"No one who has ever come to work among us at Kew has more completely won the affectionate regard of everyone with whom he has come in contact."

In his "Introduction," Mr. Hemsley gives a brief account of the geography of Simla, of its vegetation and of the chief botanists whose collections have been utilised in the preparation of the handbook. Some idea of the extent of the flora of the small Himalayan area to which it refers is obtainable from the fact that the handbook describes no less than 1326 species belonging to 639 genera and 113 natural orders.

We may conclude this brief account of a noteworthy botanical handbook with the following extract from the address of the president at the anniversary meeting of the Linnean Society on May 24 last:—

"In Sir Henry Collett we lose an accomplished botanist who was also a gallant soldier and a capable administrator, a combination of qualities that seems to be peculiarly British. It would not be easy to estimate how much this Society, and other kindred societies, owe to the public services, and more particularly the Indian, for the invaluable recruits whom we continually draw from their ranks."

We can hope that the "Flora Simlensis" will prove as enduring a memorial of its author as the record of his achievements, military and administrative, is likely to be in the history of the Indian Empire. J. S. G.

OSTWALD'S INORGANIC CHEMISTRY.

The Principles of Inorganic Chemistry. By Wilhelm Ostwald. Translated by Alexander Findlay. Pp. xxvii + 785. (London: Macmillan and Co., Ltd.) Price 18*s.* net.

VIEWS differ regarding the best method of presenting the facts and theories of chemistry to a beginner. Prof. Ostwald takes the view that "if the present-day chemistry makes greater demands on the power of rational thinking, it also renders the purely memory work of mastering the subject considerably more easy for the student. The growth of the scientific interpretation and elucidation of the separate facts of chemistry facilitates in the highest degree the impression of them on the mind and their application, and at the same time affords an incomparably greater intellectual enjoyment than the study of the older, essentially descriptive, chemistry could offer." Acting on this opinion, Ostwald has introduced physical theories, applicable to chemical facts, "in his stride," as it were. Beginning with some simple metaphysical statements, he develops the fundamental laws of classification and treats of homogeneous substances, mixtures and solutions; he next proceeds to consider the law of the conservation of weight and mass, and of work and energy, treating incidentally of the units in which these magnitudes are measured. The next chapter is devoted to "combustion," the existence of oxygen and the constancy of proportions; and the next to a rapid survey of the elements and their properties. The subsequent treatment is, in a restricted sense, systematic; the remaining chapters treat of oxygen, ozone, hydrogen, water, hydrogen peroxide, chlorine and hydrochloric acid, oxides of chlorine; bromine, iodine and fluorine, sulphur and its compounds, and, in short, the elements generally termed non-metals and their compounds; the metals and their salts complete the list.

But the discursive nature of treating the subject may be gauged by the amount of space—92 pages—devoted to the consideration of oxygen, hydrogen and water. Under the heading "Oxygen," not merely are the preparation and properties of the element considered, but also velocity of combustion, the influence of temperature on that rate, Boyle's and Gay-Lussac's laws, the temperature scales, degrees of freedom of a gas, the construction of curves, the liquefaction of gases, the solubility of gases, and ozone; the condition of allotropy is also shortly discussed. Under "Hydrogen" come methods of drying gases, molecular weights (here termed "molar" weights), the compressibility of gases at high pressures, diffusion, the law of partial pressures, the law of effusion of gases and spectrum analysis; also, *à propos* of the combustion of hydrogen, the law of mass action, chemical equilibrium and the influence of solid substances thereon; and lastly, catalysis, introduced by the catalytic action of platinum in causing combination between oxygen and hydrogen. Under the heading "Water," we find the law of continuity, graphic interpolation, coefficient of expansion, degrees of freedom of liquids, supercooling, heats of fusion, heat-units, vapour-pressures, heats of vaporisation, supercooled vapours, phases of water, ice and steam, and the triple point; next water as a solvent, and the relations between lowering of freezing point and depression of vapour pressure caused by salts; volume relation of gases, "combining" weights, symbols and formulæ, equations, and the atomic and molecular hypotheses.

Now Prof. Ostwald's style is excellent, and full justice is done to it by Dr. Findlay's translation; hence the book is most readable and interesting; the theoretical disquisitions are most clearly stated and arranged in an orderly manner, each point being taken up when its turn has come, but the reviewer doubts whether a beginner would gain much from a perusal of the book. For a teacher who is already familiar with the facts of chemistry, innumerable hints are to be found, almost on every page. But after all, the young chemical student has to familiarise himself with the facts of chemistry, and gilding the pill, even with fine gold, is apt to interfere with its assimilation. For a man of advanced years, even though he be no chemist, who can appreciate the logical arrangement of the book, much enjoyment may be obtained from it; but from long experience of the powers of mind of junior students, the reviewer doubts whether more than two or three specially gifted individuals out of a large class would retain much in their memories.

Just as in learning a language it is absolutely necessary to acquire the common verbs, prepositions and adverbs by heart, and to have at least some idea of the syntax before analytically parsing the sentences, attending to every subtlety, so with chemistry. A large number of facts and their experimental demonstration must become familiar, and it is then time to build up laws on these facts.

However, as stated at the outset, there are many methods of presenting such facts; and if the young student has energy to follow two or three methods of presentment, he will be a gainer. It appears to the reviewer that it would be better to reserve this method of considering the subject until a year, or perhaps more, has been spent in the more usual course of study. The effect of reading such a book at that stage is sure to be most stimulating, and will enable the reader, not only to revise his knowledge, but to enrich it by many necessary additions.

It is unnecessary to mention that the work is entirely up to date, and that the translator, as an old pupil and friend of the author, has completely entered into the spirit of the matter; he has left no trace of its German origin in the excellent English of which he is a master.

W. R.

A NEW THEORY OF THE UNIVERSE.

On an Inversion of Ideas as to the Structure of the Universe. By Prof. Osborne Reynolds, F.R.S. Pp. 44. (Cambridge: University Press, 1902.) Price 1*s.* 6*d.* net.

THIS is a short description of a new theory of the universe which formed the subject of the Rede lecture last June. All such theories must satisfy two conditions. The structure must be dynamically possible, and the results deduced by dynamical reasoning from the

theory must correspond qualitatively and quantitatively to the phenomena of Nature. The analytical difficulties may be too great to deduce all the phenomena, but if any be contrary to experience, the theory, at least in its exact form, must go. It is only by inventing, discussing, comparing and remodelling as many theories as possible that we can hope to arrive at any knowledge of the constitution of matter or of the æther. This new and very original attempt is therefore to be welcomed. As a rule, authors of such theories are satisfied to show how many facts their theory explains, and how probable, therefore, it is that their theory corresponds to reality. Not so, however, Prof. Osborne Reynolds. He claims to have shown that "the research has revealed the prime cause of the physical properties of matter," and that

"there is one, and only one, conceivable purely mechanical system capable of accounting for the physical evidence as we know it in the universe."

That a theory coming from Prof. Reynolds will fulfil the first of our conditions goes without saying. But that it should be possible to give a proof that it *is* the representation of the actual structure of æther and matter is too astonishing to be received without scepticism. We await the publication of the full research.

It is not possible to criticise a complete theory on a short statement of its results—a statement which by its very nature must leave much vague and much unsaid. Sufficient idea, however, is given to cause us to look forward to the complete work, which is, we understand, to be published by the Pitt Press shortly. In brief, the æther is composed of equal rigid spherical grains (diam. $= 1{\cdot}7 \times 10^{-12}$ times the wave-length of violet light) arranged in regular and closest order, and under great pressure. When strained, such a medium must expand—or show "dilatancy." The actions of the medium depend on this dilatancy. Matter is a defect of matter—a small deficiency of grains or a "negative inequality," causing, so to say, a certain looseness in the gearing of the grains where the deficiency exists and a consequent stress in the medium outside. These inequalities are permanent, and are propagated through the medium without a transference of the grains themselves. Matter is, in fact, a strain which is propagated through the medium—an idea which has occurred to others, notably Dr. Larmor in his electron theory, and to the late Mr. C. V. Burton, at the Ipswich meeting of the British Association in 1895. These strains attract one another according to the Newtonian law, may cohere but not coalesce. "Positive inequalities" (due to excess of grains), on the contrary, repel one another and so are dispersed. Electricity apparently consists of double inequalities, excess in one place and defect in another. The statement here appears rather vague, and it is difficult to understand the difference between electricity and two inequalities, one positive and one negative. The attraction is, however, enormously greater than that of gravitation. Apparently the theory gives no explanation of the fact that electricity never shows itself apart from matter, nor is any explanation offered of the electrodynamic action of one current on a conductor bearing another. A true theory must do this, and it is the crux of every theory yet produced.

In this granular medium, transverse and longitudinal waves are propagated. It would take 56 million years to reduce the energy of the transverse to one-eighth, while it would take only four one-millionths of a second to reduce that of the normal by the same amount, thus, the author says, "accounting for the absence of normal waves." This, however, is only a proof that such waves do not last. It is necessary to show that on reflection of light they are not formed, otherwise they will diminish the intensity of the reflected ray.

Many difficulties and objections suggest themselves during perusal which will doubtless be answered in the full paper. If Prof. Reynolds does in this what he promises in the *résumé*, he will go down to posterity with a greater fame than Newton. If, however, he does not succeed in convincing us that he has solved the problem of the mechanism of the physical universe, he may yet be congratulated on giving us what is evidently a beautiful, illuminative and extremely suggestive theory. He has opened to us, in any case, a new field of knowledge as well as helped to stimulate that scientific imagination which we are told it is our bounden duty to cultivate.

W. M. H.

OUR BOOK SHELF.

Report of the Yellow Fever Expedition to Pará of the Liverpool School of Tropical Medicine. By H. E. Durham. Pp. 79. (London: Published for the University Press of Liverpool by Longmans, Green and Co., 1902.) Price 7*s.* 6*d.*

THIS is the seventh memoir published by the Liverpool School of Tropical Medicine, and it is printed and got up in the same excellent style as its predecessors. It embodies the results of the Pará expedition of Messrs. Durham and Myers, and is written by the former, Dr. Myers having, as is well known, fallen a victim to the disease he was investigating, a circumstance which lends a melancholy interest to the report. When the expedition left this country, the remarkable and conclusive work of the United States Army Commission in Cuba under Major Reed in proving the conveyance of yellow fever by gnats was not known, but this problem, with many others awaiting solution as regards the disease, was present in the minds of the observers, as is seen in the preliminary report, which is here reprinted from the *British Medical Journal*. In the course of their work, they became acquainted with the results of the Americans, and a number of observations are chronicled in the report with regard to the gnat (*Stegomyia fasciata*) incriminated in Cuba. It was bred in captivity and studied in its native haunts, and much useful information gathered as to its habits—the most striking being its essentially urban habitat, and its custom of biting by day and not at night.

With regard to the actual microbe which is the cause of yellow fever, no sufficient proof is as yet forthcoming, but the observations of the expedition agree with those of Agramonte and others in absolving Sanarelli's *Bacillus icteroides* from any share in its ætiology. Attention is, however, already called in the interim report, an abstract of which is here reprinted, to a small, fine bacillus which the English observers found with considerable constancy in the intestines and in the viscera generally in fatal cases, and to which they were inclined, with due reserve, to ascribe a causal significance. It had previously been observed by Sternberg and others, but not with the constancy here recorded. A valuable series of observations on the condition of the lymphatic glands in yellow

fever and another series on the occurrence of peculiar proteid substances in the urine must also be noted.

Together with these positive results, there is necessarily included a mass of detail concerning results which proved negative. The writer has, further, added to his account of the experimental work performed a quantity of somewhat miscellaneous facts gathered in Parà and elsewhere on the subject of yellow fever and malaria, with a general account of the sanitary condition of the town. But when it is remembered that the work of the expedition was in great part crippled by the illness of both and the death of one of its members, we can but congratulate the survivor on the work which was accomplished, regretting that opportunities were not forthcoming for carrying it to a further stage of completeness. Yellow fever is a disease which has long been a puzzle to sanitary science, but appears at the present day to be on the verge of explanation. An immense step in advance has been made by the discovery of its transference by the gnat; the complete solution of the problem must be attained by further investigations on the lines of those embodied in this report, and carried out by skilled and unbiased investigators such as those sent out by the Liverpool School of Tropical Medicine.

Eyes Within. By Walter Earle, M.A. Pp. 155. (London: George Allen, 1902.) Price 5*s*.

THIS little volume of poems contains some good references to Nature and her handiwork. We are led to realise the ever-changing condition of the earth's surface, and phenomena of many kinds are dealt with. Thus:—

"See where upon a world-old mountain face
Some mighty glacier has left its trace,
A few faint scratches, all that marks to-day
Time's agonies along his primal way."

Allusions are also made to the great variety of changes always going on around us, and to the disturbing elements raging ceaselessly in the interior of the earth:—

"Shrill crash of breaker plunging in the cave,
The soughing wind, waves grinding on the shore,
Weird wail and scream of bird, set evermore
In fuller diapason stern and grave."

. . . . .

"Crack, rent and crush of overwhelming rock,
Steam bursting into flood of liquid blaze,
A world vibrating with each thunder-shock,
Suns setting in a pall of wreckage-haze."

All through the book we are struck with the delicate and subtle way with which common and every-day occurrences are referred to. Birds, flowers, insects, all have their due.

The author shows the true poetical spirit in many of his descriptions, and reveals to us the joy of possessing an eye which goes beyond the *outside* of the objects around it.

Handbook of Instructions for Collectors. Pp. v+137; illustrated. (London: Printed for the Trustees of the British Museum, 1902.)

WITH the view of obtaining the aid of naval and military officers, explorers, missionaries and others whose duty or inclination takes them to foreign lands in adding to the collections of the Natural History Branch of the British Museum, the Trustees have issued this excellent little handbook. It consists of a series of pamphlets describing the methods of collecting and preserving the various groups of animals, as well as plants, fossils and minerals. The different sections into which the book is divided have been written by members of the staff of the Museum, each of whom is a specialist in his own particular branch, and although the manner of treatment varies somewhat, each section is admirably adapted to its special subject, illustrations being introduced when necessary. The section on mammal collecting is divided into two parts, one dealing with the larger and the other with the smaller forms, a feature of the former being the inclusion of a list of species specially wanted by the Museum. Birds and the lower vertebrates follow next, after which come the various invertebrate groups, the work closing with chapters on plant and mineral collecting. The book is of a size convenient to be carried in the pocket, and has the corners rounded off the better to withstand constant use. R. L.

The First Principles of Ratio and Proportion and their Application to Geometry. By H. W. Croome Smith, B.A. Pp. iv + 32. (London: Macmillan and Co., Ltd.) Price 1*s*.

THE strict theory of geometrical proportion is difficult, and, with few exceptions, elementary students are quite unable to understand it. Opinions differ as to the compromise that is best suited for school teaching, and suggestions on this topic deserve careful consideration. Mr. Smith bases his method on the variation of two geometrical quantities; it is supposed that they vanish together and that any given increment of the one is associated with a fixed increment in the other; or, as he puts it, "when two variables change in such a way that equal changes in the one are accompanied *always* by equal changes in the other." A theory of proportion which starts from this idea is necessarily imperfect, and ignores the most troublesome part of the subject; but it will probably serve very well as a provisional compromise. At any rate, Mr. Smith's book deserves a trial.

Year-book of the Scientific and Learned Societies of Great Britain and Ireland. Pp. viii + 295. (London: Charles Griffin and Co., Ltd., 1902.) Price 7*s*. 6*d*.

THE nineteenth annual issue of this handy book of reference does not deal with a single calendar year, but with an actual working year of the great majority of the learned societies. Consequently, there are here brought together the papers read before the chief scientific societies throughout the United Kingdom from October, 1901, to June, 1902. The list of societies included in the new volume seems fairly complete, but we notice that the Geographical Association is not mentioned.

Papers on Etherification and on the Constitution of Salts. By Alexander W. Williamson, LL.D., F.R.S. (1850–1856.) Alembic Club Reprints, No. 16. Pp. 62. (Edinburgh: Published by the Alembic Club. Edinburgh agent, William F. Clay. London agents, Simpkin, Marshall, Hamilton, Kent and Co., Ltd., 1902.) Price 1*s*. 6*d*. net.

THE Alembic Club is doing valuable work by reprinting the accounts of classical researches in science in the words of the experimenters themselves. We are glad to know these reprints are increasing in popularity among teachers of science in schools where the "research" method of obtaining knowledge is encouraged. It is a matter for gratification, too, that this collection of papers, which have appeared in the publications of various scientific societies, has been printed during the author's lifetime.

Dove Dale Revisited: with Other Holiday Sketches. By the Amateur Angler. Pp. xiv + 130. (London: Sampson Low, Marston and Co., Ltd., 1902.) Price 2*s*. 6*d*. net.

THE amateur angler writes pleasantly of a beautiful country for which he has great affection. The volume is the seventh and concluding one of a series, and will encourage its readers to take an intelligent interest in animate and inanimate nature. The illustrations are numerous and exceptionally good.

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.*]

Volcanic Dust Phenomena.

