THURSDAY, APRIL 18, 1889.

A CHEMICAL "WRECKER."

Chemical Lecture Notes. By Peter T. Austen, Ph.D., F.C.S., Professor of General and Applied Chemistry, Rutgers College, and the New Jersey State Scientific School. (New York: John Wiley and Sons, 1888.)

THE work of a teacher of chemistry is becoming more difficult and more perplexing every day. The mass of facts of primary importance both to the science and to technology is now so great that the amount of time that can reasonably be devoted to the business of lecturing during an ordinary College course is wholly inadequate to overtake them. The chemical student of to-day is naturally expected to have a wider range of knowledge, and a far higher standard of acquirement, than his brother of five-and-twenty years ago. The wonder is, that one small head can carry all that he is required to know. One inevitable result of this mass of material is seen in the specialization, both in work and in teaching, which is becoming increasingly apparent. There are chemists to whom the chemistry of the carbon compounds is rapidly becoming a sort of "Dark Continent," and who begin to regard the intricacies of a structural formula with much the same feelings as they would look upon the tangled vegetation of a jungle; and, on the other hand, there are men to whom the sesquipedalian names of organic chemistry are as familiar as household words, but who are oblivious to the most ordinary facts of mineral or physical chemistry. Specialism is of course inevitable. The field is far too big to be ranged over by one man if he means to do his fair share of the work of cultivating it. But the question remains, What to teach, and how to teach it? The truth is, that as chemistry is too frequently taught to-day, the facts obscure the view of the principles. We pile up the deck-load when we ought to jettison half the cargo. What we want is, a stricter subordination of facts to principles. We need to import the methods of the statistician into our procedure. Could anything be more deadly dull, or intellectually more depressing, than the courses of so-called "advanced chemistry" professed in some of our Colleges, in which the only stimulus to mental exertion on the part of the teacher and the taught comes from the spur of the inevitable examination at the end? Not one teacher in ten seems to recognize that his first duty is to be interesting. His first duty, he will tell you, is *to pass* his men; and as our systems of examination are at present ordered, the passing is more a question of the facts than of the principles. And yet no one who has listened to the lectures of such men as Liebig or Hofmann or Victor Meyer can doubt for a moment that the teaching of even the most "advanced" chemistry is capable of affording a high intellectual enjoyment. But then, such men are not the slaves of a Syllabus; they are not held in bondage in Burlington Gardens. They are free to develop their own methods and to stamp their own individuality on their work. The revolt in the *Nineteenth Century*, the other day, might have been more successful if it had been more judiciously fought. The chemist who knows, can afford to smile at Mr. Frederic Harrison's sneer at the value of the knowledge of the number of the isomeric amyl alcohols. Of course, the bare fact of the number is not of cardinal importance, but it is evidently not given to Mr. Harrison to know all that is implied by that fact. In this respect at least, Mr. Harrison is a degenerate disciple. The Master's knowledge of chemistry was not bounded by the limits of a volume in the "International Scientific Series": Comte had dabbled sufficiently deep in the science to have appreciated the real worth even of the fact, could he have lived to acquire it. But, although Mr. Harrison may shoot badly, the circumstance that he should have gone to the barricades at all is significant; and every teacher who has a soul above that of a crammer must share in his growing impatience with the present condition of things.

Now there is no doubt, if we may judge from his book, that Prof. Austen would also gladly range himself behind the barricade if Mr. Knowles would only enlist him; but whether his shooting would be of any use, is, as we proceed to show, very questionable.

Dr. Austen writes, as he tells us, for those students who study, "not merely to pass, but to know." His book is not intended to be a text-book: it is simply a collection of notes and observations on topics which his experience as a teacher has shown "often give the student more or less trouble." No attempt has been made "to include all the rocks and shoals on which the chemical student may get wrecked." In short, the book is an attempt to deal with the philosophy of chemistry rather than with the facts; and as such it seemed to us, in view of the ideas to which we have attempted to give utterance at the beginning of this notice, to merit careful examination.

We have, first, a short introduction, in the style of certain well-known lectures, "adapted to a juvenile auditory," which we associate with the classic shades of Albemarle Street. Dr. Austen's sentiments concerning the functions and duties of a teacher are admirable, but they have just as much originality as his attempts to write in the manner of Dr. Tyndall. The introductory paragraphs are, indeed, characteristic of the rest of the book. We have much loose statement, and many faults of expression and of taste, with, now and again, a shrewd practical remark, which Mr. Harrison's clever young examinee, with the "marvellous *flair*," would certainly "spot," like the vulture he is said to resemble. But there is not a single original observation in the work, nor a single new experiment. The iron-filings and the sulphur do their time-honoured duty in illustrating the nature of chemical change, and Hofmann's well-known examples of the volumetric relations of the simple and compound gases are duly set forth, but with nothing of the *verve* of that great expositor. We admit that it is difficult to find anything better in illustration of these particular points; but then, what is the *raison d'être* of Dr. Austen's book? In dealing with such matters as Molecules and Atoms, Valency and Atomicity, Dr. Austen is clearly out of his depth, or rather he is a sufficiently good swimmer to get over the surface indifferently well—but with neither the skill nor the hardihood to get down to the pearls below. He is befogged by the smoke-rings, and muddled among the vortex-atoms. At times he seeks to be interesting, but with what success the following extracts may serve to show.