THE phenomena connected with the volcanic dust are undergoing distinct changes. In common with observers in the south of England, I noted the fresh appearance of the dust phenomena in the end of June, especially on June 26, but they were not very striking until August 1. At first the most decidedly volcanic feature was the great corona round the sun, known in the case of the Krakatoa effects as "Bishop's Ring." Whether this name should be applied to the corona this year is doubtful, as its radius has been fully double that of the Krakatoa corona, having until recently averaged about 70°, measured from the sun to the middle of the reddest part. Yesterday and this morning, however, it averaged only about 40°, and its reddest part was a yellowish-brown rather than a red. The colour of the corona this year has always been much less decidedly pink than was the case with Bishop's ring; indeed, it has sometimes been an absence of blueness in that part of the sky rather than any positive redness.

The pink glows after sunset were very strong in the end of June, but stronger still in November, and on November 1, 17 and 18 there was also a faint second glow, a phenomenon I had not previously seen since the Krakatoa sunsets.

It was not until October 30 that the colouring became very magnificent, and it reached its height about November 1, when the chief feature was an intense fiery orange sky near the west horizon. This was of an unmistakably volcanic character, different from anything that has appeared here since the Krakatoa sunsets, though not equal to those in splendour. Since that maximum, the colouring has been gradually lessening. Yesterday and to-day it was remarkably weak, the chief feature being the dust-wisps, which were more conspicuous than I have previously seen them during this apparition; indeed, I should have at first taken them for clouds had I not previously seen them in feebler form. They were plainest a little after sunrise and before sunset, when they were very bright and of a steely white.

The above descriptions apply to Sunderland; but in visits to Torquay from November 6 to 10 and to Dundee about December 1, the sky effects were not very different, only at Torquay I did not see the fiery orange.

Sunderland, December 16. T. W. BACKHOUSE.

P.S.—December 22. The fiery orange has reappeared.

The Methods of Investigating the North Sea Fisheries.

MANY of the readers of NATURE are interested in the international scheme of scientific investigation of the North Sea; but some at least are not convinced that the methods which are being employed are capable of yielding results of value as regards the condition of our fisheries.

The *essential* part of the scheme formulated at the conference at Christiania, at which the British delegates were Sir Colin Scott Moncrieff, Prof. D'Arcy Thomson, Mr. Garstang and Dr. Mill, is that each nation should fit out one or two specially equipped steamers, which should work along definite lines, and by means of which investigations as to the state of the fisheries, as well as hydrographical and biological investigations, should be conducted. The British Government agreed to participate in the prosecution of this scheme.

But it has been repeatedly pointed out that, if conclusions as to the fisheries are to be drawn from the work of these steamers, two assumptions have to be made.

(1) That the take per steamer or per capturing unit is a measure of the abundance of fish, and

(2) That samples taken from small areas are representative of adjacent districts.

Both these assumptions have been severely criticised, and we had hoped that before now Mr. Garstang would have fulfilled the promise made by him in his letter to the *Times* of April 14 of this year; when he said, in reply to certain criticisms made by others and myself, that he "could see no reason for anticipating the reply which in due course and in the proper place will be made to the real authors of the criticism he (*i.e.* the present writer) adopts."

It will be remembered, (1) that the criticism referred to is that made by the Inspectors of Fisheries in their Report for 1900 upon the method of estimating variations in the density or abundance of fish by variations in the take per capturing unit, which was employed by Mr. Garstang in his "Impoverishment of the Sea." (2) That that criticism was published at least eighteen months ago, and that it is still unanswered by Mr. Garstang.

It was expected that at the meeting of the British Association at Belfast he would have taken the opportunity of meeting these criticisms. But he does not seem to have done so. For in reply to a letter asking him if he could refer me to any published refutation of these criticisms, he writes under date December 8, 1902, "I am unable to refer you to any published replies by me to the 'criticism' you quote, other than the *Times* reports of the Belfast meeting of the British Association and the Grimsby Conference of the National Sea Fisheries Protection Association (September 30 and October 1)."

The summaries of his communication at Belfast in the *Times* of September 13 and that in the *Times* of October 1 of his remarks at Grimsby give no indication that he dealt with the criticism, a criticism which, if it is valid, renders the results of the investigations recorded in his "Impoverishment of the Sea" of no value, and—what is of greater importance—throws grave doubts on the results to be expected from the international investigations at present in progress.

The publication of the Report of the Departmental Committee on Ichthyological Research, which has just been presented to Parliament, must be looked forward to with interest, since the Committee must necessarily have given some expression of opinion upon the questions touched upon in this letter.

D. NOËL PATON.

22 Lynedoch Place, Edinburgh, December 14.

Carved and Perforated Antlers.

IN NATURE for November 20, p. 55, there is a reference to the probable use of the carved and sometimes perforated antlers, by some called "batons de commandement." By Mr. A. W. Franks and others, in the "Reliquiæ Aquitanicæ," the simpler forms are recognised as the "Pogamagan" (*striker*) of the North American Indian (pp. 40, 50, 189, 200, and pp. 30, 102, 159 and 180, of description of the plates iii. and iv., xv. and xvi., xxx. and xxxi.). It seems to me important to mention that in Westminster Abbey a Pogamagan is sculptured as being held in the right hand of a North American warrior on Colonel Townshend's mural tombstone (dated near the end of the eighteenth century), on the south side of the nave.

December 13. T. RUPERT JONES.

St. Elmo's Fire during Snow Storm.

[MR. W. N. SHAW, secretary to the Meteorological Council, has kindly forwarded to us the following letter received at the Meteorological Office.—EDITOR.]

IT may be interesting to your Society to know that we find in a report received from our local committee at Margate relative to the launch of one of our lifeboats there, viz. *Eliza Harriet*, on December 3 and 4, that it is stated that about 2 a.m. a bright light was observed on the top of each of the lifeboat's masts, also one on the lee foreyard, which remained quite three-quarters of an hour and lit up all the wire pennants, making them perfectly clear. The lights in question appeared to be of the size of a small lantern. At the time it was blowing very hard and a heavy sea was running, and during the whole time it snowed so hard that it was impossible to see a yard in front of the boat. These lights continued until nearly 4 a.m. and finally disappeared on the snow lifting. It could not possibly have been a reflection from any light on the lifeboat, as they had none showing. It seems to us that this was probably a case of St. Elmo's fire, occasionally seen in a highly electrified state of atmosphere. CHARLES DIBDIN, Secretary.

Royal National Lifeboat Institution,
Adelphi, London, W.C., December 12.

THE FARTHEST SOUTH.[1]

IT is with a feeling of disappointment that one learns that the name of Tierra del Fuego does not carry in it the tradition of the volcanic fires which, though once seen by man, are now nearly all extinct; but we are told that the name was given by Magellan because of the immense number of fires lighted by the native Indians to keep themselves warm or cook their food, or give notice of the approach of strange craft. All the descriptions of the country connect it in climate with Chili, the land of snow, as its native name implies, and give greater prominence to its glaciers and icebergs than to its one still active volcano.

Fitzgerald has given a fuller account of the exploration of the same region as that traversed by Sir Martin Conway, and the aspects of Nature which struck both these travellers we may regard as characteristic of the region.

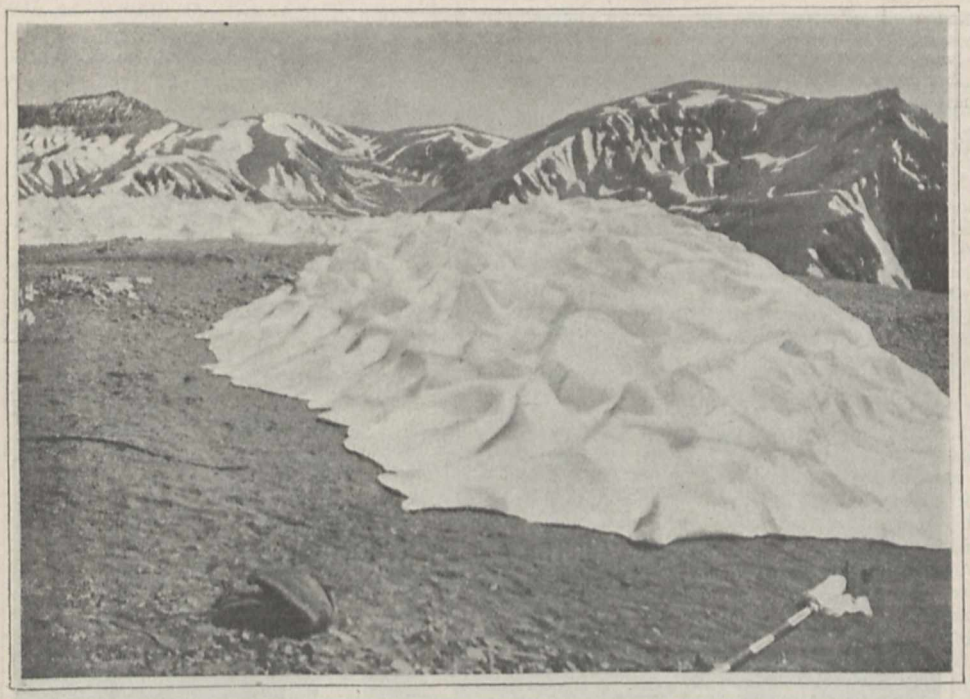

FIG. 1.—Nieves Penitentes in Process of Formation. (From Conway's "Aconcagua and Tierra del Fuego.")

Many of the accidents and incidents, often very untoward, which befell them both may be expected as inevitable accompaniments of exploration at great elevations, while others may be provided against when the traveller has realised what is before him and taken due precautions. Both watched the purple shadows creeping over the ocean, the gorgeous colours of the rocks and the deep blue of the ice. Both tell us of the rapidly rising torrent which carried off mule and man, of the glissade of the ponies down the steep talus of crumbling stone, of the struggle and recovery of the mule on the slippery rocks, of the frost-bitten guide, the mountain-sickness and other discomforts arising from impaired circulation and the want of constant supplies of warm and nourishing food, of the difficulties of the dense forest and spongy ground; and this similarity of experience and consensus of opinion warns the future traveller who may try those heights what to look out for and what to prepare for.

Sir Martin Conway's diary, in its description of details, gives a freshness and local colouring to the story; even his constant references to the weather, by which, in such cases, the best-laid plans are often thwarted, do, in spite of Mark Twain's grumble, help the reader to realise the nature of the enterprise. Perhaps this remark would apply less strongly to his introduction of unexplained Spanish or native words with which his readers could not be expected to be familiar. We certainly do feel that we are reading about a foreign country when we come suddenly upon alameda, alfalfa, arriero, or pejerey, peon and posado. They have their effect, like "that blessed word Mesopotamia"; but we lose the thread of the story if we do not know whether our traveller has arrived at a wayside inn or a position of equilibrium at the bottom of a crevasse.

Darwin, in the "Voyage of the *Beagle*," has described the features of this interesting region more especially from the scientific point of view; Sir Martin Conway often helps us greatly to realise the general effect by pointing out that it is like something nearer home which his readers would probably have seen.

It is an interesting region. The double range of the Andes carved into every variety of peak and valley is submerged at its southern end so that the deeper hollows have been invaded by the sea, which fills a long trough parallel to the coast-line and many a transverse channel. He compares it to the Norwegian and Alaskan inland steamboat routes (p. 141). The submerged mountains are attacked by air and ocean with almost ceaseless fury, and we learn that it is not always safe to assume, when we see the tops of a group of mountains all touching an approximately uniform level, that we have there the wreck of a sea-plain or, as some would call it, a plane of marine denudation or base level of erosion, out of which the separating valleys have been carved after its upheaval, for here we have an example of a mountain region being submerged and the heights during any stationary period being planed off to a uniform level, the valleys having existed previous to the submergence.

The mountains around still rise so high that their snows feed glaciers which descend to sea-level. Before the submergence, their greater ice-flows crept further out on to the lowlands and left traces of ancient glaciation far beyond its present limit.

How recent some of the great geographical and climatal changes of the southern end of the Andes are, we may learn from a comparison of what the glaciers of Sarmiento were like when Darwin visited the straits and the same glaciers as seen by Sir Martin Conway. In

[1] "Aconcagua and Tierra del Fuego." By Sir M. Conway. Pp. xii + 252. (London: Cassell and Co., Ltd., 1902.) Price 12*s*. 6*d*. net.

Darwin's time, they actually ended in the water, now they are cut off from the channel by belts of densely wooded moraine. The former greater extension of the ice is also shown by the way in which "the graceful ice-rounded foundation rocks of this and all the other mountains around slope up to the cliff and jagged arrêtes above" (p. 199), and proofs of oscillations of level are seen in the raised beaches and iceberg-carried boulders near Otway Water (p. 219).

Aconcagua (pp. 71, 72) towers into the sky, the grandest peak of the southern Andes. It appears to be built up of approximately horizontal beds of volcanic rock of different texture, hardness and friability, which are carved into steps like those which gave their name to the "trap" rocks of Sweden. The steps are better preserved towards the right- and left-hand sides of the slope than in the middle, where the downward drift of débris and the fall of avalanches are most common. The edges of the steps are there completely worn away and buried. The flow of débris down the face is such that the fragments tend to become rounded or subangular, like pebbles in a brook by their friction against one another. When he was descending the mountain, the stones at one point (about 20,500 feet up) poured away beneath his feet and disclosed the subjacent rock, which he perceived to be ground quite smooth by the passage of the débris over it.

Sir Martin gave some time to the examination of those curious remnants of great slipped or drifted masses of snow, the *nieves penitentes*, so called because they stand like devotees enveloped in shroud-like robes doing penance. They require peculiar conditions for their full development, and therefore, although somewhat similar pillar-like remnants of melting snow may sometimes be seen even in this country, they are not common anywhere in the Old World and only over limited areas in South America. They are cut out of avalanche snow which has been subjected to pressures roughly perpendicular to the direction of its fall, and thus hardened into approximately vertical strata of different densities. The wind has nothing to do with their origin, but they are carved out by the melting action of direct solar radiation. They are roughly elliptical and somewhat bent over to the north, the major axis of the elliptic sections being oriented east and west. On searching for *penitentes* in different stages of development, he found that a thick bed of well-compacted snow, when exposed to the action of the sun, soon becomes pitted over with little saucer-like depressions, and the deeper these become, the less power has the sun's rays upon their sides and the more upon the bottoms of the depressions. The hollows enlarging ultimately run into one another, leaving rough pyramids of snow standing up between them, until at last the ground is reached; the spires are entirely separated from one another and are seen standing about on the stony floor like separate sugar cones.

There is also a mountain called Penitentes (p. 108), from the weathered-out columnar structure of the rocks which form its summit, not unlike what we sometimes see in our strongly jointed Mountain Limestone or Millstone Grit.

Many other curious questions arise out of an examination of such an area; for instance, the great unconformity (p. 105); the inosculating valleys (pp. 127, 131); the landslips and rock creep, or rivers of mud and stone, similar to those described by Heim in Switzerland; the moraines modified by blown sand (pp. 55, 56).

So little has been done towards the exploration of those strangely varied and, for most people, inaccessible regions that we gladly welcome Sir Martin Conway's diary of his adventurous journey through southern Chili and Tierra del Fuega, and of his difficult climb and almost equally dangerous descent of Aconcagua and Sarmiento. T. McK. H.

FIG. 2.—Nieves Penitentes; the last stage. (From Conway's "Aconcagua and Tierra del Fuego.")

SECONDARY AND TECHNICAL EDUCATION.

NOW that the Education Act has become law, one of the first duties of the newly constituted local authorities will be to determine what are the educational needs of their districts and how far these needs are met by existing institutions; they will then be able to decide in what directions increased educational facilities are needed and how they can most efficiently provide what is wanted.

It is in the domain of secondary education that such a survey as is foreshadowed above is likely to form most

frequently the basis for a demand for a revision of the curricula of some of the schools in the district. Thus, in many of the administrative counties, we still have too many schools which devote a large amount of time to the study of classics, not because most of their pupils are best fitted for life by such study, but mainly because the school prepares each year a boy or two for Oxford or Cambridge. Wise county councils will probably decide to limit the number of classical schools within their counties, sending, by means of scholarships, the best boys capable and desirous of receiving a good classical education to one or more selected schools in the district. The remaining county grammar schools will, it may be hoped, be modernised and adapted to the needs of the bulk of the pupils attending them. In many, a strong agricultural side should be developed; in some, a good modern education should be given.

It will be asked, "What is here meant by a good modern education?" In the opinion of the writer, this should include English—taught much more thoroughly than is usually the case in grammar schools, where classics absorb the lion's share of the pupil's time—and mathematics, based on practical measurements and including a knowledge of geometry gained by methods more suitable for boys and girls than those set forth in Euclid's elements. German, taught by colloquial methods, should be a compulsory subject because the study of its grammatical peculiarities forms a mental training as useful as can be given through the medium of Latin or Greek, and because it is becoming increasingly difficult for one who does not know this language to follow the latest developments in either industry or commerce. French should also be taught where possible, but in cases where only one language can be learned, it should be German. Drawing would naturally form part of the course, and some suitable form of manual training, such as modelling or woodwork, should be introduced.

Above all, it is to be hoped that local authorities will discourage the pseudo-classical schools which have sprung up in the last two decades owing to the desire of some ancient grammar schools to meet the demand for the teaching of modern subjects while still devoting some portion of the school time to Latin. The result is—what might be expected—that neither Latin nor modern subjects are mastered; the pupil has a smattering of too many things.