In the section on Substitution or Replacement we read :—

"It takes but a slight imagination to see in many reactions analogies with the diplomatic methods of human affairs. Thus the reduction of potassium dichromate to chromic chloride in the presence of alcohol and hydrochloric acid, is particularly suggestive of what in politics is called a 'deal,' or in diplomacy an 'understanding.' . . . So again, in the case of bleaching by moist chlorine, the reaction $H_2O + Cl_2 = 2HCl + O$ becomes possible if there is some substance to take up the O. Otherwise there is no reaction, as O refuses to be put out and allow H to dissolve their partnership, and unite with Cl, unless provided for. But if an easily-decomposed organic substance can be procured, the reaction can be consummated. The colouring matter is attacked by the O, and the H and Cl unite, all participants being apparently satisfied."

Now if truth be the test of real humour, it follows that this humour, if humour at all, is false. At best it is but a tawdry imitation of the style of "Die Verlobung in der Bleikammer," which Dr. Austen seems to admire.

In a lecture on the Nature of Affinity we are told that "no word has been more abused than 'affinity.' Used in the sense to denote the tendency or desire to combine, the word is proper, and in its right place." And this is how Dr. Austen illustrates the "proper" use of the term :—

"$HBr + Cl = HCl + Br$.

"Assume that H represents a young lady from the High School, Br a bore, and Cl a College student, and the mechanism of the reaction becomes at once apparent." The parable is probably intended to indicate a "rock" or a "shoal" on which the chemical student may get wrecked if he does not take care. Indeed, the too-susceptible Dr. Austen cannot keep the "fair sex" out of his pages. The following burst of eloquence is culled from a lecture "On the Chemical Factor in Human Progress" (p. 62) :—"To what an extent is the fair sex indebted to the humble chemist! We have given them the wonderful aniline colours, which would put Solomon in all his glory to shame, and compel the peacock to hide both his head and his tail in bedazzled desuetude." "Bedazzled desuetude" is not bad, and Dr. Austen has prudently copyrighted it, with the rest of the work. We take breath and read on :—"We can make artificial blushes, heart palpitations, and alabaster complexions, . . . we can change raven locks to tresses of glinting gold, or *vice versâ*; we can supply eyes of any shade of colour, as well as any number or kind of teeth. In fact, the chemist is to the girl of the epoch what the lamp was to Aladdin—only more so." The "girl of the epoch" is doubtless properly grateful, and we hope "the man of the time" is equally so, when he knows that his "overcoat may have in it the remains of ball dresses and prison shirts. It may have laid on luxurious beds, or in the gutter, or both."

Dr. Austen proceeds to inquire, "what is the effect of the increasing accuracy in chemical analysis upon our civilization. Chemical analysis is the balance-sheet of trade. It establishes responsibility. It says to the cheat, honoured and respected though he may be in the community, and there are countless thousands of them, 'Thou art the man!' It compels accuracy of statement—rigid truth" After this astonishing example of "accuracy of statement," the reader will be prepared for anything, and we might give him a dozen instances of the same kind of "rigid truth" if it were worth while to spend more time on this silly production. We are only too thankful that this uncertificated chemical pilot has not attempted to include more of the rocks and shoals on which the student may get wrecked.

The whole book is a jumble of feeble sentiments, false statements, and mischievous reasoning, thrown together with no attempt at order or connection. The spirit of prophecy was surely on him when Dr. Austen wrote this brilliant passage in "The Chemical Factor," &c. (p. 56): "Tangle your cord ever so intricately, the chemist will cut it at a single stroke, and will prick the bubble of your silly babble." The metaphors are mixed, but the meaning is clear.

In concluding this notice of a book about which it is impossible to say a single good word, we are sufficiently mindful of the Laureate's saying about the satire which has no pity in it to offer Dr. Austen the grain of comfort which is contained in his own statement (p. 48): "The more the world abuses you, the more reason you have to suppose that you have evolved an idea that has some claim to be original."

THE BEST FORAGE CROPS.

The Best Forage Crops. By Drs. Stebler and Schröter. Translated by A. N. McAlpine, B.Sc. Lond. (London: David Nutt, 1889.)

DR. STEBLER'S well-known work, "Die besten Futterpflanzen," has found a translator into English. A French translation is also before us, so that it is now available to everyone who speaks any one of the three great languages of the civilized world. It may be described as a complete account of the herbage which constitutes permanent pasturage and rotation grasses. The precise technical value of the word *Futterpflanzen* we do not attempt to give, although forage or fodder crop appears to be the correct English equivalent. An English agriculturist would, however, be somewhat surprised to find in a work dealing with the best forage crops no mention made of what are looked upon in this country as the best fodder crops. We are accustomed to rank such crops as vetches, rape, winter rye, trifolium, kale, and cabbage, as among the forage crops; and even swedes, mangel, carrots, and parsnips, although separately classed as root crops, would not be improperly included in the same designation. By fodder crops we usually mean plants cultivated for their leafy herbage for forage, and "grass" and "hay" would come under the designation. Dr. Stebler's work deals exclusively with these last sections of the class fodder crops. We therefore consider the title of this work, as rendered into English, too ambitious, as it is scarcely a "complete account" of the best-known forage plants, but an exhaustive treatise upon some of the less-known ones, most of which are included by English farmers under the term pasture or meadow grasses.

These remarks apply to the title only, and are not to be considered as detracting from the value of the book, which is unquestionably very great. The number of facts and the variety of authorities quoted are extraordinary, and we welcome this addition to the literature of grasses as most opportune. The work is practical as well as theoretical. It deals with hay-making and ensilage, impurities and adulteration, preparation of the soil, time for sowing, quantities of seed, and judging the quality of seed. It also supplies accurate botanical descriptions, describes varieties, and treats of geographical distribution, growth, and development. So far as the list of plants described is concerned, the work is complete; so far as it purports to treat of the "best forage plants," it is incomplete, and ought either to have been preceded, or be followed, by another. As a botanical account of various members of the Gramineæ and Leguminosæ, the book is exceedingly useful. It must, however, be borne in mind that a large proportion of the grasses described are unimportant economically, and are therefore not to be ranked as among the best fodder crops. Take, for example Yorkshire fog (*Holcus lanatus*), false oat grass (*Arrhenatherum elateus*), yellow oat grass (*Avena flavescens*), sweet vernal grass (*Anthoxanthum oderatum*), reed canary grass (*Phalaris arundinaceæ*), upright brome grass (*Bromus erectus*), awnless brome grass (*Bromus inermis*), kidney vetch (*Anthillis vulneraria*), and goat's rue (*Galega officinalis*). These plants are not of any agricultural importance, and yet they occupy about one-third of the attention of the reader.

Dr. Stebler's book is, in fact, a study of pastoral plants rather than of agricultural crops, and its chief students will be found among seedsmen and those who are abandoning agriculture for the simpler processes of pastoral life.

As a manual of grasses it is exhaustive, so far as the plants selected for description are concerned, but the number described is limited, and the order in which they are introduced is curiously unscientific. Why, for instance, is sainfoin interpolated between *Festuca ovina* and *Festuca heterophylla?* and with what object is Alsike clover pitched in between rough-stalked meadow grass and sheep's fescue, and separated from red and white clovers by a number of true grasses?

Somewhat significantly, the first position in this standard work is allotted to perennial rye-grass, and in the light of the present controversy upon the value of this grass it is interesting to know what so high an authority as Dr. Stebler has to say upon its value and permanence. Speaking of it, he says:—"At times over-estimated, at times depreciated, it is yet one of the most valuable grasses. It is more a 'bottom' than a 'top' grass. For pastures on heavy soils it cannot be surpassed. In marshy districts where the soil is good, it forms a large proportion of the herbage, so much so that in such cases experienced agriculturists use only perennial rye-grass and a little white clover. Its duration depends very much on the nature of the soil and the climate: on dry, light soils it disappears after the second year, whilst in moist climates and on good heavy soils, it will persist for seven years or even longer." The word perennial must always be used in a qualified sense, as no grass, unless it be gifted with immortality, can actually be so described. The individuals perish, but their place is taken by fresh generations, and in is sense rye-grass may be considered as a lasting ingredient in pastures. Its occurrence on village greens, where it cannot seed, meadows, and town moors, as well as in almost all pastures, and especially those which are closely grazed, are evidences that rye-grass can hold its own for an indefinite length of time. Our own climate is especially suited to it, especially when the soil is of a heavy nature and of good quality. Dr. Stebler recommends 5 per cent. as the maximum amount in a mixture required for permanent pasture, but on this point we must differ from him. He, in fact, is not quite consistent, as he tells us that 80 per cent., with white clover to complete the mixture, is used for forming the excellent pastures on the alluvial flats of Northern Germany.

In the discussion now occupying the attention of agriculturists as to the value of perennial rye-grass, both sides may adduce arguments based on Dr. Stebler's opinion, but a perusal of the work will show that the relative permanence of the various grasses described is not pointed out with clearness. The subject is, indeed, beset with many difficulties, and the chief argument in favour of the true perennial character of rye-grass is its continual presence in closely-grazed pastures.

The illustrations of seeds and the botanical descriptions are among the most useful features of this excellent work. The analyses and chemistry of the grasses are also instructive. The book is evidently written from actual personal knowledge, and the positions of Dr. Stebler as Director of the Seed Control Station at Zürich, and of Dr. C. Schröter, the Professor of Botany, also at Zürich, are guarantees that the work is thorough and trustworthy.

Prof. McAlpine, who has undertaken the arduous work of translation, is the Botanist to the Highland and Agricultural Society. The work has been printed abroad, and the typography is somewhat cramped and the quality of the paper and binding scarcely worthy of the text. A glaring advertisement on the outside of the cover might well have appeared somewhere else than on a work of such standard merit as that of Drs. Stebler and Schröter.

JOHN WRIGHTSON.

THE ZOOLOGICAL RESULTS OF THE "CHALLENGER" EXPEDITION.

Report on the Scientific Results of the Voyage of H.M.S. "Challenger" during the Years 1873–76, *under the command of Captain George S. Nares, R.N., F.R.S., and the late Captain Frank T. Thomson, R.N.* Prepared under the superintendence of the late Sir C. Wyville Thomson, Knt., F.R.S., &c., Director of the Civilian Staff on board, and now of John Murray, LL.D., Ph.D., &c., one of the Naturalists of the Expedition. Zoology—Vol. XXIX. Published by Order of Her Majesty's Government. (London: Printed for Her Majesty's Stationery Office, and sold by Eyre and Spottiswoode, 1888.)

VOLUME XXIX. contains a Report, by the Rev. Thomas R. R. Stebbing, on the Amphipoda collected during the cruise of the *Challenger;* it forms one of the longest volumes yet issued, consisting of 1774 pages of letterpress, and is illustrated with an atlas of 212 plates.

Of this immense volume, which will always remain a memorial of the patient research and labour of the author, just 640 pages are devoted to the bibliography. It is, perhaps, the most elaborate ever written as a preface to any form of a Report, and meeting one on the first opening of the pages, seems to challenge a few words of comment.