Although a diminution in the amount of classical teaching is here advocated, it must not be supposed that the value of sound classical training is underestimated; where a pupil's time suffices for this as well as for the subjects he needs to enable him to earn his living, it is well that he should study Latin and, if possible, Greek. But in cases where the school life of a boy or girl is necessarily limited, it is much better that his or her mind should be trained through the medium of subjects likely to be of greater service in after life; above all, it is very doubtful whether a child obtains any substantial benefit from a classical training so imperfect that he remains unable to appreciate, or even to read easily, classical literature.

In the towns, the matter will be more complicated. Many local authorities will have to determine how best to deal with the higher grade board schools, where they exist. In each town, the problem will be different; where the towns are badly provided with secondary schools, it may be wise to convert the higher grade board schools into secondary schools, but, in such cases, they should not be allowed to strangle existing efficient secondary schools by providing education of the same kind as these schools offer, practically free of charge. If the circumstances of the town make it desirable that secondary education of a certain type should be offered free, then all the schools of this type should be placed in a position to offer the same terms to their pupils, so that such competition as exists will depend only on the relative efficiency of the teaching in the schools. On the other hand, in some towns the higher grade board schools have been competing needlessly with secondary schools in their neighbourhood. In such towns, the higher grade board schools can be converted into higher elementary schools, giving a training for the large number of boys and girls who must leave school at a comparatively early maximum age, say fourteen or fifteen. Indeed, as recent Parliamentary returns show, there are, in most higher grade schools, very few boys or girls above fifteen, except backward ones. The curricula of these schools should be materially altered; they are at present far too ambitious, having regard to the average age at which their pupils leave, and should be amended so as to include only that amount of work which can be satisfactorily covered, and the comparatively few pupils for whom the present curricula are devised should be transferred, by means of scholarships, to secondary schools.

One of the most fertile causes of the comparative inefficiency of some of the secondary schools in this country is the large number of examinations for which they find it necessary to prepare their students. Thus we have, not only the examinations of the Board of Education, but also the local examinations of the various universities, special examinations for the Army, the Navy, the Civil Service, different county and other scholarships, &c. It would be an enormous gain if, in place of all these various examinations, we had one State examination, on the results of which there would be issued a certificate, guaranteeing a good general education and recognised as qualifying for admission to the universities, the Civil Service, the Army, the Navy, &c. Unfortunately, enormous vested interests are opposed to such a plan, as the present system of indefinite multiplication of examinations finds employment for a large number of examiners and is stamped with approval by the action of the older universities, which have in recent years extended their system of local examinations so as to include quite young children; *e.g.*, the maximum age for admission to a so-called "honours" class in the preliminary local examination of the University of Cambridge is fourteen!

Assuming that a suitable basis for technical education has been made by the provision of an adequate number of secondary schools, it will then be necessary to consider what technical institutions are needed in the district. This will, of course, depend largely on the nature of the industries which exist in particular neighbourhoods. In many administrative counties, the only technical institution needed will be an agricultural college, and for some counties a share in an agricultural college would suffice. In other administrative counties, provision must be made for proper technical instruction in such subjects as coal mining, metallurgy, fisheries, &c. But, as a rule, the county will find much of what it wants in the large technical colleges already existing in the great cities within, or adjacent to, the geographical borders of the county.

In many of the smaller county boroughs, there are already technical schools providing evening classes for artisans; in the remainder, such evening classes might not infrequently be provided in connection with the modern secondary school of the place. In large cities, which are great centres of population, a first-class technical institution will be needed, providing not only evening classes but more especially instruction for adult day students on a par with that given in Germany and the United States. This can only be done effectively by concentrating in one institution for each district either all the higher technical education or, at least, the highest part of such education in a certain number of branches of technology and commerce. For it is only in institutions with numerous pupils that it is economically justifiable to provide the expensive equipment needed for such work

and the large number of highly paid specialist teachers who ought to be employed therein.

At present there is no technical institution in the United Kingdom which is staffed on a scale even approximately equal to that of such foreign institutions as the Charlottenburg Technical High School, Berlin, and the Massachusetts Institute of Technology, Boston. In these magnificent technical high schools, in place of two or three professors, *e.g.*, of engineering, we find a very large number of highly qualified men, each dealing with some special branch of engineering knowledge, and this can be economically done because of the very large number of engineering students gathered together in one institution. In this country, at present our comparatively few adult engineering day students are scattered among a relatively large number of institutions; as a result, such far-reaching subjects as electrical engineering have to be entrusted to a single professor. Indeed, there are some technical colleges in which there is only one professor of engineering, and electrical engineering is in charge of a poorly paid assistant lecturer.

To remedy this, coordination of work is necessary, not merely within the great towns, but even between neighbouring educational authorities, which are not infrequently jealous of one another and pursue their work regardless of what is going on around them. Hence we have cases of towns within easy reach of one another where technical institutions have been established, each of which tries to do the highest possible work in all the subjects which it undertakes. The result is a small number of students in each subject in each town and a staff of teachers proportionate, it is true, to the number of students, but inadequate for the purposes of advanced technical education. It would be well, therefore, if power were given to the Board of Education to select a limited number of central institutions where alone higher technical education in the day-time should be given.

Liberal financial aid will be needed to place such institutions on a satisfactory basis, and as they will be national rather than local institutions, a large part of the money for their support should be provided from the imperial exchequer; the remainder should be contributed by the various local authorities in the districts which they serve.

Another important matter which must be determined is the relation of institutions providing the highest kind of technical training to the universities or university colleges in the same district. The best solution of this problem in such a case as, *e.g.* Manchester would be for the technical institution to absorb all the higher technical work of the city and for the university college to devote itself to the faculties of theology, literature, philosophy, medicine, law, pure science, music, &c. Where local universities are established, the technical institution would become the faculty of technology and commerce; it should not be subjected to the academic control of the university, which might tend to destroy its usefulness for industrial and commercial purposes.

The great technical institutions of Germany and America exist side by side with important universities; they are, however, independent of these, and it is partly to this fact that they owe their usefulness in promoting the industrial progress of the German and American nations.

An important problem for the new local educational authorities will be the training of teachers of trade subjects. It is easy to find men with a good knowledge of their respective trades, or persons who can teach well, with a superficial knowledge of an industry, but the combination of these qualifications is comparatively rare. It is not easy to see how this can be speedily remedied, but an improvement might be produced by arranging a higher scale of remuneration for teachers of trade subjects who had passed examinations giving evidence of their power to explain in simple language matters connected with their own industry. More than this it is probably impossible to demand at present.

As regards the more highly qualified teachers needed for adult day classes in technical institutions, one of the greatest difficulties is how best to keep such men in touch with their respective industries. If the teacher's whole time is not required for the work of the institution, he can remain in contact with the industry by doing consulting work and by research. Unfortunately, in such cases there is often a tendency for him to regard his teaching work as the least important part of his occupation; in fact, one has known cases where the principal value of such a teacher to his students has been the fact that his name was well known in the industry and his recommendation consequently a valuable one, though his actual teaching work was of a merely nominal character. The cure for this would be to make the pay which the teacher receives for teaching by far the largest part of his income; such an arrangement would, however, mean a considerable increase in the salaries of teachers of technical subjects, but, in the opinion of the writer, it would be justifiable, as it would make it possible for some of the best men to continue teachers; at present, such men are attracted to the industries by the incomparably larger financial prizes which they offer.

J. WERTHEIMER.

PREVENTION OF RABIES.

A LETTER headed "Mr. Hanbury admits the failure of the muzzle" has been addressed to us by a member of the executive committee of the National Canine Defence League, which letter, as might be expected, urges in so many words on behalf of the canine species the total abolition of the muzzling order at all times and under all conditions. The writer of the letter vindicates for himself, as might also be expected, a superior knowledge concerning rabies, its nature and its mode of spread; he, as a matter of course, is one "who understands dogs" and considers "that the muzzle was from the first condemned as useless cruelty." According to this authority, the Board of Agriculture, including, we presume, its veterinary department, "itself ignorant of dogs and their diseases, has persistently refused to be advised and guided by those who do possess the requisite knowledge" (*sic!*).

To be serious, it is no new thing that there never is any lack of amateurs who, notwithstanding the obvious want of special knowledge required to form an opinion, are in their own estimation quite capable of judging of the merits or demerits of a question that can be only dealt with adequately by the specialist possessed of the requisite knowledge.

Rabies is an infectious disease, directly communicated by the bite of a rabid animal, in the vast majority of cases a rabid dog. In the interest of the animals themselves—all domestic animals are susceptible to the disease—and above all in the interest of human beings, the disease should be, and as a matter of fact has been, controlled, checked and prevented from spreading by the thorough, not half-hearted, carrying out of the muzzling order: that is, the slaughter of ownerless and stray dogs—the most dangerous because the most frequent means of contagion—and by the muzzling, not merely the pretence of muzzling, of all dogs, so as to include also those that may and sometimes do harbour the contagium before the actual disease has fully declared itself in them. Such is the practice, the only rational practice, which is followed, and successfully followed, in other countries at times when rabies makes its appearance. The private opinion of Mr. Hanbury or any other politician on this subject, and the complaint that—owing, most probably, to the loose and half-hearted manner of

administering the muzzling order—rabies has not been stamped out in Wales, does not touch the real merits of the question.

Mr. Long, the former President of the Board of Agriculture, who has proved himself thoroughly well instructed in the whole question of rabies, has with laudable firmness resisted the outcry and the repeated assaults of the uninstructed sentimentalists, and as a result was able to demonstrate that by the strict carrying out of the muzzling order rabies in England was checked and was almost reduced to extinction, though at first it was so prevalent as to be really alarming. It seems hopeless to discuss this or any other dog-question with people who, in the face of all expert opinion as regards prevention of rabies, and particularly against the opinion of sensible owners of dogs, can write that "the muzzling order and the muzzle are a gross and wanton cruelty to animals."

But even if it were not an exaggeration, as we are persuaded it is, that the owners of dogs in general object to the muzzling order and consider it a cruelty to animals, what about the human species? Human beings who are not members of the executive committee of the National Canine Defence League regard the muzzling order as an important safeguard. One of the duties of the State is to protect the health and lives of its citizens. Hydrophobia of man is one of the most terrible diseases, and the slaughter of stray dogs and the muzzling of all dogs in places where rabies is rife has been proved to be at present the best and only means to prevent the spread of the disease to man. Besides, it should be the interest of owners of valuable animals to insist on the retention and strict carrying out of a measure which to a very large extent insures against the spread of rabies and consequent loss—seemingly of indifference to the members of the Canine Defence League.

RECENT WORK OF THE GEOLOGICAL SURVEY.

THE Report referred to below[1] shows that the Geological Survey continues with activity and success its investigation of the geology of these islands. It bears witness to a large amount of steady and useful routine work, which may not make much show, but which will contribute to our knowledge of the detailed structure of these islands and in some instances will have direct economic usefulness. Among the more interesting scientific results of the year's work, the progress of the re-examination of Cornwall has brought to light evidence of a younger granite than the main mass of that rock, showing that the granitic intrusions form a somewhat more complex series than had been supposed. The clue, however, to the detailed structure of the so-called "killas" and the boundaries between the true Devonian and older rocks still eludes the keen eyes with which the surveyors are searching for it. If we could hope that the appointment of a mining geologist would do anything towards reviving the decayed mining industry of the region, we should still more rejoice in this increase to the strength of the staff. Another of the problems which for years past has baffled the officers of the Survey is that of the Old Red Sandstone of South Wales. They are still unable to draw any satisfactory line between the lower and upper divisions of the system. If the key is not found before the western coast is reached, we can hardly hope that it will be discovered in any part of this region.

Some interesting discoveries were made during the year in Scotland. Foremost among these is the finding of proof that the granite of south-west Argyllshire has invaded and altered a portion of the Lower Old Red Sandstone series of Lorne. The importance of this new fact lies in its relation to the history of the metamorphism and igneous protrusions of the Scottish Highlands, for it shows that some of the granitic masses, like those of Galloway and Leinster, are certainly post-Silurian in age. Another notable "find" is that of the zone of *Pecten asper* in the island of Scalpay and of Upper Cretaceous rocks in the sound of Soay.

In Ireland, the energies of the Survey are now concentrated on the Drift, with the view of preparing accurate maps of the superficial deposits of the country. But under Mr. Lamplugh's direction, the geological interest of the glacial geology is not likely to be lost sight of. One of the features of the work in the Dublin district was the finding of evidence which seems to support the view that the eskers represent water-channels which existed under the ice-sheet.

A new arrangement has been made in this Summary. Its materials are grouped by districts instead of, as formerly, by formations. The change will no doubt save trouble in the preparation of the volume, but it gives a great deal more to the geologist who wishes to ascertain what additions to our knowledge the Survey has been able to make in any particular part of the geological record. Another change is the omission of the Director's name from the book. It surely cannot have been the wish of those who wield the new brooms at South Kensington to sweep Mr. Teall's name clean out of his Report.

[1] "Summary of Progress of the Geological Survey of the United Kingdom and Museum of Practical Geology for 1901."

PROF. P. P. DÉHERAIN.

DÉHERAIN (b. 1830, d. 1902), who in 1887 succeeded to Boussingault's place in the Académie des Sciences, was, for the last twenty-two years of his life, professor of vegetable physiology as applied to agriculture at the Muséum in Paris. His early work was chiefly agricultural, and included researches on calcium phosphate, on the salts of potassium, &c.; he was author of a "Cours de Chimie agricole," and it should not be forgotten that he founded the *Annales agronomiques*. In the region of pure physiology, he was author of a number of memoirs, of which those written in collaboration with Maquenne, Moissan and others are perhaps especially well known. He worked at gaseous interchange, including the absorption of oxygen by succulents and by oily seeds, also at the assimilation of CO_2, being especially interested in the action of the different parts of the spectrum on this process. His researches extended to other subjects, such as transpiration, the assimilation of free nitrogen and denitrification.

A sympathetic appreciation of his personal character and of his career as a teacher is given by his former pupil, Maquenne, in *La Nature* of December 13, to which we acknowledge our indebtedness. Although Déherain's name is not associated with any great discovery, he deserves the place he won for himself in the annals of plant-physiology and the honour due to one who dies in harness. F. D.

TRANSATLANTIC WIRELESS TELEGRAPHY.

MR. MARCONI'S latest success is a wonderful achievement. Messages have been exchanged in both directions across the Atlantic, between his two new stations at Glace Bay, Cape Breton, and Poldhu, Cornwall. Transatlantic wireless telegraphy has thus been successfully established; and the persistent effort which has enabled this result to be accomplished merits the fullest recognition. The messages which we print from the *Times* represent the inauguration of a system of

communication which is not only of the highest scientific interest, but also of practical importance.

The following messages and particulars referring to them appeared in the *Times* of December 22 and December 23 :—

Ottawa, December 21.

The first message to be sent across the Atlantic Ocean by wireless telegraphy was despatched to-day to King Edward by Lord Minto. Notice of its successful transmission was received to-night by the Governor in the following message :—

"Glace Bay, Cape Breton.

"I have the honour to inform your Excellency that your message to his Majesty has now been transmitted by me from Cape Breton to Cornwall by wireless telegraphy, and has been forwarded to its destination.—G. MARCONI."

Lord Minto replied as follows :—

"I am delighted at your message, which I have just received. My warmest congratulations on your spendid success."

December 22.

King Edward has replied to Lord Minto's telegram sent to His Majesty by Signor Marconi's apparatus, as follows :—

"I am much interested by the wireless message which you have sent me, and am delighted at the success of Signor Marconi's great invention, which brings Great Britain and Canada into still closer connection.—EDWARD."

On Monday, the *Times* published the following message from its correspondent at Glace Bay :—

"Being present at its transmission in Signor Marconi's Canadian station, I have the honour to send through the *Times* the inventor's first wireless Transatlantic message of greeting to England and Italy."

The following message, also transmitted by wireless telegraphy, was published on Tuesday :—

The Government of Canada, through the *Times*, desires to congratulate the British people on the accomplishment by Marconi of the greatest feat which modern science has yet achieved.

"CARTWRIGHT, Acting Premier,
"Ottawa, December 21."

NOTES.

THE King of Denmark has conferred upon Lord Lister the honour of Knighthood of the Grand Cross of the Order of Dannebrog.

M. DARBOUX, permanent secretary of the Paris Academy of Sciences, has been appointed a member of the Bureau des Longitudes in succession to the late Prof. Cornu.

Mr. C. A. ANGOT, of the Bureau central météorologique de France, and Prof. W. L. Moore, of the United States Weather Bureau, have been elected honorary members of the Royal Meteorological Society.

THE council of the Manchester Literary and Philosophical Society has awarded the Wilde gold medal for 1903 to Prof. F. W. Clarke, of the United States Geological Survey, and a Dalton medal to Prof. Osborne Reynolds, F.R.S. In view of the fact that next year will mark the centenary of the discovery by Dalton of the atomic theory, Prof. Clarke (whose writings on the atomic weights are well known) has also been invited and has consented to deliver the Wilde lecture for 1903. The presentation of the medals and the delivery of the lecture will probably take place in May, 1903.