The importance of a bibliography to a student no one will refuse to acknowledge. A list of the works written on the subject of a Report not only shortens the references in the necessary quotations under the genera and species, but, when not required for this purpose, it helps to furnish material for further workers. Whether the list of works published should be arranged under the dates of publication or under the authors' names, alphabetically placed, has been a matter on which differences of treatment have occurred; in the present case they are arranged chronologically. The bibliography begins with the fourth century before Christ, when Aristotle wrote his "De Animalibus Historiæ," and is carried down to the present time, and is illustrated with woodcuts.

Under the date of publication, the author's name, and particulars of his birth and death, are given; these are followed by the full titles of his work, and then comes an analysis of the contents of the work, so far as these relate to Amphipod Crustacea. All of these analyses are of interest; all, or at least most, of them involved great skill and patience in their compilation; and many of them will be of service to future students. But still, it may very legitimately be doubted whether all this enormous mass of details as to the writings of the Milne Edwardses, Spence Bate, Boeck, &c., was necessary in a Report of the nature of the one before us, or whether it be in keeping with the regulations laid down for the guidance of those intrusted with the preparation of these Reports. In the printed suggestions made by the first Superintendent of these Reports, Sir Wyville Thomson, and, to the best of our belief, also approved of by Dr. Murray, was one "that no printing shall be unnecessarily repeated of matter which has already been printed elsewhere." This, it was added, does not apply to the preliminary Reports, leave to print which in various journals had been given.

If the important bibliographical list of Axel Boeck had been brought up to date, the student would have been benefited, and space would have been enormously saved; but the aim of the author seems rather to have been "to produce a record, after the annalistic method, of the progress of knowledge in this branch of natural history" —a very worthy aim, no doubt, and, as far as we can judge, well accomplished, but one outside a Report on the species taken during the *Challenger* cruise.

One hundred and eighty species are described as new, and thirty-one new genera are defined. The author feels sure that our knowledge of the group is still very imperfect, and calls attention to the fact that a few weeks' stay at Kerguelen yielded forty-eight species from this small region, previously supposed to be barren in Amphipods; and still none of the shore-frequenting species, mentioned by Dr. von Willemoes Suhm as "everywhere under stones," were apparently collected, so that still further additions to the Amphipod fauna may be expected.

As to the bathymetrical distribution of the Amphipods, there must be a good deal of uncertainty, as with other groups of animals taken in the trawls and tow-nets; some were undoubtedly taken at or near the bottom, while others were as certainly taken in the surface and subsurface waters: still, there seems some significance in the fact that, of twenty-eight species of the group of the Gammarina, said to be from depths of from 300 to 2300 fathoms, twenty-five genera are represented, of which ten are new, and twenty-six of the twenty-eight species are also new.

Many of the species described as new are as interesting as novel, but the details relating to them do not admit of being particularly referred to. In the introductory remarks, the author states that he believes the two well-known species of Gammarus, *G. pulex* and *G. locusta*, to be the representatives of an ancestral form of Amphipod.

"Far more than any other Amphipod, *Gammarus pulex* appears to have spread itself over the fresh-water streams of the world, and *Gammarus pulex* is connected by the very closest ties with *Gammarus locusta*. It is clear, from the general distribution of the Gammarina, that the chief nurseries whence they issue are the weeds of the coast. From these, the rivers are accessible, as well as the ocean; yet in the rivers the species of Amphipoda are few, while in the ocean they are multitudinous. This admits of a simple explanation, if we accept *Gammarus locusta* as representing the ancestral form which at one time occupied the world without the competition of other species of Amphipoda.

"In order to enable the family to extend its range over the fresh waters of the world, no further change was needed than such as would enable some of the progeny to pass from salt water to brackish, and from brackish to fresh. But, the section of this genus having once obtained command of the rivers, by the capacity of living vigorously in the river water, would have an immense advantage over all rivals attempting in the future to make a lodgment in the stream while their capacity for life therein was in its initial stages and only feebly developed."

There is an atlas of 212 plates, the figures on which have all been drawn by the author in a most satisfactory way. It is to be regretted that there are no detailed descriptions of these plates; perhaps with the 640 pages of bibliography, and sixty of index, this was too much to expect.

OUR BOOK SHELF.

Magnetism and Electricity. By Edward Aveling, D.Sc. (London: Chapman and Hall, 1889.)

As most intending candidates for London Matriculation will be aware, the new regulations affecting the science subjects have been in force since last June. Chemistry and natural philosophy have been replaced by mechanics, which is compulsory, and chemistry, light and heat, or magnetism and electricity, at the option of the student. To meet these new requirements Dr. Aveling has prepared a series of text-books on the specified subjects, of which the book before us is one. The book is of necessity planned on examination lines; and, although the author hopes "that the matter and method may be of service in the introduction of students generally to the subjects considered," we could hardly recommend it to those who do not require it for examination purposes. However, it completely covers the syllabus, and gives accurate, though often scanty, information. In the chapter on "Terrestrial Magnetism," for example, some very useful data are given, but the explanations of the methods of determining them are very meagre. Thus, on p. 22 the declination compass is described, and the explanation given for its use is simply that "the telescope is set in the plane of the geographical meridian, and, as the needle sets in the plane of the magnetic meridian, the angle between the telescope, which always lies over 0° to 180° on the circle, and the needle, is the declination." Again, referring to the determination of dip, it is simply stated "that when the instrument is arranged with the circle in the plane of the magnetic meridian, the angle of inclination can be read off on the circle" (p. 26). We fear that very few students would succeed in getting even approximate values with only these brief statements to guide them if the instruments were put into their hands.

One chapter is devoted to "Examples on Formulæ," which will, no doubt, be of great service to students, although the title is rather suggestive of cramming. The examples given are not less numerous than useful, no less than 52 out of 144 pages being devoted to them. Several of the papers set at previous Matriculation, Science and Art, and other examinations are given.

The book is well illustrated throughout, and although it is more of an epitome of the chief laws and experiments than a text-book, it will, no doubt, be of great service to those for whom it is primarily intended.

Heat and Light. By Edward Aveling, D.Sc. (London: Chapman and Hall, 1889.)

THIS is another text-book of the series referred to in the preceding notice, and follows on the same lines. It is characterized by the same bare outline, the explanations of the methods of determining the various data generally including no suggestion whatever as to difficulties and corrections. This is especially noticeable in the account of Joule's classical experiment (p. 26), in which no mention whatever is made of the corrections for loss of heat due to radiation or for the velocity of the weight on falling. The diagram, too, is seriously wrong, since it simply shows a set of vanes revolving in a vessel of water; without the pierced partitions necessary to prevent the rotation of the water, the experiment is, of course, useless.

The chapter on the composition of white light and the spectrum is perhaps the least satisfactory in the book. The merest outline of the subject is given, and there are two or three very obvious slips. On p. 165, for instance, the electric light and the lime-light are quoted as examples of monochromatic light. and again on p. 166 it is stated that "glowing gases yield spectra with *dark* lines." The idea that the actinic rays are confined to the violet part of the spectrum is rather old-fashioned, and is scarcely likely to be credited by a student who may have happened to experiment in the direction of orthochromatic photography.

Like its predecessor, the book contains numerous examples and illustrations.

The Encyclopædia Britannica. Ninth Edition. Index. (Edinburgh: Adam and Charles Black, 1889.)

THE publication of this volume (of 500 pages) marks the completion of one of the greatest literary undertakings of the present age. As to the necessity for an index there can be no doubt, since, as the editor explains, the plan of the "Encyclopædia Britannica" was that subjects rather than words should be dealt with, and that large subjects should be discussed in a connected way, under general headings, so that the book might be used not only for occasional reference, but for systematic study. This plan was adhered to, and the result is that "many things which a reader may wish to understand are explained, not under their own names, but in the course of a larger discussion." In such cases reference must be made to the index; and this is so full and so accurate that no one who may have occasion to consult it will ever have the slightest difficulty in at once finding what he wants. The index has been compiled by Mr. William Cairns, and arranged and revised by the Rev. George M'Arthur, with the assistance of Miss Emily Stevenson and Mr. J. T. Bealby. The volume contains also a complete list of contributors, with a key to the initial letters affixed to the longer articles. A glance over this list, which includes almost all the foremost writers of the day, suffices to explain the high character of the work as a whole.

Blackie's Modern Cyclopædia of Universal Information. Edited by Charles Annandale, M.A., LL.D. Vol. I. (London: Blackie and Son, 1889.)

IT is intended that the work of which this is the opening volume shall serve as "a convenient work of reference for readers of all classes—comprehensive in scope, handy in size, moderate in price, and generally adapted to the needs of the day." Of course no one who may want to obtain a thorough knowledge of any subject will think of seeking for it in such a work as this; but the editor does not place before himself too high an object of ambition when he expresses a hope that the new Cyclopædia may prove useful to persons who have little time for acquiring information from books in general, though they take an interest in many topics lying outside their own pursuits. The present volume deals with words beginning with the letter A, and with many of those beginning with B. The articles are short but clear, and, so far as they go, accurate. Especial attention has been given to matters which are of living interest in our own day, and we are glad to see that many scientific articles have been written or revised by specialists. The volume contains some good maps and many interesting pictorial illustrations.

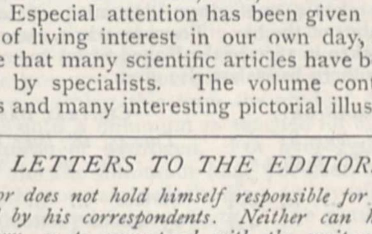
LETTERS TO THE EDITOR.

[*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.*]

Spherical Eggs.

A BIOLOGICAL friend lately asked me for a solution of the problem, How many spherical eggs, 0·03 millimetre in diameter, can be contained in a cubic millimetre?, the whole space occupied by the eggs being large compared with a millimetre. Assuming the eggs as closely packed as possible in a horizontal stratum, their centres will lie at the angular points of a series of equilateral triangles whose sides are equal to a diameter. The number of spheres in this stratum corresponding to a unit of area will thus, on an average, be $\frac{2}{d^2\sqrt{3}}$, d being the diameter.

The next stratum above will have the centres of the spheres placed so that each is at the vertex of a regular tetrahedron,



having alternate equilateral triangles of the lower series as base. Evidently, in a volume of the slice between the two planes of centres, having a unit of area for its base, there will be, on an average, $\frac{2}{d^2\sqrt{3}}$ spheres. But the thickness of the slice is $d\sqrt{\frac{2}{3}}$. Hence, in a unit volume, on an average, there will be $\frac{\sqrt{2}}{d^3}$ spheres, *i.e.* $\sqrt{2}$ times, or about $\frac{7}{5}$, as many as would be contained, assuming their centres at the corners of cubes.

Possibly some of your readers may have considered this problem, and may be able to suggest some other method of packing the spheres. I do not remember to have met with any discussion of it. W. STEADMAN ALDIS.

University College, Auckland, New Zealand, February 4

Temperatures in Lake Huron.

SOME very interesting results observed by Commander Boulton, R.N., on the temperature of the waters of the Georgian Bay, the eastern basin of Lake Huron, have been placed by him in my hands. They appear to establish that the waters of the bottom of the bay are colder than the even deeper waters of the rest of the lake.