AT the general meeting of the Zoological Society of London on December 18, it was announced that Mr. William Lutley Sclater had been selected by the council out of twenty-two applicants for the vacant post of secretary. Mr. Sclater is now director of the South African Museum, Cape Town, and has previously held appointments as science master at Eton and as assistant director of the Indian Museum, Calcutta. He is a well-known authority on the mammals and birds of India and Africa, and on other zoological subjects, and is at present editing a series of volumes on the fauna of South Africa, of which four have already been published.

WE regret to record the death, on December 13, of Dr. John Young, late professor of natural history in Glasgow University since 1866.

THE death is announced of Prof. Zaayer, professor of anatomy in the University of Leyden. The death is also announced of Prof. Leonard Landois, professor of physiology at the University of Greifswald (Pomerania).

MR. T. BRICE PHILLIPS, of Uckfield, has been awarded the prize of fifty pounds, together with a silver medal, offered by the council of the Society of Arts for his essay on "Existing Laws, By-laws and Regulations Relating to Protection from Fire, with Criticisms and Suggestions." Prizes of ten pounds with a bronze medal have also been awarded to Mr. George H. Paul and to Dr. W. C. Henderson.

IT is announced in *Science* that the Section of Geology and Geography of the American Association for the Advancement of Science, which will meet at Washington on December 27, has arranged to devote a session of the meeting to the discussion of the recent eruptions of Mont Pelée and La Soufrière by Messrs. Russell, Hill, Heilprin, Jaggar, Curtis and Hovey, who visited the islands of Martinique and St. Vincent a few months ago.

THE Coats family have given 10,000*l.* between them to the cancer research scheme, 5000*l.* being from Sir Thomas Coats and family, and 5000*l.* from Mr. Archibald Coats and his two brothers. The *Times* states that a few more such contributions would bring the fund up to the required amount, and would enable the investigations to be carried through on the comprehensive lines indicated in the scheme which was formulated and is being directed by the Royal Colleges of Physicians and Surgeons.

A REUTER message states that at 9.30 a.m. on December 16, Andijan, in the province of Fergana, Russian Central Asia, was totally destroyed by an earthquake. Andijan is a town of about 50,000 inhabitants. According to a rough estimate, 16,000 houses have been destroyed and 2500 persons killed as a result of the earthquake. Subterranean rumblings and tremblings of the earth continue. At New Marghelan, the capital of Fergana province, the shock lasted nearly three minutes. The direction was from north-east to south-west.

A TELEGRAM to the Paris *Petit Journal*, dated December 17, states that for several days past Mount Vesuvius has been throwing out rock masses, vapour and dust.

WE learn from the *Times* that news has been received at Stockholm that the Swedish Antarctic exploration ship *Antarctic* left Tierra del Fuego at the beginning of November on its second summer expedition. It was expected that the expedition, after some cartographic work and natural historical research in the northern and western portions of the Dirck Gerritz Archipelago, would arrive about December 10 at the winter quarters in Snow Hill Land, where Dr. Nordenskjöld would resume the leadership of the entire expedition. The *Antarctic* will probably return to Port Stanley (Falkland Islands) at the end of February or the beginning of March.

IN the House of Commons on December 16, the President of the Board of Trade was asked whether he was aware that three dangerous varieties of colour-blindness escaped detection by the Board of Trade test, whilst many normal-sighted persons were rejected by it. In reply, Mr. Gerald Balfour said the present

system was adopted on the recommendation of a committee appointed by the council of the Royal Society, and that the Board of Trade in doubtful cases had the assistance of the gentleman who acted as secretary to the committee. The President of the Board of Trade said he did not think there was any necessity for a small departmental committee to reconsider the test in the light of recent discoveries, as had been suggested.

MR. FRANCIS WATTS, Government Analyst and Agricultural Chemist for the Leeward Islands, sends us from Antigua the following particulars of recent high tides received from correspondents in various neighbouring islands, and possibly connected with changes due to the late volcanic disturbances:—*Barbuda.* During the month of October and early in November, the tide was abnormally high, the rise being from 18 inches to 2 feet above the ordinary. Old inhabitants do not remember a like rise, except perhaps in a severe gale such as a hurricane, and then only for a short time.—Oliver Nugent. *Nevis.* Tides unusually high for eight or nine days, commencing about November 1.—R. B. Roden. *Dominica.* Tides unusually high for few weeks ending November 12, the level being constantly at about high-water mark. No determination had been made whether this was caused by high tides or change of level.—W. H. Porter. *Tortola.* Tides much higher than usual—a fact generally commented upon and noticed while bathing. No exact observations made, but the difference could safely be put down as a foot in depth.—Dr. Cookman. Referring to these records, Mr. Watts remarks, "Of course, it may turn out that there has simply been an abnormally high tide throughout the Leeward Islands, but so far the tide does not seem to have returned to its normal height. Observations will be continued and submitted from time to time. It will not be a very easy matter to determine if there have been slight changes of level, particularly in places where the shore is very steep, as it is in many of the islands of volcanic origin."

AN aëronautical problem of some interest, and of far less difficulty than the problem of artificial flight, is the performance of journeys across the sea in a balloon. In *La Nature* for November 15, Lieut.-Colonel G. Espitalier gives an illustrated account of M. Henri Hervé's balloon, the *Méditerranéen* No. 2, and the methods adopted for directing it at sea. In order to prevent the balloon from being depressed by a shower of rain, its top part terminates in a cone. Instead of trailing a single guide rope, M. Hervé proposes a system of "triangulation," consisting of a trailer floating at the end of a long rope behind the balloon, and a balance weight hanging in the water by a nearly vertical and shorter rope, the resistance of the latter body being necessarily smaller than that of the former. The sea itself furnishes an inexhaustible supply of ballast, and this can be drawn up into a cylindrical reservoir suspended above the balance weight, a suction hose being used for filling the reservoir when required. This "compensator" is fixed near the surface of the water. M. Hervé employs two deviators for diverting his balloon by the action of the water, one, which he calls a "minimum deviator," for angles of about 30°, and the other, the "maximum deviator," for angles which are alleged to reach as much as 70° or 80°. M. Hervé first experimented in this direction on the North Sea in 1886, and last year he transferred the seat of his operations to the Mediterranean.

IN a message from Buenos Ayres, a correspondent of the *Times* states that Mr. Reginald Rankin made the ascent of Aconcagua alone on December 14, having been deserted by his native guide. Being caught by a snowstorm, Mr. Rankin spent the night in the open at 22,000 feet, and on December 15 walked and rode continuously to Puente del Inca, a journey of 12½ hours, with frostbitten hands and feet. His toes have had to be amputated, but his fingers will probably be saved.

UNTIL recently, a rule has been in force in the Lahore Veterinary College prohibiting *post-mortem* examinations of cows or pigs or any other "sacred or prohibited animals." We learn from the *Pioneer Mail* that the principal has subjected the carcass of a bull to examination for educational purposes and has declared that in future the thing will be done as a matter of course. The Bengali Press is indignant and prophesies the most dire results to British rule if the practice is continued, but it is difficult to see how veterinary surgeons can be trained satisfactorily without practical dissection of the kind to which objection is taken.

IN our correspondence columns of December 4 (p. 103), under the title "Germs in Space," the suggestion was made that the dust which reaches the earth from space may contain living as well as dead matter. Mr. John Munro writes to say that in the "Bijou" biography of Lord Kelvin, published some time ago, the same view is expressed in the following passage. The passage runs (p. 81):—"Nay, it seems rather a crude hypothesis, for the seeds of life may be floating like meteorites in space and ready to sow the crust of a new and virgin planet."

DR. H. HERGESELL, President of the International Aëronautical Committee, states that the results hitherto obtained from the monthly balloon ascents have justified in every way the continuation of the experiments, and that it is proposed to continue them during the year 1903. During the current year, about 110 registering balloons and 52 manned balloons have been sent up. In addition, kites have been regularly employed in Europe and Boston, U.S.; on two occasions, they were also flown from steamers on the Lake of Constance. The complete results for the year 1901 will be published shortly, and those for 1902 are also in the press.

SEVERAL interesting articles of a semi-scientific nature appear in the Christmas number of the *Gardener's Magazine*, notably the description by Mr. J. Yeld of a climbing tour through the south-western Alps, and a historical account of the gardens at Hampton Court by Mr. G. Gordon. A calendar for the new year is included in the issue.

AN investigation into the causes of larch and spruce fir canker, by Mr. George Massee, forms the subject of a publication by the Board of Agriculture. The fungus which generally attacks the larch is *Dasyscypha calycina*, and an allied species, *Dasyscypha resinaria*, is mainly the source of trouble in spruce canker; but these species are not easily distinguishable except to the expert. These two forms are not confined to the larch and spruce, but they may attack certain pines and firs, while other species also are destructive to coniferous trees. Mr. Massee confirms Hartwig's conclusions that they are wound parasites and finds that aphides are frequently the cause of trouble, although late frosts, which induce rupture of the bark and consequently extrusion of sap, are also a source of danger. Seedlings and young trees may be protected by spraying, but in the case of older trees the disease cannot be eradicated.

A HISTORY of systematic botany prior to Linnæus is given by Dr. B. Schorler in the *Sitzungsberichte* of the "Isis" Society of Dresden. To Aristotle is attributed the commencement of the study of botany as a branch of science; Theophrastus observed about 450 plants, Dioscorides about 800. According to Dr. Schorler, the earliest herbariums now extant are those of Aldrovandi in Bologna, Girault in Paris, Caesalpini in Florence, Hernandez in Escurial (Spain), Rauwolff in Leiden, Harder in Ulm, Ratzenberger in Cassel, Caspar Bauhin in Basle and von Burser in Upsala.

IN a series of articles upon the dissociation of matter, which have been published in some of the recent issues of the *Revue Scientifique*, M. Gustave le Bon gives an interesting account, partly historical and partly descriptive, of the experiments

performed by himself and others on radio-activity, and of the theories which have been based upon them. The final conclusion at which he arrives is that kathode rays, X-rays and all the various phenomena of radio-activity appear to be particular aspects of a new form of energy which is as common in nature as electricity or heat, and the closer study of which may reveal to us a connecting link between matter and energy.

WE have received a copy of vol. xvi. of the *Journal* of the College of Science of the Imperial University of Tokyo, which contains a number of interesting contributions on electrical subjects. The first of these, from the pen of Mr. Y. Homma, discusses some of the observations on atmospheric electricity made at the Central Meteorological Observatory of Japan, dealing more especially with the effects of wind, fog, rain and snow on the atmospheric potential. The remaining papers, six in number, are contributed by Prof. Nagaoka, Mr. K. Honda and others, and all deal with magnetostriction and other allied phenomena in ferromagnetic substances. Those interested in the subject may be referred to these papers as containing the records of much valuable experimental work.

REFERRING in these columns a few weeks ago to the manufacture of apparatus from vitreous silica, the hope was expressed that our manufacturers at home were not going to be left behind in the application of this art. We have since learnt that Messrs. Baird and Tatlock have been manufacturing silica vessels by Mr. Shenstone's process for the past eighteen months and are prepared to make a variety of apparatus to specification.

THE Paris correspondent of the *Times* states that an automobile system is to be tried on the lines of the Paris-Lyons-Marseilles Railway. The trial trip is to be made by three cars next June from Paris to Dijon, and it is hoped to cover the 300 kilometres in a little more than three hours, or at an average rate of about sixty miles an hour. Each car is to be of the same size as an ordinary corridor carriage and capable of seating forty passengers; the petroleum engine is at the front of the car. The cars are to be built by Messrs. Gardner and Serpollet and will have the same weight as a corridor carriage. At present it is only intended to try the system for passenger traffic, but if it is successful it will doubtless be widely extended. It is also announced that a similar system is to be tried on the North-Eastern Railway between Hartlepool and West Hartlepool, where there is keen competition between the railway and the tramway. These cars are to carry a petrol engine driving a dynamo which will generate electric current for the actual driving motors.

A BRIEF description of the laboratories recently fitted up for electrochemical analysis at the Chemical Institute at Nancy is given by M. Arth, director of the Institute, in *l'Éclairage Électrique* for December 13. There are two rooms, one of which serves as a balance and apparatus room, the other containing the working benches. The laboratory proper is fitted up with two double tables each capable of accommodating eight students and a single table having room for two more. Each student has at his disposal two sets of leads, which can be connected to a supply of suitable voltage, a rheostat, and terminals by means of which an ammeter and voltmeter can be put in circuit. There is one ammeter and voltmeter provided between the four students working at the same side of the table, so that they have to make their measurements in turn, but these are so connected that the measurements can be made without interrupting the circuit. Extra terminals are, however, provided, by means of which additional apparatus can be connected in circuit. The circuits are purposely so arranged that the operations are not made too automatic, but the student has to understand what he is doing each time he makes a connection or a measurement. A full set of platinum electrodes, dishes, &c., completes the equipment.

THE river terraces in New England form the subject of an essay by Prof. W. M. Davis (*Bulletin* Museum Comp. Zool., Harvard College, vol. xxxviii.). He discusses the formation of terraces in valleys occupied by drift, and urges the importance of studying them in plan as well as in section. He points out that they may be accounted for, firstly, by the behaviour of a meandering and swinging stream, slowly degrading the valley deposits; and, secondly, by the control exerted here and there over the lateral swinging of the stream through the opening up of previously buried rock-ledges. The effects of uplift on the formation of terraces and rock-platforms are duly considered.

A MEMOIR on the geology of Lower Strathspey, by Mr. L. W. Hinxman and Mr. J. S. Grant Wilson, has been issued by the Geological Survey. The region described, which is in the counties of Elgin and Banff, is formed mainly of igneous and metamorphic rocks with a considerable area of Old Red Sandstone. The metamorphic rocks include granulitic schistose rocks of the Central Highland or Moine schist type, and various quartzites, schists and limestones with associated igneous rocks, grouped as the Banffshire series. To this series the foliated granites belong, while of later date is the great granite mass of Ben Rinnes and the Convals, which forms the dominant feature of the district. The petrography is dealt with by Dr. Flett. Two divisions of Old Red Sandstone are noted, the Middle or Orcadian and the Upper, and between these there is unconformity, as the Upper Old Red Sandstone rests on the basal conglomerates of the Orcadian series and extends on to the crystalline schists. Dr. Traquair contributes an interesting note on the general distribution of fishes in the Old Red Sandstone, observing that there are "three distinct fish-faunæ," while Mr. Kidston, in a note on the fossil plants, remarks that they also show a clearly defined threefold division of this formation. Glacial drifts extend over much of the ground, with the exception of the higher hill tops, and they present many features of interest.

A SUPPLEMENTARY list of lantern slides, recently issued by Messrs. Newton and Co., contains particulars of many slides of scientific interest. Among the subjects of slides suitable for science lectures or lessons are British reptiles and other animals, photographed from life by Mr. D. English; butterflies and moths; trees and plants; photographs of ripples on mercury and water, by Dr. J. H. Vincent; sound waves, by Prof. R. W. Wood; and photomicrographs by Dr. Spitta to illustrate the morphology of the malarial parasite.

IN the November number of the *Field Naturalist's Quarterly*, Dr. G. Leighton reopens the question of adders swallowing their young. Although he is unable to cite any definite instance of the occurrence of the phenomenon, he shows that some of the objections which have been urged against it are based on a misinterpretation of anatomical facts, and demonstrates that there is nothing inherently impossible in its taking place. As the gullet of an adder is perfectly capable of containing the body of a field-mouse, and as frogs are known to live for a considerable time after being swallowed by snakes, there is no reason why young adders should not be swallowed by their parent without being killed. The question remains, however, to be proved by positive evidence. "Of the possibility of the phenomenon," writes the author, "we have not the slightest doubt, of the probability of it we have considerable doubt."

WE have received from the publisher, Herr G. Fischer, of Jena, an interesting pamphlet by Prof. Max Weber, of Amsterdam, entitled "The Indo-Australian Archipelago and the

History of its Fauna." In a previous essay, the author has adduced evidence to show that Celebes should be referred to the Oriental rather than to the Australasian region, the Moluccan Channel, and not the Macassar Strait, forming the division between the two areas. In the present communication, he endorses the opinion that marsupials and monotremes reached Australasia from Asia. According to the author's view, in pre-Tertiary—very likely Cretaceous—times Australia was united by land with Asia. A Euro-Asiatic fauna inhabited this land, from which during the Eocene a southern portion was cut off by partial submergence, this southern portion being the modern Australia and New Guinea, the home of monotremes, marsupials and ancient forms of other groups, such as cassowaries and birds-of-paradise, while widely distributed specialised types are wanting. Northwards extended a coral-sea, in the islands of which dwelt primitive rodents, insectivores and other ancient groups, with perhaps cuscuses. During the Miocene, great changes of level took place in the Archipelago, which attained its present form in the Pleistocene. Celebes was insulated early, Java late. Intermittent land-connections took place, which allowed of periodical immigrations of Asiatic forms from one side and of Australian types from the other. The question is left undecided whether the cuscuses of the Austro-Malay islands are remnants of the primitive Euro-Asiatic fauna or later immigrants from Australia. The suggestion is also made that the Australian and Philippine rodents are relicts of the original pre-Tertiary fauna, although it is admitted that the specialisation of Hydromys is against this. The author fails to see any evidence in favour of a former connection of Australasia with either South America or Antarctica.