Lake Huron in its profound depths forms three great basins—the Georgian Bay, defined along its western outline by the bold cliffs of the Niagara limestones, and the central and southern basins, separated by the subaqueous corniferous escarpment which diagonally crosses the lake in a south-eastern direction from the outline of Lake Michigan. Whilst the southern basin has generally a sandy bottom, and is in many parts comparatively shallow, the central basin has a floor chiefly of clay, and includes the deepest portions of the lake.

The surface temperature necessarily varies with the seasons, and with the continuous or fitful nature of the weather for days preceding the observations. Thus on May 11, 1888, when the ice had but recently broken up, the surface water of the Georgian Bay near Owen Sound registered 34° F., whilst at $15\frac{1}{2}$ fathoms the minimum was $34\frac{1}{2}$° F.

Observations will during the coming summer be continued in this and other lakes, but in the meantime the records given hereunder may be taken as preliminary illustrations of the temperature of the waters of the bay. For comparison, some published observations taken in 1860 by the United States engineers in the central and southern basins are also given.

GEORGIAN BAY.

Lat. 45° 6′, *long.* 81° 7′.
July 27, 1888, 8.30 *a.m.*

	° F.
Surface	$60\frac{1}{4}$
10 fathoms	$45\frac{3}{4}$
20 ,, ...	$41\frac{1}{2}$
35 ,, ...	41
66 ,, (bottom)	$39\frac{1}{2}$

Lat. 45° 35′, *long.* 80° 49′.
August 20, 1886, 8 *a.m.*

	° F.
Surface	$59\frac{3}{4}$
31 fathoms (bottom)	$39\frac{1}{2}$

Lat. 45°, *long.* 80° 52′.
August 20, 1886, 12.38 *p.m.*

	° F.
Surface	65
42 fathoms (bottom)	$37\frac{3}{4}$

CENTRAL BASIN.

Lat. 45° 18′, *long.* 82° 23′.
July 30, 8 *a.m.*

	° F.
Surface	52
65 fathoms (bottom)	42

SOUTHERN BASIN.

Lat. 44° 33′, *long.* 82° 54′.
August 5, 10 *a.m.*

	° F.
Surface	58
38 fathoms (bottom)	52

Lat. 43° 46′, *long.* 82° 1′.
June 20, 9 *a.m.*

	° F.
Surface	55
45 fathoms (bottom)	52

On August 20, 1886, the temperature of the surface rose from $59\frac{3}{4}$° F. at 8 a.m., to 62° at 9 a.m., $63\frac{3}{4}$° at 11.34 a.m., and 65° at 12.38 p.m.

The suggestive explanation of the lower temperature of the Georgian Bay depths is that whilst the more southern and warmer waters of Lake Michigan in their course from the inlet to the outlet do not reach the bay, a considerable portion of the colder waters of Lake Superior find their way into it by the channel north of the Manitoulin Islands. Further, the subaqueous cliffs which block the western side of the bay preclude a free circulation between the deeper waters of the bay and the profound depths of the lake beyond. A. T. DRUMMOND.

Will Fluctuations in the Volume of the Sea account for Horizontal Marine Beds at High Levels?

IN the interesting article "On the Gradual Rise of the Land in Sweden" (NATURE, March 21, pp. 488-92), Nordenskiöld arrives at the conclusion that the small alterations of the relative level of sea and land which observation proves have taken place in Sweden, are due to movements of the land, not to fluctuations of the sea-level. On the other hand, he contends that the extensive horizontal stretches of marine strata found in many places on the earth's surface at heights measured by thousands of feet above the sea-level indicate fluctuations of level in the sea itself. This is certainly reversing the order of things as believed in by most geologists. It is also suggested that the fluctuations of sea-level are due to alternate increase and decrease of the volume of the sea, arising from gaseous and fluid additions from outer space or loss thereto, the alternate gains and losses balancing one another over long periods.

It is not my object in this communication to discuss the physical possibility of such alterations of the volume of the sea having taken place in this way, but to point out that, even if granted, such rising and falling of the sea-level fails to explain the geological phenomena for which it is invoked. Formations horizontal in one place are disturbed in another. They cannot be divided into two hard and fast stratigraphically dissimilar kinds of marine deposits, the *horizontal* and the *folded*, as is attempted by Nordenskiöld. Even the example quoted by him of the Tertiary strata of Spitzbergen shows this, as it is stated, "Near the west coast they are much disturbed, but further inland they form horizontal strata of sand and clay, &c."

The plains of Russia are, as was shown long ago by Murchison, largely occupied by nearly horizontal strata of undisturbed Silurians, while in the Ural Mountains the same formation is thrown up on end. I venture to pronounce this continuity of horizontal with disturbed deposits an almost universal phenomenon, for where plateaus are capped by horizontal strata, as often happens, these cappings are only the remnants left by denudation.

It is a well-known geological fact that as strata recede from a mountain range they become less and less disturbed and more horizontal. Again, there are no horizontal strata of any extent or thickness that are not riven with faults showing that they have been subjected to upthrow or downthrow as the case may be, and these have to be accounted for as well as the level at which the strata occur. Except in the very newest deposits, strata bear very little relation to the levels at which they are now found. Because strata are often horizontal at high levels it is no indication that they have not been upheaved. The Colorado plateaus may be cited as an instance, and such instances may be multiplied to any extent.