THE Rev. George Grenfell, of the Baptist Missionary Society, has constructed a map of the Congo River between Leopoldville and Stanley Falls from running surveys made during 1884–89 in the steamers *Peace* and *Goodwill*. The map is in ten sections, two on a sheet, and the five sheets are published in a convenient case by the Royal Geographical Society. A reprint of Mr. Grenfell's article, "The Upper Congo as a Waterway," which was printed in the *Geographical Journal* for November, 1902, accompanies the map and serves the purpose of explanatory notes.

THE "Englishwoman's Year Book and Directory, 1903," shows in a most convincing manner the ever-increasing part that women are taking in the work of the world. The editor has again obtained able assistance in the preparation of many of the sections, those dealing with science, medicine and education being typical instances. The original work in science done by women workers, a list of colleges where women may study, the names of women holding college appointments, and a list of scientific societies of which women may be members, are some of the subjects included in the science section.

THE issue for 1903 of the well-known annual biographical dictionary, "Who's Who," is considerably larger than previous editions, though all the preliminary tables which have appeared in former years have been removed, except that enumerating the members of the Royal family and the obituary for the year ending September 30, 1902. As usual, prominence is given to the biographies of men who have distinguished themselves in various branches of science, whether pure or applied, and the information is generally trustworthy as well as interesting. The annual is one of the few which can justly be termed indispensable books of reference.

A TRANSLATION, by Prof. J. D. Everett, F.R.S., and Miss Alice Everett, of Dr. H. Hovestadt's "Jena Glass and its Scientific and Industrial Applications," which was reviewed in our issue for December 20, 1900, has been published by Messrs. Macmillan and Co., Ltd., at 15*s*. net. With a view to make the book as clear as possible to English readers, the translators have given the spirit rather than the letter of the original, and they have, in cases where it seemed desirable, added brief explanations, which are always distinguished from the text. Some few matters of subordinate interest have been condensed. The details of an important application of science to industry will, by the aid of this translation, now be accessible to British students and opticians unfamiliar with the German language.

THE permanent seismological commission appointed two years ago by the Imperial Academy of Sciences of St. Petersburg has recently issued its first report, a quarto volume of more than two hundred pages. Most of the papers are written in Russian, and only one of these is accompanied by a summary in French. Several communications deal with the foundation of the International Association of Seismology at Strassburg in 1901; in others, Prof. Lewitski describes experiments with simple seismoscopes and with seismographs the movements of which are registered mechanically. The president of the commission considers the theory of the horizontal pendulum and Mr. B. Galitzin that of other seismographs, the latter erroneously attributing Darwin's bifilar pendulum to Davison. General Pomerantzeff contributes an examination of the seismogram traced at Strassburg on June 24, 1901, and concludes that it is extremely difficult to explain the oscillations of horizontal pendulums during earthquakes either by tilts of the ground or by horizontal displacements alone, although they might be produced by a combination of such movements.

A SPECIAL report on the mineral waters of Kansas has been made by Mr. E. H. S. Bailey, with the assistance of Messrs. E. B. Knerr, Crane and McFarland, for the University Geological Survey of Kansas, which is conducted under the authority of the Board of Regents of the University of Kansas. The volume runs to 343 pp. and is divided into two parts; the former provides a discussion of the subject of mineral waters in general, while the latter arranges and classifies those of Kansas and supplies full analyses of a great number of samples of them. Many illustrations and one or two maps add to the value and interest of the report.

OUR ASTRONOMICAL COLUMN.

COMET 1902 *d*.—Herr M. Ebell has calculated the following elements for this comet from observations made on December 3 (Königsberg), December 5 (Hamburg, two observations) and December 7 (Heidelberg):—

T = 1903 April 19·441 Berlin M.T.

$$\left.\begin{array}{rl} \omega = & 51^\circ\ 51'\cdot2 \\ \Omega = & 112\ 54\cdot9 \\ i = & 42\ 10\cdot5 \\ \log q = & 0\cdot17344 \end{array}\right\} 1902$$

The ephemeris which accompanies these elements estimates that the brightness of the comet on December 31 will be 2·4, its brightness on December 2 being taken as unity.

THE ALGOL VARIABLE R.V. (13, 1902) LYRÆ.—In *Circular* No. 66 of the Harvard College Observatory, Prof. Pickering gives the results of an examination of some of the Draper memorial photographs in regard to the new Algol variable, R.V. Lyræ, recently discovered by Mr. Stanley Williams. From a photograph taken July 11d. 18h. 0m., 1893, a correction of +4h. or −2h. to Mr. Williams's ephemeris is obtained, but which of these values is the right one Prof. Pickering has not yet been able to determine.

PROPER MOTION AND PARALLAX OF NOVA PERSEI.—In the *Astronomische Nachrichten* (No. 3834), Herr Asten Bergstrand details the observations he has made in order to determine the proper motion and the parallax of Nova Persei.

Using the astrographic refractors of the Upsala Observatory, Herr Bergstrand has obtained eighteen negatives of the Nova

region, and from ninety-five measurements of these negatives he has obtained the following values for the relative yearly motion of the Nova in regard to the comparison stars here given :—

Comparison Star.	Relative yearly motion of Nova. In R.A.	In Decl.
	"	"
a (B.D. +43°730) ...	+0·06 ...	±0·05
b (B.D. +43°732) ...	−0·07 ...	±0·07
c (B.D. +43°748) ...	0·00 ...	±0·07
d (B.D. +43°751) ...	+0·10 ...	±0·02

Herr Bergstrand has obtained +0″·033 as the final value for the absolute parallax of the Nova.

STAR WITH PROBABLE LARGE PROPER MOTION.—In making observations of Comet 1902 *b*, M. J. Pidoux, of Geneva, has found the position of the star B.D. −1°·3359, relative to the position of the star B.D. −1°·3360, to be $\Delta\alpha = -0s.03$ and $\Delta\delta = 10'\ 33''.6$. In the catalogue for 1855, these values are given as −2s.·4 and −12″·1 respectively, thus showing—if the observations of M. Pidoux are confirmed—that the star has a large proper motion (*Astronomische Nachrichten*, No. 3834).

REPORT OF THE GOVERNMENT ASTRONOMER FOR NATAL, 1901.—This report deals with all the meteorological data collected during 1901 at the Government Observatory at Durban and at the thirty subsidiary meteorological stations which are scattered throughout the colony.

The equipment of the observatory has undergone no change during the year.

The table giving the yearly rainfall shows that the amount of rain which fell at Durban during 1901 was considerably above the average, being more than double the quantity recorded during 1900.

TOTAL ECLIPSE OF THE MOON, APRIL 22, 1902.—Several series of observations of this eclipse are recorded in this month's *Bulletin de la Société Astronomique de France*, and an excellent coloured plate, showing the appearance of the moon at various phases of the eclipse as seen by Dr. W. van der Gracht, of Graz (Styria), accompanies the observations made by him.

THE GREAT IRRIGATION DAM AT ASSUAN.

THE country of Egypt consisted principally in its natural state of level, arid plains with a few patches of vegetation on the higher parts. Its agricultural prosperity depends entirely on the irrigation derived from the River Nile. It is many thousands of years ago that the first attempt was made to regulate this river and make it serviceable to mankind. In the time of Menes, the west side of the river was embanked, and the water led by a system of canals and embankments to the land lying between the river and the Libyan mountains. When the river was in flood, openings were cut in the banks and the country converted into a series of lakes, the land being enriched and rendered fertile by the warp brought down in suspension by the turbid water of the river. When the floods subsided, the water drained off and the openings made in the banks were again filled up.

This system remained in existence until after the English occupation, when regulating sluices took the place of the more primitive method of cutting and making good the banks. A great depression on the Libyan side of the river was also, in the time of the Pharaohs, converted into a vast regulating basin known as Lake Mæris which was reckoned one of the wonders of the world. Afterwards the right side of the river was also embanked, and the channel enlarged and regulated.

To Joseph of scripture fame belongs the merit of having made one of the principal canals used for irrigating the land, and after the lapse of 4000 years the Bahr Usuf, or Joseph's waterway, is still doing useful work.

For records of further works of importance, it is necessary to skip over a very long period to the time of Mehemet Ali, about the year 1833, who, under the advice of French engineers, caused to be constructed the great barrage above Cairo across the Rosetta and Damietta branches of the Nile, and, by thus holding up the water when plentiful, a very large area of land is irrigated and rendered highly fertile during the dry period. When the difficulty and cost of obtaining the stone necessary for this great work was pointed out to the Egyptian ruler, it is said he at once gave orders for the destruction of so many of the pyramids as would provide the necessary material, and these monuments were only preserved by the engineers assuring the Khedive that the cost of this would be greater than transporting the stone from other places. Until the English occupation, this barrage was more or less a failure, as, owing to defective foundations, the water could not be held up sufficiently high to make the irrigation effective as it otherwise would be. When the English Irrigation Department obtained control over the works, this defect was with great skill and difficulty remedied.

It has long been recognised by the English irrigation engineers that the present system of irrigation very imperfectly makes use of the fertile properties of the Nile floods. The most perfectly irrigated lands command a rent equal to 5*l.* an acre; imperfectly irrigated land is not worth more than 1*l.* an acre, while one-third of Egypt, or about two million acres, is yet undeveloped. It is estimated that the rental value of Egypt may be increased six millions a year by an effective system of irrigation. The great bulk of the land is dealt with by the original plan of basin irrigation, where the water is carried on to the land during the Nile floods and after remaining there for about six weeks is drained off. The more effective and profitable plan is where perennial irrigation is carried on, that is, where water can be supplied, not only in times of flood, but in summer and dry seasons. To effect this it becomes necessary to store up the water in floods in impounding reservoirs and let it out as required in the dry season.

The great dam at Assuan, which was opened with much ceremony in the presence of the Duke and Duchess of Connaught and the Khedive at the beginning of December, has been constructed for this purpose. This dam, erected across the Nile, will hold up the water for a distance of 147 miles.

For several years, the staff of the English Irrigation Department was engaged in surveying the country in order to arrive at the best site for the intended reservoir, and finally it was decided that the first cataract at Assuan offered the most eligible conditions for this purpose. A scheme designed by Mr. Wilcocks, the chief of the Engineering Department, was approved. This scheme was opposed because the Temple of Philæ would be submerged, and ultimately, in deference to the objections of archæologists and the foreign members of the International Commission who had to be consulted, a compromise was arrived at and the height of the dam was reduced, allowing the temple to stand out above the level of the water. The dam has, however, been so designed that at any future time the additional height can be added to it so as to take full advantage of the natural reservoir capacity. When this is done, ten millions of rental will be added to the resources of the country at a cost of about a quarter of a million of money.

The great dam is a Cyclopæan work. It is a mile and a quarter long, constructed of solid granite and cement, and is founded on the natural bed of granite over which the river runs. The height is 82 feet, and when full it will have a head of 65 feet of water against it. The base is 80 feet and the top 24 feet wide. It is pierced by 140 lower openings 23½ feet high by 6 feet wide, and 40 upper openings. These openings are provided by doors so hung and balanced that they can be lifted and lowered with very little labour. Through these openings, the Nile water will flow in floods and the scour will carry with it the sediment that may have settled when the water is still. As the flood waters decrease, the doors will be closed and the water impounded and only allowed to escape in such quantities as will be required for irrigation during the summer months. For the navigation, a canal a mile long has been cut through the rocks with a width of 50 feet, and a lock constructed having a descent of 69 feet in four drops.

For the further regulation of the water, another dam has been constructed across the Nile 330 miles lower down, above the entrance to the Ibrahimeh Canal at Assiout, to control the irrigation below this point. Here also a lock has been made of sufficient size to allow the largest steamers using the Nile to pass through.

When this scheme of irrigation was ripe for commencement, a question arose as to how the large sum of money required for its execution were to be raised. The International Commission charged with the finances of Egypt refused to allow a charge to be made on the public debt, and without this per-

mission the resources of Egypt were not equal to finding the money. In these circumstances, English enterprise came to the rescue. Sir Ernest Cassel, backed by a financial syndicate, undertook to find the money and Sir John Aird contracted to carry out the work. The capital fund is to be repaid by instalments of 166,000*l.* extending over thirty years, and it is anticipated that the irrigation will produce a revenue of 400,000*l.* a year. Sir Benjamin Baker has been the consulting engineer, and the work was carried out under the direction of Mr. Fitzmaurice, lately appointed engineer of the London County Council. The dam has thus been entirely carried out by English enterprise and English capital.

THE VELOCITY OF PROPAGATION OF X-RAYS.

M. R. BLONDLOT has recently made an experimental determination of the velocity of propagation of X-rays, as a result of which he finds that they travel with the same velocity as light. The full account of the work is published in the *Comptes rendus* for October 27 and November 3 and 10 (vol. cxxxv. pp. 666, 721 and 763), and a translation of the first two papers is given in the *Electrician* for November 21. As the subject is one of great importance, the following brief abstract of the methods used and the results obtained may be of interest to the readers of NATURE.

The method is based on a principle similar to that of Römer's method of determining the velocity of light. The arrangement of the apparatus is shown diagrammatically in Fig. 1. B and B′

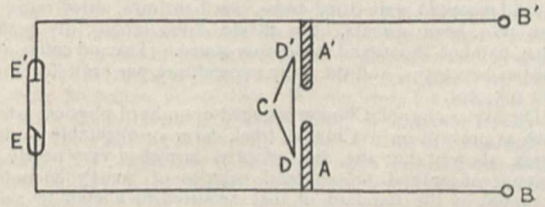

FIG. 1.—Diagram of M. Blondlot's apparatus.

represent the terminals of the secondary of an induction coil which are connected to the poles A, A′ of a Hertz radiator and to the electrodes E, E′ of an X-ray tube. Beneath the Hertz radiator is placed a resonator consisting of a copper wire folded into the shape of a triangle DD′C. The spark gap, C, of this resonator is so placed that it receives the X-rays from the focus tube, but is protected from all other radiation by screens of black paper and an aluminium plate. The oscillator AA′ consists of two brass cylinders arranged horizontally in a bottle of vaseline oil. By suitably altering the length of the spark gap, the oscillator and the focus tube can be made to work simultaneously. The action is then as follows:—At each current of break, the potential between E and E′ rises sufficiently for the X-ray tube to respond. As the potential continues to rise, a spark passes in the oscillator, and this, withdrawing energy from the focus tube, extinguishes it. By careful adjustment, the spark potential of the exciter can be made only slightly greater than the potential necessary to work the tube, in which case the tube will be extinguished very soon after the beginning of the oscillatory discharge, at the end of a time less than a quarter of the period of the radiator. The electric force at the resonator gap only reaches its maximum after a time equal to half the period of the oscillator; hence if the X-ray tube is close to the gap, the X-rays having been extinguished prior to this, there can be no action of the tube on the secondary spark. This conclusion is verified by interposing a sheet of lead between tube and gap, when it is found that the spark is not affected.

Now let the focus tube be kept in the same position and the wires AE and A′E′ be lengthened each by the same amount. This has the effect of delaying the extinction of the tube by the time required for the Hertzian waves to traverse this extra length of wire, and consequently the disappearance of the X-rays at the spark gap C is delayed by the same amount. The X-rays can, therefore, act upon the spark, and that they do so is shown by the fact that the interposition of a lead sheet now makes the spark less bright. If, on the other hand, the wires AE and A′E′ are kept of constant length and the tube moved farther away from the gap, then the X-rays will experience a retardation equal to the time they take to travel from the tube to the gap. The effect of moving the tube farther off should, therefore, be the same as that of lengthening the wires, and this is again confirmed by experiment; the spark grows brighter as the tube is moved away, but if a lead sheet be interposed, the brightness is unaffected by moving the tube. For a certain distance between tube and gap, the X-rays will have at the gap their full intensity during the whole of the time the potential at the gap has an appreciable value; at this point their effect is a maximum, for increasing the distance diminishes their intensity without increasing the time during which they and the electric force act together at the gap. This position of maximum can be found by experiment.

Let v and v′ be the rates of propagation in centimetres per second of the Hertzian waves and the X-rays respectively, and after determining the position of the tube giving the maximum spark when the connecting wires AE and A′E′ are of given length, let these wires be lengthened by α cm. The cessation of X-rays at the gap is thus retarded by α/v seconds. In order to re-establish the coincidence of the times and to find the new maximum, the tube must be moved nearer to the gap by a length β cm., such that $\beta/v' = \alpha/v$. The experiment gives β/α, and therefore v'/v. The following table gives the results of a series of experiments, the first column giving the values of α, the second and third columns the values of β as determined by M. Blondlot himself and his assistant, M. Virtz, respectively, and the fourth column the mean of these two values. Each of the numbers in columns 2 and 3 is the mean of five determinations.

α	β		
	Blondlot.	Virtz.	Mean.
− 7	− 5·9	− 6·5	− 6·2
9	10·5	8·9	9·7
12·5	12	12·6	12·3
15	15·1	14·5	14·8
25	25·3	24·5	24·9
30	31	30	30·5
40	39·3	39·6	39·4
25	24·6	23·2	23·9

The mean result of all the experiments in this and other series gives the value 0·97 for the ratio v'/v.

A variation of the method was also tried in which the ends of the resonator were separated by 0·3 cm., and two wires soldered to them and connected to a micrometer spark gap. These wires were bent back on themselves so as to bring the new gap into the same position as the old one. The Hertz waves have to traverse these wires before producing the spark, and if each wire is lengthened by a cm., the spark is retarded by a/v seconds. To obtain the new maximum, the tube must be moved away from the gap by a distance b cm. such that $b/v' = a/v$. A number of very concordant experiments by this method gave a mean value 0·93 for the ratio v'/v.

The final result of all the experiments, therefore, leads to the conclusion that *the velocity of propagation of X-rays is equal to that of Hertzian waves or of light through the air.* M. Blondlot concludes his papers by pointing out that this conclusion is in harmony either with the hypothesis that X-rays are radiations of very short wave-length or with that of E. Wiechert and Sir George Stokes, that they are electromagnetic impulses produced by the impact between the molecules or electrons in the kathode stream and the antikathode. The fact brought out by these experiments that the X-rays cease simultaneously with the current traversing the Crookes' tube, also supports the latter hypothesis.

MAURICE SOLOMON.

RECENT DIETARY STUDIES.

THE character of the daily menu is influenced by various considerations, but it will be universally conceded that the idiosyncrasies of the palate play the predominant part, and to suggest to the ordinary housekeeper that scientific principles should be allowed a voice in the determination of our diet would be simply to court ridicule, for of all departments of the household the kitchen is probably the most conservative in its customs and the most dominated by habit and tradition. It will not be

the fault of our Transatlantic cousins, however, if the reign of ignorance and indifference in this department of domestic life be permitted to continue, for the United States Board of Agriculture has recently published a series of bulletins or reports on the dietetic value of food stuffs of various kinds, embodying also the results of dietary studies on individuals carried out in all parts of the country.

These studies have not been confined to a particular class of persons, but have been undertaken in connection with the well-to-do as well as with the very poor, and embrace people engaged in hard physical work as well as those whose occupation is more sedentary in character; in fact, the common labourer and the average professional man are both represented in the types selected.

Of particular interest are the studies recorded of the dietary habits of the Chinese, for tradition assigns to this race the highest attainment in the art of producing from a given area the maximum amount of food material. This success is due firstly to a much more "intense" cultivation of the land than is customary in the western hemisphere, and secondly to the utilisation of a great variety of food plants, many of which are quite foreign to our culinary arts, but the employment of which enables the Chinaman to exploit every kind of soil and climate and compel it to yield up its quota of food material.

Thus a European visiting the Chinese market of San Francisco would have some difficulty in realising that the wares displayed were for culinary purposes, for amongst other garden plants he sees costly lily roots which he has been in the habit of importing at a high price with which to adorn his conservatories, here offered for sale as an attractive addition to the diner's menu. Many varieties of lily bulbs are eaten both by the Japanese and Chinese, but that principally on offer in the San Francisco Chinese market is the *L. brownii*. They are regarded as a delicacy and an especially desirable food for invalids, and are usually eaten but slightly cooked and with the addition of sugar. Chemical analysis shows the albuminoids present to be distinctly greater than in potatoes, but the most important constituent of the bulbs is starch, which is present in sufficient amount to endow them with a high nutritive value as a food stuff. But not only are the bulbs of lilies eaten; the dried flowers of the lovely day lily, *Hemerocallis fulva*, so sought after by all lovers of gardens on account of its rich colour and wealth of blossom, are largely used and highly prized by the Chinese as a flavouring ingredient. This article is sold under the name of "Kam cham t'soi" or the "gold-needle vegetable," and it has been found to possess a not inconsiderable nutritive value, besides being an attractive condiment.

Space does not permit of a reference to all the numerous and, to our ideas, strange articles which a Chinaman draws upon for dietetic purposes, but some mention must be made of the plant which both tradition and art have from time immemorial endowed with such a full measure of religious and classical associations.

To those of us who associate the *Nelumbium speciosum* of the botanist with the "mild-eyed, melancholy lotus eater," of the poet "whose voice was thin as voices from the grave," whilst "deep asleep he seemed yet all awake," the extensive economic use to which the lotus plant is put comes as a surprise. Whilst sought after on account of its surpassing beauty and grown in some parts in great vases placed at the doors of the houses, its more material applications are both numerous and varied. Thus we read, in a report published by Jules Grisard in 1896, that the stamens are used in China as an astringent remedy and also for the toilet; the petioles and peduncles furnish a viscous sap employed in India as a remedy for vomiting and diarrhœa; the fibro-vascular bundles of the petioles are made into lamp wicks, and the carpophore furnish a popular remedy for blood spitting. The seeds are eaten either raw, boiled or roasted, much as we use chestnuts, but the dark green germ is very bitter and is removed before use, and has given rise to the Chinese saying "bitter as the plumule of the lotus seed." A kind of bread is made of the seeds in Egypt, whilst they are also used as a remedy for indigestion, &c. Starch is extracted from the roots which is highly prized for its reputed strengthening properties; but this does not by any means exhaust all the virtues attributed to this wonderful plant. The Chinese materia medica, however, is said to present too many incongruities to permit of implicit reliance being placed upon the numerous medicinal properties associated with it, but the roots are on sale in considerable quantities, Mr. Blasdale informs us in his report, throughout the winter and early spring months in the Chinese market of San Francisco.

It is popularly supposed that the Chinese live almost entirely upon rice and that their diet is limited in amount, the apostles of vegetarianism not infrequently quoting the Chinaman as an example of how large an amount of hard work can be accomplished on a vegetarian diet. Studies, however, made in the Chinese quarter of San Francisco[1] do not support this theory, but show that whilst much more varied than that of an American or European, the Chinese diet is neither scanty in amount nor inferior in nutritive quality, whilst it is decidedly more varied and far cheaper than that of the former.

Thus, in the dietary study of a Chinese dentist's family living in comfortable circumstances and fairly typical of the average Chinese professional man, it was found that whilst the total amount of nutrient actually consumed per man per day agreed very closely with that suggested, as the result of inquiry, as a standard for a man engaged upon light muscular work, viz. 112 grams protein and 3150 calories of energy, the cost per man per day in the case of the Chinaman's family was about 50 per cent. less than that which experience has shown to be the average expenditure in the family of a professional man of the same position in the United States.

On inquiring more closely into the nature of the diet of this Chinese family, we find that as regards the source of animal protein pork took the first place, supplying nearly one-third of the total; fish comes next, followed by chicken, and last on the list is beef. The main vegetable food was rice, but considerable quantities of bread and other cereal products were also used, and a large amount of cheap green vegetables, the greater part of the latter being Chinese varieties. Amongst the unfamiliar articles of food recorded were dried crabs, dried shrimps, dried radishes, taro root, bean sprouts, bean cheese, dried fungus, lily petals, algæ, bamboo shoots and the leprosy gourd. Tea and coffee were used as beverages, and the daily expenditure per head for these was 0·5 cent.

Dietary studies of Chinese engaged upon hard physical labour such as prevails on a Chinese truck farm or vegetable garden, again, showed that the diet adopted furnished very nearly the amount of animal protein and calories of energy commonly accepted as the standard of that required by a man in active work, *i.e.* 150 grams protein and 4500 calories. In this case also the diet was very varied, and we find included among the peculiarly Chinese articles of food water-lily roots, dried lily flowers, water chestnuts, bean cheese, dried fungus, &c. The cost per head per day was 19·7 cents, and Prof. Jaffa, who furnishes the report on these Chinese diet studies, says that as regards the Chinaman's capability for work there is no question; "few Americans could walk as he does for hours at a stretch, often up and down hill, burdened with a load of from 300 to 400 pounds in the baskets which he carries suspended by ropes to a pole balanced across one shoulder, whilst in adverse circumstances, such as long hours, great heat or exposure to cold and dampness, a Chinaman can not only do more work, but can stand the strain better than a strong white man."

Let us now turn to some of the dietary studies made in New York city amongst the poorer classes and reported by Messrs. Atwater and Woods. The district selected is described as "one of the worst congested and typical of the portions of the city known as slums," whilst the families selected for dietary study were chosen as representative of the population of the district. The diet of no less than twenty-one different families over a period of ten days was carefully recorded, and the results obtained are of much economic importance, showing that in many cases unwise expenditure is fully as responsible for distress as a too limited income.

As an instance of this the case of a mechanic's family in very poor circumstances may be cited. This family had received a great deal of help from the Association for the Improvement of the Condition of the Poor, and yet it was found that the expenditure on food was nearly twice that per head in the family of a well-to-do professional man, hardly anything being left over from the wages earned for fuel, lights, clothing and the many other requirements of a family. The food consumed furnished at least 25 grams of protein and 600 calories of energy per head in excess of that required by a man at moderate work. Whilst the amount of food purchased could have been reduced 25 to 30 per cent., a more judicious selection of the same and more skill in its preparation would have enabled a

[1] From inquiries it was ascertained that the system of diet adopted by the Chinese in San Francisco differs but little from that of the Chinese in their own country.

large proportion of the money spent on food to have been expended on other things.

What applies to this family applies equally to many of the other families in which dietary studies were carried out, and over and over again we find it stated that more food was purchased than was necessary for efficient nourishment. To each dietary study is appended criticisms of and suggestions for changes and improvement in the diet pursued, and these constitute a valuable addition to the report and form, indeed, an eloquent argument that our school curriculum should provide for the education of children in the elementary principles of diet in relation, not only to the economy of the body, but also to that of the family purse.

The selection of food stuffs on rational or scientific principles does not, perhaps, sound appetising, but the numerous investigations on the nutritive value attaching to substances which have been carried out in America and elsewhere cannot be overlooked, and it is, perhaps, not unreasonable to believe that current notions on diet may become modified in the future, more especially in those cases where on economical grounds reform is so urgently needed. These studies are, therefore, of social as well as scientific importance, and acquire particular significance for the poor at times when taxes shall tell heavily upon their resources.

In conclusion, brief reference may be made to the elaborate experiments which have been carried out on the different degrees of waste entailed in the different methods adopted for the cooking of food of various kinds.

Amongst the names associated with investigations on the loss of nutrients in the cooking of meat, we find that of Thudicum in this country, Vogel and König in Germany, whilst in America the most recent contributions to this subject have been made by Grindley, in conjunction with Messrs. McCormack and Porter. As regards the loss in weight which takes place, various investigators agree in stating it to be from one-fifth to one-third, whether the meat be boiled or roasted. Where beef, for example, is cooked in water, from 3 to 20 per cent. of the total solids is found in the resulting broth, the degree of loss in constituents appearing, to a certain extent, to depend upon the size of the piece of meat employed, the smaller the dimension it is reduced to the greater being the loss; whilst the duration of time of cooking must also be taken into consideration, the more prolonged it is the greater, again, being the loss entailed. The practical lesson to be learnt from the investigations which have so far been made appears to be that the most economical method of cooking meat is to broil it in a frying-pan, for in this manner the least loss of nutrients occurs.

In the case of vegetables, the losses entailed by cooking appear to be even greater than those recorded for meat. Thus as regards carrots, in boiling them nearly one-half of the mineral matters present are lost, together with about 40 per cent. of the total nitrogen and about 26 per cent. of the sugar present.

These percentages of loss or waste may be considerably reduced if the carrot is boiled whole instead of being first cut, as is customary, into small pieces. In this manner the loss in sugar, for example, instead of being 26 per cent., is reduced to very nearly half that amount, and similar economies may be effected in regard to the other constituents of the carrot.

In boiling cabbages the loss is very considerable, from 35 to 40 per cent. of the total nitrogenous matter present being left in the water, which, as everyone knows, is consigned to the kitchen sink as rapidly as possible. The Scotch recipe for making broth, which involves the addition of uncooked cabbage to the stock-pot, besides being justly renowned for the excellent results it produces, has also, therefore, distinct advantages from an economic point of view. As regards potatoes, we cannot do better than follow the custom of cooking them which prevails in the Emerald Isle. The Irish method of boiling potatoes in their skins is not only the most palatable, but also the most economical way of using them, for when potatoes are peeled and then boiled there is a very considerable loss, not only of organic nutrients, but also of the mineral salts present.

The above brief review may help to emphasise the economic importance quite apart from the scientific interest attaching to such investigations, for by indicating, not only the best means of utilising the existing sources of food supply, but also for extending their range, such researches may conceivably contribute not a little to the prosperity of a country as a whole, whilst they can undoubtedly promote the well being and to a certain extent, therefore, the happiness of the individual.

G. C. FRANKLAND.

MAGNETIC OBSERVATIONS IN BADEN.

AN account of a minute magnetic survey of a small district in Baden, adjacent to the Rhine, where there is considerable local magnetic disturbance, has been received from the author.[1] Observations of horizontal force were made at nearly 400 stations, and observations of declination and inclination were made at about 140 of them. The object seems to have been to observe at a large number of stations with moderate accuracy in a short time. In fact, most of the data recorded in the tables on pp. 6-26 seem to have been obtained in the two months August and September of 1898. Horizontal force was observed only to the nearest 0·001 C.G.S., and declination and inclination usually only to the nearest 0°·1. Within the narrow region dealt with—some 150 square kilometres—declination was observed to vary between 3°·7 W. and 20°·8 W., inclination between 56°·6 and 72°·0, and horizontal force between 0·173 and 0·227 C.G.S. In a district so disturbed, it would have been of doubtful advantage to have employed superior instruments, giving a higher order of accuracy than that actually aimed at. The results are embodied in four charts, which give respectively the lines of equal horizontal force, the isoclinals, the isogonals, and particulars of the horizontal and vertical components of the disturbing force system. The chief conclusions appear on p. 39. The most interesting of them is that the basaltic rocks—using *basaltic* in a general sense—which form the chief hills in the district, behave mostly like vertical magnets with their north poles uppermost. Their magnetisation is thus *opposite* to what it would be if induced under the action of the earth's own field. The phenomena thus differ in a remarkable way from those observed by Rücker and Thorpe in the United Kingdom. A second somewhat interesting deduction from the observations is that there is an extension of underground basaltic masses beneath part of the level country adjacent to the Rhine near Breisach, where local disturbances would not have been anticipated from the superficial appearance of the country. The author also gives the results obtained from taking a line integral of the horizontal magnetic force round the whole district and round four subdivisions. With the exception of one of the smaller subdivisions, the departure of the line integrals from zero is very small. This may be regarded as evidence of the accuracy of the observations, if we assume that the magnetic forces are derivable from a potential, which can hardly fail to be the case so far as concerns the field answering to the local disturbances. C. C.

THE ORIGIN OF THE THOROUGHBRED HORSE.[2]

THE author said that he had shown (*Academy*, January, 1891, p. 91) that not only, as had been long observed, did the Homeric Greeks drive the horse before they rode him, but that the same was true of all ancient peoples—Egyptians, Canaanites, Assyrians, Aryans of Rig-Veda, Umbrians, Celts—and that the explanation of this was given by Herodotus (v. 9), who, in speaking of the Sigynnæ, the only tribe north of the Danube, whose name he knew, said that they had small horses, with large flat noses and very long hair, which, though not able to carry a man, were excellent under chariots: "wherefore they used chariots." Dio Cassius likewise says that the Britons used chariots in war, because their horses were "small though active." The description of the horses of the Sigynnæ tallies exactly with the abundant remains of the primitive horse of Europe, eaten in great quantities and delineated on antlers by the men of the Stone Age. He was a small animal about 10 hands high with a big head. Even after domestication he remained very small, as witness bits of bronze and horn found in Swiss lake dwellings, the shoes found at Silchester, and in camps on the Roman Wall, &c. Authorities are agreed that from this primitive horse has been developed the cart horses of the continent and these islands, whilst our blood horses have come from an eastern stock of slight build and smart appearance. Our problem is to ascertain the original habitat of this superior horse. He has not come from upper Asia, as the Mongolian pony is taken as the type of the coarse, thickset horse from which sprang the cart horse. The Mongolian pony probably

[1] "Erdmagnetische Untersuchungen im Kaiserstuhl." Von Dr. G. Meyer. Mit 4 Karten. (Separatabdruck aus den Berichten der Naturforschenden Gesellschaft zu Freiburg i. B. Bd. xii., 1902.)

[2] Abstract of paper read before the Cambridge Philosophical Society on November 24, by Prof. Ridgeway.

represents the Scythian horses, which continued to be of a small size down to Strabo's time, and they were derived either from the tarpan or Prezevalsky's horse. The Mongolian pony, though surefooted and enduring, is slow of pace. Neither China, Siam nor Burmah have any indigenous horse answering to the blood horse. India could never breed horses, says Marco Polo, in whose time India was supplied either with Mongolian ponies from Yunnan or with Arabs from south Persia, Aden and other Arabian ports. These Arabs fetched enormous prices, equivalent to 200*l*. It has hitherto been universally held that Arabia is the original home of the blood horse. This is a baseless assumption. In the Old Testament, the Arabs are never mentioned as riding anything but camels and asses. Though the author of Job knew of the war horse, yet Job did not own a single horse, his equine possessions consisting of 500 she asses. Herodotus (vii. 87) enumerates the nations (including the Libyans) that supplied cavalry to Xerxes' host, but the Arabs only furnish a camel corps. Agatharchides (cited by Strabo) describes the Arabs as camel keepers.