There is, however, another difficulty appertaining to the explanation offered by Nordenskiöld. It is this, the general rise of the sea-level over the whole globe to the extent even of 1000 feet would obliterate an enormous area of land. Where, then, would the sediment come from to form the beds appealed to in proof of the rise of the sea-level? Formations are not arranged concentrically at varying levels or, in other words, stratigraphically contoured, as would be the case were they due to this cause. But there is a final and still greater difficulty to be met. Denudation is year by year reducing the height of the land, and if no compensatory elevation excepting over disturbed areas took place, continents instead of growing as they are supposed by some to do, would long ago have been obliterated, and the earth planed down to a uniform level, so that when periods of "high water" recurred all terrestrial life would be destroyed. This contingency no doubt to some minds will be plain demonstration of the truth of Nordenskiöld's theory.

T. MELLARD READE.

Park Corner, Blundellsands, near Liverpool, March 25.

The Meteorological Conditions of the Aruwhimi Forest Tract.

I CANNOT but think that the true explanation of the rank exuberance of the Aruwhimi forests, so graphically described by Mr. Stanley, or rather of the humid climate that fosters them, is different from that suggested either by the great traveller himself or the writer of the notice in last week's NATURE. The source of the winds that feed the rainfall of this region seems to me a question of secondary importance, but since in equatorial regions, as a rule, easterly winds predominate, I am inclined to think, with the writer of the article, that this source is most probably the Indian Ocean.

If, however, this be so, since in the interval between the coast and the Aruwhimi basin they have to pass over some of the highest mountains in the continent, and reach the latter on a descending slope, they would be comparatively dry winds, more or less analogous to the Alpine *föhn*, were there not other conditions present which more than counterbalance the desiccating influence of the eastern mountains. The first and most important of these conditions I take to be the equatorial position of the Aruwhimi basin; the second that it is situated in the heart of the continent. Both of these, but more particularly the former, determine it as the seat of ascending air-currents, and therefore of their dynamic cooling on a gigantic scale, and it is to this dynamic cooling that the high rainfall of the region is to be ascribed.

Very probably a considerable portion of the precipitated moisture is locally re-evaporated, so that, as suggested long ago by Sir John Herschel in the case of the Brazilian forest rainfall, the same water is precipitated again and again. There are not, I believe, in the lower atmosphere, any steady winds blowing outwards to carry away the evaporation of the damp forest tract, and the main loss of water to be supplied by easterly or other winds is that carried off by the river drainage, probably less than half of the rainfall. The air which has ascended to the higher regions of the atmosphere as a part of the main circulation of the globe, parts with nearly the whole of its vapour in the act of ascending.

We have a case in some respects analogous to that of the Upper Aruwhimi in the very damp and equally forest-clad province of Upper Assam. This too is characterized by a very calm atmosphere, being girt with lofty mountains on the north and east, and also shut off on the south and south-west from the Bay of Bengal by hills of considerable elevation. Such gentle winds as blow in the valley are chiefly from the east or down valley. Yet the rainfall is over 100 inches in the year, and the whole tract is one of marsh and dense forest. It is indeed not situated under the equator, and herein it is less favourably conditioned as a region of excessive rainfall than the basin of the Aruwhimi.

As the result of a long study of the rainfall of India, and perhaps no country affords greater advantages for the purpose, I have become convinced that dynamic cooling, if not the sole cause of rain, is at all events the only cause of any importance, and that all the other causes so frequently appealed to in popular literature on the subject, such as the intermingling of warm and cold air, contact with cold mountain slopes, &c., are either inoperative or relatively insignificant.

Folkestone, April 11. HENRY F. BLANFORD.

"Les Tremblements de Terre."

M. FOUQUÉ's letter (NATURE, March 28, p. 510) does not meet the main points of my criticism of his book. He thinks that a pendulum swinging in synchronism with the ground's motion is the right thing to use as an absolute seismometer. M. Poincaré's mathematical note, to which he refers as supporting his view, does not support it, but shows why such a pendulum is unsuitable. It is necessary to emphasize this, for it relates to a fundamental matter in the dynamics of earthquake measurement—a matter on which the work done of late years in Japan seems to me to be so intimately based that a misunderstanding about it must be fatal to a proper appreciation of that work. And, in point of fact, I did not find that M. Fouqué gave an appreciative account of what any of the Japanese observers had done. As to his mention of Prof. Ewing's seismograph, in particular, I criticized it not so much because it was meagre as because it was incorrect,—so incorrect as to justify the inference that the author was not acquainted with that instrument.

THE REVIEWER.

Hertz's Equations.

MR. WATSON's criticism, that Hertz's equations are only true for places at some distance from the oscillator, is no doubt perfectly valid. [There is, by the way, an insignificant and obvious misprint of λ for ρ about the middle of his letter.] But this was entirely recognized by Hertz himself; he treated the oscillator as infinitesimal, knowing that it was nothing of the kind when you got near it, and refrained from drawing his diagram-curves into its neighbourhood, for this very reason.

The fact is surely that, to work out completely the case of electric oscillators in a compound body formed of a couple of spheres joined by a cylinder, would tax the resources of a strong mathematician; and it is impossible that the vibration can be, in any sense, a pure one; all manner of sub-vibrations must be superposed upon the main.

From the physical point of view, some general notion of what was happening at a distance of a wave-length or more from the oscillator was desirable, and this Hertz satisfactorily obtained.

But, to work out what is happening in the immediate neighbourhood of a dumb-bell oscillator must be left, I imagine, to the time when some pure mathematician may devote his attention to this particular shape of conductor, if the case appears to him of sufficient interest. At present I see no special reason why it should be so regarded, but of that Mr. Watson is a better judge. I hope he may see fit to attack the problem.

Grasmere, April 13. OLIVER J. LODGE.

THE COMPRESSIBILITY OF HYDROGEN.