Finally, Strabo (*flor.* A.D. 1) expressly states that neither the peoples of Arabia Felix nor those of Arabia Petræa bred horses. Naturally, then, Scaurus after defeating the Arab king Aretas put on his coins Aretas leading his camel. It is clear, then, that down to the Christian era the Arabs bred no horses. It is therefore clear that though the Persian kings in the fifth century B.C. bred the largest and best horses in Asia, these were not of an Arab strain. These horses were kept largely in Armenia, and are described by Strabo as similar to the Parthian horses, and as differing from the horses bred in Greece and the other kinds of horses known in the Roman empire. There can be little doubt that they were the same horses as Marco Polo found in great numbers in Armenia (1270 A.D.) known as Turquans, the Turcoman ponies well known in Persia to-day. The Persian horses cannot, then, have been the ancestors of the thoroughbred, though it is quite possible that their superiority was due to their having a cross of thoroughbred blood, for already by 900 B.C. Solomon imported horses from Egypt (1 Kings x.), and "so for all the kings of Syria and for all the kings of the Hittites" Egypt could not breed horses, neither could she have got them from the Arabs, who bred none even 1000 years later. But she could and did get them from the Libyans, who from the dawn of history are masters of the most famous horses. Cyrene sent the best horses to the games of Greece (Pindar, *Pyth.* iv., &c.). It is noteworthy that it was in the same century as the founding of Cyrene that the four-horse chariot and the racehorse were added to the Olympic events. The Phœnician settlers at Carthage found the Libyans using these beautiful horses, and when they struck coins placed a horse or a horse-head on them as the badge of Libya, and used a similar type on their coins struck in Sicily, whither, doubtless, they carried the Libyan breed. This accounts for the extraordinary fame of the horses of Etna and Syracuse and the famous steeds of Tarentum. It is now clear that the Arabs never owned a good horse until they had become masters of North Africa and the Barbary horses, from whom are sprung our own racing stock through Lord Godolphin's Barb. North Africa, therefore, and not Arabia or any other part of Asia is the original home of the thoroughbred.

Now, though the pedigree of the cart-horse type can be traced to the coarse, thickset little horses of Europe and Asia, the wild ancestor of the Barb is yet to seek, for Africa has no wild horse, such as tarpan or Prezevalsky's, though she has an ass and four zebras, including the quagga, now extinct. Can the Barb be sprung wholly or in part from a zebra? Arab foals at birth constantly have zebra markings, sometimes retained when full grown, as by Prof. Ewart's Arab filly Fatima. Strabo, too, notices that the horses of the Libyan Garamantes have longer hoofs than any other horses. Prof. Ewart's hybrids from Burchell's zebra and various mares show the markings, not of a Burchell's zebra, but of a Somaliland zebra, from which it has been inferred that the remote ancestor of both *Equus caballus* and Burchell's zebra was striped like the Somaliland and mountain zebra. But is it necessary to go back so far? May not the Somaliland zebra stripes in the hybrid be due to the circumstance that the dam in each case had a certain amount of Barb blood in her, which was derived from either the Somaliland zebra or a closely allied species? He (Prof. Ridgeway) had crossed a Muscovy drake with a common white duck, derived from the common wild duck, with the result that all the offspring are coloured, and their colouring resembles that of the mallard. No one would say that the hybrids show a reversion to a remote common ancestor of both mallard and Muscovy, for it is obvious that the colouring is simply that of the white duck's immediate ancestors. Authorities like Captain Hayes have pointed out the great similarity in form between Burchell's and the Somaliland zebra to a well-bred horse, *i.e.* a horse that has Barb blood in him. He therefore suggested that the Barbary horse, from which he had shown all the fine horses of the world have sprung, was derived either from the zebra of north-east Africa or, as is more likely, from some very closely allied species, now extinct, which, like Prezevalsky's horse, may have had castors on its hind legs like *Equus caballus*.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. A. S. GREEN has been appointed professor of dyeing at Yorkshire College, in succession to the late Prof. Hummel.

THE University of California is about, says *Science*, to erect a physiological laboratory at a cost of 25,000 dollars. It will be under the charge of Dr. Jacques Loeb.

THE royal assent was given to the Education Act, 1902, on Thursday last. The Act comes into operation, except as expressly provided, on March 26, 1903, or such other day, not being more than eighteen months later, as the Board of Education may appoint. The Act does not extend to Scotland or Ireland, or for the present to London.

BEDFORD COLLEGE FOR WOMEN, London, and the Sanitary Institute have in conjunction arranged a conference on the subject of hygiene for schools, to be held at the College on January 21, 1903. Prof. C. S. Sherrington, F.R.S., Dr. Gow, Mr. Michael Sadler, Prof. Adams and others are expected to speak. Further particulars and cards of admission can be obtained either from the Sanitary Institute or from Bedford College.

THE special committee appointed to consider the needs of South Africa in regard to technical education, with special reference to the Transvaal, have, says the *Chemist and Druggist*, submitted a lengthy report, and state they are convinced that there is a great demand, especially in Johannesburg, for technical education. This demand can best be met, in their opinion, by establishing an institution providing the highest kind of training in arts and sciences. They recommend that all students, before admission to the institution, pass an examination of a standard equal to the matriculation of the Cape University. Complete courses should be provided in the new institution, the committee think, in mining, mechanical and electrical engineering, metallurgy and chemical engineering, civil and sanitary engineering, and architecture.

IN his paper on French rural education, read before the Society of Arts on December 10, Mr. Cloudesley Brereton explained the part taken by the primary and secondary schools in the agricultural education of the nation. In France, in some communes, one person in every four is a land proprietor, and the aim in the primary schools has been to give the pupil some grasp of the principles underlying the science of agriculture. The teacher is not so much supposed to follow implicitly the departmental programme, but rather to choose those portions which best suit his own particular district. There is still doubt in the minds of French educational authorities whether the scientific or the agricultural side of the instruction should predominate in the instruction given in primary schools. The teachers in these schools are themselves trained by professors of agriculture in the training colleges, and though the course of instruction is a good one, it might with advantage be more practical. In the secondary schools of France, agricultural education has an insignificant place, but the work done in this direction by means of lectures and evening classes carried on in connection with old boys' clubs and other organisations is very great.

AN important article, by Mr. W. M. Webb, on the progress and interpretation of "nature-knowledge," especially in relation to the experience gained at the Nature-Study Exhibition held last August in London, appears in the October issue of the *Record of Technical and Secondary Education*. After referring

to the importance of nature-study as a factor in the new education, the author insists on its value as a means of cultivating the powers of observation and at the same time warns his readers that it is not to be considered as in any way identical with elementary science. Various definitions and limitations of the subject are then given, after which attention is directed to its aims and objects. Among these, stress is laid on its power of interesting pupils—especially those to whom the ordinary school-curriculum is peculiarly distasteful—and thus rendering education a pleasure rather than a toil. It is also urged that nature-study promises to be the form of education best adapted to develop the pupils into good citizens capable of making their way in the world and, above all, of relying on their own judgment. Healthful it certainly is, and the love of nature it engenders may, it is suggested, tend to check the exodus of the population from the country to the towns. The difficulty of securing the right class of teachers claims a considerable share of attention, and some amount of discussion is devoted to the question as to the extent to which books should be used. Collecting, again, is a phase of the subject which requires very careful treatment in order to prevent the pupils from degenerating into mere curiosity-hunters. The author is, however, of opinion that both books and collections have their place in the scheme. The relative values of outdoor and indoor work are then discussed, in the course of which much importance is attached to the "seasonal method" of study. Before the final summary, the article winds up with observations on teachers of all grades and classes, and the best method of training them, followed by a reference to the objections against, and the difficulties connected with, "nature-study."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 27.—"The Inter-relationship of Variola and Vaccinia." By S. Monckton Copeman, M.A., M.D. Cantab., F.R.C.P. Communicated by Lord Lister, F.R.S.

The term "variolæ vaccinæ" employed by Jenner, as a synonym for cow-pox, has been generally accepted as affording evidence that, in so naming this disease "small-pox of the cow," he was desirous of placing on record his belief that cow-pox or vaccinia was intimately related to human small-pox, if indeed it were not directly derived from it.

But the difficulty experienced by the writer and numerous other investigators in attempts to transmit small-pox to bovines, whether cows or calves, has not infrequently been cited as a reason for regarding Jenner's theory with distrust.

It is well known, however, that a great deal, at any rate, of the small-pox which was prevalent at the time that Jenner lived and wrote was of that comparatively mild variety which, under the name of inoculated small-pox, was intentionally produced in healthy subjects, with the object of thereby conferring protection against subsequent attack by the disease in virulent form.

So mild indeed, at times, were the results of inoculations in the hands of such operators as Adams and the brothers Sutton, that, as we learn from contemporary records, in many instances but little obvious effect was observed, with the exception of the local vesicle arising at the site of insertion of the small-pox virus. The majority of persons thus inoculated are not likely, therefore, to have been incapacitated, as the result of the operation, to a much greater extent than are those who undergo efficient vaccination at the present day, and, doubtless, they would be, for the most part, capable of following their ordinary avocations during the progress of the induced disorder.

Not only were the effects following on inoculation comparatively mild, but the disease in this form was intentionally carried into many country districts which otherwise might not have become invaded by small-pox.

In the light of these facts, it would appear not improbable that it was from the *inoculated* form of small-pox rather than from the ordinary variety of the malady that much, at any rate, of the cow-pox in the pre-vaccination era was derived. Supposing this to have been the case, it is not difficult to understand how that the cracks, so often found on the udders of cows, might become infected by a milker with fingers contaminated by contact with the inoculation sore upon his arm.

In default of inoculated small-pox in the human subject, use was made of the monkey, which, as the writer had shown in a previous communication to the Royal Society, is readily susceptible to the disease. The necessary small-pox material has been obtained during the course of recent outbreaks of small-pox at Middlesbrough, Glasgow and London.

The results of the experiments may be briefly summarised as follows:—In each of the separate series, the human small-pox lymph or pulp was first inoculated directly on calves, and in every instance, so far as could be observed, with altogether negative results. But with monkeys, success was as invariably obtained, and when, after one or more passages through this animal, the contents of the local inoculation vesicles were employed for insertion on the calf, an effect was now produced which, after two or three removes in that animal, was indistinguishable from typical vaccinia. Moreover, from the contents of vesicles raised in this manner on the calf, a number of children have been vaccinated, some of whom were afterwards kept under observation for a considerable period. Every such vaccination "took" normally, and in no case was any bad result subsequently observed.

The experimental results obtained all tend, then, to confirm the view that the vaccinia of Jenner's time was derived, in all probability, from a comparatively mild form of small-pox. Of even more importance is the fact that the work has afforded conclusive evidence of the essential identity of the virus of small-pox and cow-pox or vaccinia.

December 4.—"On the Vibrations and Stability of a Gravitating Planet." By J. H. Jeans, B.A., Isaac Newton Student and Fellow of Trinity College, Cambridge. Communicated by Prof. G. H. Darwin, F.R.S.

The first part of the paper deals with the vibrations and stability of a gravitating elastic sphere. The matter is not necessarily homogeneous, but is arranged in spherical layers. It is pointed out that, in the classical investigation of the displacements produced in a gravitating sphere by given surface-forces, the most important of the gravitational terms is omitted. The effect of this omission is to necessitate a correction, and this may entirely invalidate the solution when we are dealing with spheres of the size of the earth or other planets. In fact, it appears that for a gravitating solid of the kind we are discussing the spherical configuration may be one of *unstable equilibrium*, the instability being brought about by these gravitational terms. The vibration through which instability first enters is one in which the displacement at every point is proportional to a harmonic of the *first* order.

In a former paper, "The Stability of a Spherical Nebula" (*Phil. Trans.*, A, vol. cxcix., p. 1), the suggestion was put forward that the instability of a nebula, sun or planet, which, upon the nebular hypothesis, is supposed ultimately to result in the ejection of a satellite, may be largely brought about by a gravitational tendency to instability of the kind described. We take, for the moment, an extreme hypothesis, and imagine that this agency is the preponderating agency and that the rotational tendency to instability may be disregarded in comparison.

Except for the changes which have occurred since the consolidation of the planets, the solar system supplies material for testing the consequences of this hypothesis. When a number of planets of varying masses have thrown off satellites, we find (upon our present extreme hypothesis) that the masses ought to be proportional to the *squares* of the radii. It is found that this law is approximately obeyed in the solar system. It is further found that the absolute values of the masses and radii are approximately such as would be expected.

It is interesting to compare two extreme hypotheses, the first referring the phenomena of planetary evolution solely to rotational, the second solely to gravitational, instability. Given the approximate values of the density and elasticity of a planet, and the fact that this planet has thrown off a satellite, then the former hypothesis leads to a certain inference as to the angular momentum of the system, the latter to an inference as to the radius of the primary. The former leads to no inference at all as to the size of planets which are to be expected—they are as likely to be of the size of billiard balls as of the size of the planets of our system—while the latter leads to no inference as to the angular momentum of the system, but presupposes it to be small. The contention of the present paper is that the inferences which are drawn from the former hypothesis are not borne out by observation on the planets of our system, while those which are drawn from the latter are borne out as closely as could be expected. The true hypothesis must of necessity lie somewhere between the two extremes which are being

compared, but the evidence seems to show that it is much nearer to the latter (gravitational) than to the former (rotational).

We next consider a number of questions connected with the figure of the earth. It seems to be almost certain that the present elastic constants of the earth are such that a state of spherical symmetry would be one of stable equilibrium. On the other hand, if we look backwards through the history of our planet, we probably come to a time when the rigidity was so small that the stable configuration of equilibrium would be unsymmetrical. At this time the earth would be pear-shaped, and the transition to the present approximately spherical form would take place through a series of ruptures. It is suggested that the earth, in spite of this series of ruptures, still retains traces of a pear-shaped configuration. Such a configuration would possess a single axis of symmetry, and this, it is suggested, is an axis which meets the earth's surface somewhere in the neighbourhood of England (or possibly some hundreds of miles to the south-west of England). Starting from England, we find that England is at the centre of a hemisphere which is practically all land; this would be the blunt end of our pear. Bounding the hemisphere we have a great circle, of which England is the pole, and it is over this circle that earthquakes and volcanoes are of most frequent occurrence. Now, if we suppose our pear contracting to a spherical shape, we notice that it would probably be in the neighbourhood of its equator that the changes in curvature and the relative displacements would be greatest, and hence we should expect to find earthquakes and volcanoes in greatest numbers near to this circle. Passing still further from England, we come to a great region of deep seas—the Pacific, South Atlantic and Indian oceans; these may mark the place where the "waist" of the pear occurred. Lastly, we come, almost at the antipodes of England, to the Australian continent. This may mark the remains of the stalk-end of the pear.

Physical Society, December 12.—Mr. S. Lupton, vice-president, in the chair.—Mr. S. W. J. Smith exhibited and described a portable capillary electrometer. This instrument is a modification of the form of capillary electrometer which consists of two wide tubes joined by a cylindrical capillary tube which may be horizontal or inclined. The apparatus contains mercury and sulphuric acid of about maximum conductivity suitably distributed in the tubes. A spring key is commonly used with the instrument, but the author has devised a key consisting of a U-tube closed at one end, communicating at the other with a pneumatic pressure ball and containing mercury in the bend. By squeezing the ball, the same change of contacts can be produced as by pressing the lever of an ordinary spring key. Using this key and a microscope magnifying 50 diameters, a potential difference of 1/10,000th volt can be detected without difficulty. The instrument, used as a surface-tension galvanometer, is more convenient than an ordinary galvanometer with a magnetic system because there is no suspension, no lamp and scale, and practically no levelling.—A paper on astigmatic aberration was read by Mr. R. J. Sowter. This paper affords a simple explanation of some of the shadow phenomena observed by Prof. S. P. Thompson in his experimental researches on the aberration of lenses, namely, in those experiments in which the aberration is wholly or in part astigmatic.—Prof. L. R. Wilberforce exhibited apparatus for a lecture experiment on gaseous diffusion. In Graham's experiments on diffusion through porous septa, the gas experimented upon was contained in a vessel inverted over water, and the pressure was kept approximately atmospheric by applying a counterpoise to the vessel. This adjustment, however, is imperfect owing to the weight of the water displaced by the material of the vessel. Prof. Wilberforce showed that, by suspending the vessel from one arm of a balance rendered suitably unstable by a weight above the central knife-edge, a compensating effect could be introduced and the pressure kept sensibly constant for a considerable range of motion of the vessel. He pointed out that this device could also be utilised for the measurement of pressure.—A paper on vapour-density determinations, by Sir W. Ramsay and Dr. Steele, was read by Sir W. Ramsay. This paper gives a detailed account of some accurate experiments on the densities of vapours over a large range of pressure carried out by a modification of Gay-Lussac's method. This method has the advantage that while densities are being determined, compressibilities can, within certain limits, be simultaneously estimated with the same sample of material. From results of experiments, it appears that the densities of certain compounds calculated for zero pressure are not proportional to their molecular weights deduced from the atomic weights of the elements which they contain. This conclusion involves one, or it may be several, of a series of assumptions enumerated in the paper. These assumptions are fully investigated and discussed, and the authors suggest that it may be possible that the atomic weights of the elements depend on the proportion in which they are present in the compounds which contain them.

Royal Astronomical Society, December 12.—Dr. J. W. L. Glaisher, F.R.S., president, in the chair.—Mr. Innes presented a paper on some developments in terms of the mean anomaly and also the results of measures of double stars made at the Royal Observatory, Cape of Good Hope, in 1902. He made some remarks on the excellence of the McClean telescope, with which the measures were made, and the great convenience of the rising floor of the observatory.—Mr. Hardcastle read a note on binding together réseaux and plates. In measuring some photographs of the moon, on which no réseau had been impressed, the réseau plate and photograph were bound together film to film, but in the course of measurement a slight shifting occurred, which it was difficult to prevent.—Mr. Bellamy read a note on preserving negatives. Some developed star negatives which had been placed in envelopes and stacked on shelves were found after a time to have received on the film a faint image of the inscription that had been written on the envelopes. Mr. Knobel remarked that this was certainly not due to the effect described by Prof. Russell, as the writing was only visible on the film by reflected light.—The Astronomer Royal exhibited and described a new measuring machine which had been made by Troughton and Simms for the Royal Observatory, Greenwich, and was intended for the measurement of photographs of Eros.—A paper by Mr. Robinson, of the Radcliffe Observatory, Oxford, was read, on the photographic and visual magnitude of α Orionis. Between March 9, 1901, and October 22, 1902, the photographic magnitude of this star had slightly increased, and since the latter date there appeared a gradual decline in brightness; both the increase and decrease were confirmed by the visual estimations.—Photographs of the spectra of Jupiter, Saturn and other planets, taken by Mr. Percival Lowell at Flagstaff, Arizona, were shown on the screen.—Mr. Hinks exhibited photographs of Mr. Ritchey's series of drawings from the negatives of the nebula surrounding Nova Persei taken at the Yerkes Observatory. Mr. Hinks showed by the aid of diagrams how the apparent motion of the nebula might be explained upon the hypothesis of Prof. Kapteyn, that successive portions of the nebula were illuminated by the star and that there was no real motion of the nebula itself.

Mathematical Society, December 11.—Prof. Lamb, president, in the chair.—The following papers were communicated:—Prof. L. E. Dickson, (1) The abstract group simply isomorphic with the group of linear fractional transformations in a Galois field; (2) Generational relations of an abstract simple group of order 4080. The first paper deals with the abstract group of order $\frac{1}{2}p^n(p^{2n}-1)$, which is simply isomorphic with the group of all linear fractional transformations on one variable, with coefficients belonging to the Galois field $[p^n]$, and with determinants equal to unity. It is shown that when $n = 1$, the group may be generated by two operations which are subject to generational relations, and these relations are determined. When n has other values, the generating operations are more numerous, but the generational relations are again determined. The validity of the theorems depends in general on the solution of a problem in the theory of numbers, which can be treated readily in any particular case. In the first paper, p is supposed to be greater than 2; the second paper deals with the case $p = 2$.—Dr. H. F. Baker, (1) On the calculation of the finite equations of a continuous group; (2) On the integration of linear differential equations; (3) On some cases of matrices with linear invariant factors. In the second paper, use is made of the matrix notation for the systematic study of linear differential equations. This study leads to two independent problems. One problem consists in the determination of all irreducible types of multiplication tables of sets of matrices of the same order, a problem akin to that of the enumeration of types of discontinuous groups. The other problem consists in the investigation of the properties of a class of functions which arise by repeated integrations from simpler functions. The serial solutions which are obtained converge for all finite values of the

independent variable in a suitably chosen "star-region," and their character near the corners of the region is determined. The work is applied to elucidate the connection between the form of the system of linear equations and the form of the linear substitutions, by which the monodromy group of the system is generated. The results are exemplified by the study of particular equations of the hypergeometric type.—Prof. M. J. M. Hill, The continuation of the power series for arc sin x.—Mr. E. T. Whittaker, The functions associated with the parabolic cylinder in harmonic analysis.—Mr. H. M. Macdonald, Some applications of Fourier's theorem. The expression of an arbitrary function by means of Fourier's theorem is thrown into the form of a double integral, the path of integration with respect to one variable being part of the axis of real numbers, and the path with respect to the other variable going to ∞ in the two senses of the axis of imaginary numbers. The theorem is generalised by altering the latter path of integration, and the generalised form is applied to the evaluation of certain integrals involving Bessel functions. Numerous properties of these functions are deduced.—Rev. F. H. Jackson, Series connected with the enumeration of partitions.—Mr. W. H. Young, Sets of intervals, part ii., overlapping intervals. In the present paper, some of the methods and results of a previous paper by the same author are applied to the case of overlapping intervals on the straight line. In this way, direct proofs are obtained of a theorem in the theory of aggregates due to Heine and Borel, and of its so-called counterpart. Certain restrictions in the usual enunciation of these theorems are shown to be unnecessary.—Mr. G. H. Hardy, On the expression of the double Zeta and Gamma functions in terms of elliptic functions. The logarithms of the functions studied by Barnes (*Phil. Trans.* Roy. Soc., Ser. A, vol. cxcvi., 1901) are expressed by means of definite integrals involving the Weierstrassian elliptic and Zeta functions.—Mr. J. H. Grace, Perpetuants (second paper).

Royal Microscopical Society, November 19.—Dr. Hy. Woodward, F.R.S., president, in the chair.—Dr. D. H. Scott, F.R.S., gave a demonstration on the microscope in fossil botany. After giving a brief history of the subject from 1833 to the present time, he proceeded to describe its principal features, aided by lantern slides projected on the screen. There were also under microscopes in the room nearly 30 slides of sections of Calamites, Calamostachys, Sphenophyllum, Lepidodendron, Bothrodendron, Lepidostrobus, Spencerites, Lepidocarpon, Lyginodendron, &c., many of these having been photographed for the series of lantern slides.—Dr. Edmund J. Spitta then described a new apparatus for obtaining monochromatic light with an ordinary mixed jet. A diagram of the apparatus was shown on the screen and also three photographs of *Amphipleura pellucida*; the first, taken with white light, gave faint indications of markings, the second, taken with a Gifford's fluid screen, showed the appearance of striæ, and the third, with blue monochromatic light, obtained by means of Dr. Spitta's new apparatus, showed the diatom clearly resolved into dots. The principal feature in the apparatus was the mounting of a Thorp diffraction film upon a corrective prism which Mr. Thorp had contrived. The diffraction film thus mounted can be used with the ordinary optical bench, giving light in a direct line from the burner to the microscope. The apparatus was exhibited in operation in an adjoining room.—Dr. P. E. Shaw sent a paper on an electrical method of taking microscope measurements.

Royal Meteorological Society, December 17.—Mr. W. H. Dines, president, in the chair.—A paper by Mr. C. V. Bellamy, on the climate of Cyprus, was read by the secretary. The mean temperature for the year at the capital city, Nicosia, is 67°·2, the extreme highest temperature being 108° and the extreme lowest 28°. The annual rainfall is about 14 inches, which falls mostly in the winter months. The author also gave particulars as to the meteorological conditions at Troödos, the sanitarium and summer resort of Cyprus, which is situated in the mountains at an altitude of more than 5000 feet above sea-level.—A paper by Mr. H. H. Clayton, of the Blue Hill Observatory, U.S., on the eclipse cyclone of 1900, was also read by the secretary. The author in a former paper discussed the meteorological observations made along the path of the total solar eclipse in the United States on May 28, 1900, and stated that he found that a cyclone followed in the wake of the eclipse—though the changes were very minute and feeble—the fall of temperature developing a cold-air cyclone in an astonishingly short time with all the peculiar circulation of wind and distribution of pressure which constitute such a cyclone. This theory was not readily accepted by meteorologists, and Prof. Bigelow, who has discussed all the observations received by the U.S. Weather Bureau, thinks that they scarcely confirm Mr. Clayton's conclusions. The author now examines Prof. Bigelow's discussion and points out that the observations really confirm his own statements.

Zoological Society, December 2.—Dr. Henry Woodward, F.R.S., vice-president, in the chair.—Dr. Hans Gadow, F.R.S., gave an account (illustrated by lantern slides) of his recent expedition to southern Mexico. He described the Valley of Mexico, and discussed the question of the axolotls and their metamorphosis. He also gave an account of his ascent of the Volcano of Orizaba, and of the two types of *tierra caliente* met with on the Atlantic and Pacific slopes, and pointed out the various phases of animal life met with in these different localities.—Dr. Einar Lönnberg contributed a series of notes, illustrated by photographs, of the variations observed in the elk in Sweden, more especially as regards the form of the antlers. These the author classed in three groups—"palmate," "intermediate" and "cervine." The last were comparable to the type lately described as *Alces bedfordiae*. These differences, in the author's opinion, were not attributable either to age or to degeneration, neither did they seem to indicate racial distinction.—A communication was read from Mr. R. Lydekker, F.R.S., calling attention to a photograph of a skull and antlers of a reindeer obtained by Mr. H. J. Pearson in Novaia Zemlia. On account of the palmation of the antlers differing markedly from that of the known races of the reindeer, Mr. Lydekker was of opinion that the specimens belonged to a new race, which he accordingly named *Rangifer tarandus pearsoni*.—Mr. H. R. Hogg read a paper on the Australian spiders of the subfamily Sparassinæ. It contained descriptions of twenty-five new species and a list of those previously known.—A communication from Mr. W. F. Lanchester contained an account of the crustaceans of the groups Anomura, Cirripedia and Isopoda (marine forms) collected during the "Skeat Expedition" to the Malay Peninsula in 1899–1900.—A communication from Mr. F. F. Laidlaw contained an account of the dragon-flies of the subfamily Cænagrioninæ collected during the "Skeat Expedition" to the Malay Peninsula.—Mr. R. I. Pocock described a new species of marine spider, discovered by Mr. Cyril Crossland in Zanzibar, under the name *Desis crosslandi*.—Mr. Pocock also read a paper containing descriptions of twenty new species of harvest-spiders of the order Opiliones from the southern continents. Two of these formed the types of the new genera Sorensenella and Lomanella.

Linnean Society, December 4.—Mr. Wm. Carruthers, F.R.S., vice-president, in the chair.—Rev. John Gerard exhibited specimens of a Polygala from Grassington, in the West Riding of Yorkshire; the plant has been named *P. amarella*, Crantz. He also showed a monstrous form of *Geum rivale*, Linn., from between Long Preston and Settle; the terminal flower was apparently normal, but about one inch and a half below the calyx there appeared a whorl of about twenty petaloid members, on extremely long "claws," and surrounded by a series of leaf-like bracts.—Mr. R. Morton Middleton showed an extremely well-developed fasciated stem of asparagus.—Dr. George Henderson called attention to a passage in the Georgics of Vergil (i. 73 *seqq.*), in which the poet, after recommending a system of fallowing, proposes as an alternative means of restoring the fertility of the soil that before taking a second grain crop the soil should be refertilised by planting it with a leguminous crop. The Romans believed that these plants actually enriched the soil, especially if the roots were plentiful. It is remarkable that recent discoveries regarding the nitrification of the soil by the roots of Leguminosæ should have been foreshadowed so long ago.—The first paper was one by Dr. Gilbert C. Bourne, on some new and rare corals from Funafuti, based on material dredged off Tutanga at a depth of 200 fathoms. The only oculinid coral was *Lophohelia tenuis*, Moseley, previously only obtained at a depth of 375 fathoms; the present specimen is figured to correct the figure given in the *Challenger* report. Seven turbinolid corals were obtained, two being new to science, and figured from photographs; one, a species of Trochocyathus, having several fossil congeners.—Mr. E. A. Newell Arber gave a digest of his paper on the morphology of the flowers and fruits of the

Xylosteum section of Lonicera.—Mr. C. B. Clarke read a paper, Note on *Carex Tolmiei*, Boott. The species was founded upon a specimen from the Columbia River, to which the author had subsequently added three other plants. The author has redescribed the original specimen, and has described two of the supposed component forms as new species.—A paper by Herr C. With, of Copenhagen, was briefly characterised by Prof. G. B. Howes, F.R.S., on the Indian Phalangidæ contained in the Indian Museum, at Calcutta. The collection was put into Herr With's hands to compare with the types of Thorell's species. With regard to the distribution of forms, the author remarks that the Indian peninsula and adjacent islands seem characterised by the presence of the subfamily Gagrellinæ.

PARIS.

Academy of Sciences, December 15.—M. Bouquet de la Grye in the chair.—On the presence of argon, oxide of carbon and hydrocarbons in the gas from the fumaroles of Mont Pelée at Martinique, by M. Henri Moissan. The gas, which was collected by M. Lacroix, emerged at a temperature of about 400° C. Besides those gases which have been already mentioned as present in other volcanic eruptions, a considerable quantity of combustible gas was found, together with about 0·7 per cent. of argon. The percentage of carbon monoxide (1·6 per cent.) would render the gas very toxic, and it is possible that many of the deaths during the eruptions may have been due to this cause.—On the stability of equilibrium and the variables without inertia, by M. P. Duhem.—Experiments on the duration of the germinating power of seeds preserved in a vacuum, by M. Émile Laurent. Samples of seeds of various species of plants were kept in the dark in a vacuum, side by side with duplicate samples in air, and these were tested after intervals of two-and a-half years, five years and seven-and-a-half years. Fatty seeds appear to keep better in a vacuum than in air, but no general rule could be deduced from the other seeds, the results being variable.—Remarks by M. le Général Bassot on the *Annuaire* of the Bureau des Longitudes for 1902.—Perturbations independent of the eccentricity, by M. Jean Mascart.—Observations of the Giacobini comet (1902 *d*) made at the Observatory of Besançon, by M. P. Chofardet. The comet appears as a small nebula of the twelfth magnitude, and has an apparent diameter of about 45″.—On the integration of a partial differential equation of the second order of the hyperbolic type, with more than two independent variables, by M. R. d'Adhémar.—A method for the electrical separation of the metallic part of a mineral from its gangue, by M. D. Negreano.—On aluminium fluoride, by M. E. Baud. The preparation of pure aluminium fluoride, $Al_2Fl_6.7H_2O$, is described, and its thermochemical data determined.—The action of boron chloride upon gaseous ammonia, by M. Joannis.—As previous researches on the reaction between ammonia and boron chloride have given conflictory results, the reaction has been reinvestigated, especial attention being given to the temperature of the reaction, which was kept at about −70° C. Ammonium chloride and boron amide appear to be the only products; at 440° C., the latter compound is partly decomposed, the compound $Bo_2(NH)_3$ being produced.—On a violet ammonio-manganese phosphate, by M. Ph. Barbier.—The separation of the alkalis from peroxide of manganese, by M. H. Baubigny. The alkali salts carried down by precipitated peroxide of manganese, which cannot be completely removed by washing with boiling water, can be eliminated by a preliminary washing with a concentrated solution of ammonium nitrate.—The diffusion of arsenic in nature, by M. F. Garrigou. The arsenic is obtained in the state of sulphide, which is then submitted to Bunsen's flame reaction, in which a film is produced on porcelain. It is claimed that quantities of arsenic of the order of 0·00001 milligram can be detected and approximately estimated. Remarks by M. Armand Gautier on the preceding paper. In working with such minute quantities of arsenic as those mentioned by M. Garrigou, the extreme difficulty of allowing for the arsenic derived from the glass and reagents is pointed out.—On *p*-benzene-azobenzoic acid and its derivatives, by MM. P. Freundler and de Laborderie.—On oxybenzylphosphinic acid, by M. C. Marie.—On a new method of chlorination of aromatic hydrocarbons, by MM. Seyewetz and Biot. The reagent used in the chlorination is the double compound of ammonium chloride and lead tetrachloride. By its aid, chlorine derivatives of benzene, toluene, xylene, naphthalene and anthracene were readily obtained.—A cœlomic gregarian in Coleoptera, by M. L. F. Blanchard.—On the evolution of the acrosome in the spermatid of Notanecta, by MM. J. Pantel and R. de Sinéty.—Teleomitosis in *Amœba Gleichenii*, by M. P. A. Dangeard.—On photosynthesis outside the organism, by M. Luigi Macchiati. Some facts in confirmation of the statement by M. Jean Friedel on the production of chlorophyll assimilation outside the plant. These researches prove that the principal agent in chlorophyll assimilation in the green plant, and also in the photosynthesis outside the living organism, is an enzyme and that the chlorophyll pigment appears to act as a chemical sensitiser.—The ripening of seeds and the appearance of the germinating power, by M. P. Mazé.—On the *rôle* of vortices in wind erosion, by M. Jean Brunhes.—On the ocean current near the Landes coast, by M. L. A. Fabre.—On the origin of the transversal break of the Kosva (North Ural), by M. Louis Duparc.—The rapids in the river Kosva are due to an old synclinal more or less orthogonal to the direction of the folds.—On the deposits of phosphate of lime in the Belemnites chalk, by M. N. de Mercey.—The influence of catalytic agents upon the working of the organism: spermine, cerebrine and chloradrenal, by M. Alexandre de Poehl.—The diseases of organic demineralisation: plasmatic anæmia, by M. Albert Robin.

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