AS stated in the obituary notice that appeared in NATURE (vol. xxxviii. p. 598) at the time of the melancholy accident which caused his death, Wroblewski was engaged in an investigation of the behaviour of hydrogen on compression. The results of this investigation, as far as it had then advanced, have now been made public (*Monatsh. für Chem.*, 1888, p. 1067 *et seq.*). They are of a most important and interesting nature, and form a fitting memorial of the patience and skill of the observer, who most unhappily was not spared to bring this, the last and most complete of a long series of similar investigations, to a close.

Hydrogen has long occupied an exceptional and isolated position among gases. This is due to the fact that, as Regnault first pointed out, hydrogen forms the sole exception to the law that the product of the pressure into the volume, pv, of any gas decreases with increasing pressure,—the exact converse being true in the case of hydrogen, this product showing a regular increase. It is true that, as since shown by Amagat and others, this behaviour of hydrogen becomes general for all gases when the pressure is increased beyond a certain limit, but before reaching this limit the product pv invariably decreases until a minimum is reached for all gases with the exception of hydrogen. For hydrogen neither the decrease nor the minimum have yet been observed, the gas as hitherto examined showing an invariable increase of pv with increasing pressure. The natural inference was, however, that the exception was only apparent, and that the minimum above noted would be found to occur also with hydrogen if the gas were examined at lower pressures than those hitherto investigated—that is to say, at pressures below one atmosphere. But a difficulty in the way of this hypothesis arises from the fact that the critical pressures of all gases are found to be *below* the pressure at which the minimum value for the product of pressure into volume occurs, and therefore on the above reasoning the critical pressure of hydrogen would have to be phenomenally low and considerably beneath one atmosphere.

To gain a further insight into the relation of volume to pressure in the case of hydrogen, Wroblewski decided to investigate this relation through a wide range of temperature. For this purpose he selected as temperatures sufficiently apart, the boiling-point of water, 100° C., the melting-point of ice, 0° C., the boiling-point of liquid ethylene, − 103°·5 C., and the boiling-point of liquid oxygen, − 183° C. The pressures employed varied from one to seventy atmospheres.

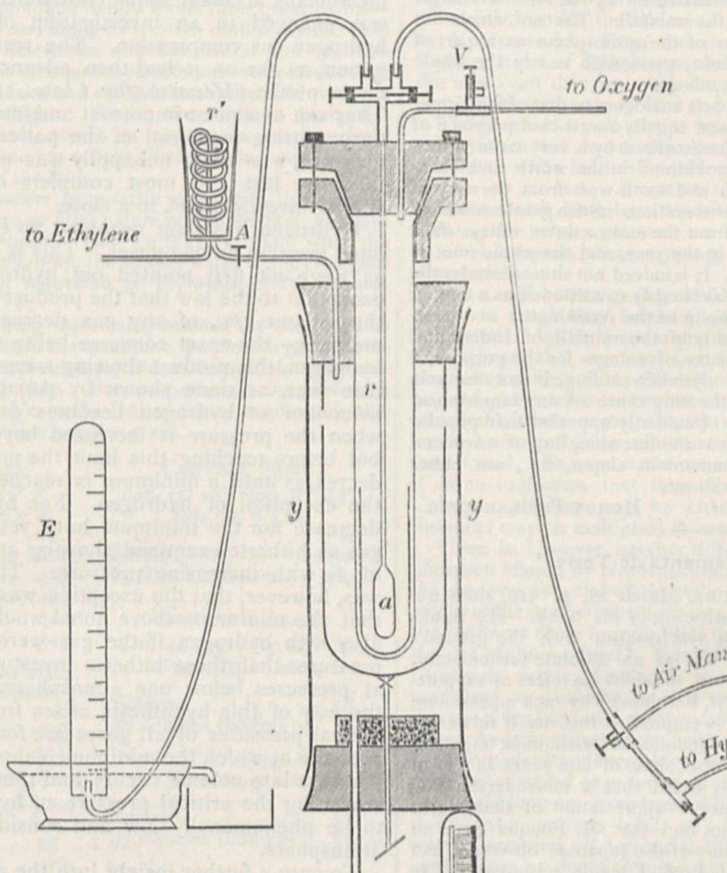
The method of experimenting was exceedingly simple. The gas at a known pressure was forced into a bulb of known capacity having a capillary neck, and kept at one of the above four temperatures. A sufficient length of time was allowed for the gas to attain the fixed temperature; it was then transferred to a eudiometer, and its volume measured. It is needless to add that every precaution was taken both in purifying the gas and in applying the necessary corrections.

The results with the three first of the above temperatures agree with the behaviour of hydrogen already observed, the product of volume into pressure constantly increasing with the pressure. It was found that for the range of pressures under investigation (one to seventy atmospheres) the relation between these two quantities may be expressed in all three cases by the general equation $pv = a + bp + cp^2$. The curves which this equation represents have their concave side towards the axis of p. Between the temperatures $-103^{\circ}\cdot 5$ and 100°, then, nothing is observed that contradicts former experience with regard to hydrogen on compression.

But at the temperature of boiling oxygen, -183°, the behaviour of hydrogen is very different. Up to a pressure of about fourteen atmospheres the product pv decreases with rising pressure, and the above equation no longer holds good. At about fourteen atmospheres, however, this decrease has reached a minimum, and from this point the gas behaves in the ordinary way, and the product pv increases with the pressure in accordance with the equation given above. Not the least sign of liquefaction occurs at this temperature at any of the pressures employed.

This is an observation of great importance. It shows that at sufficiently low temperatures hydrogen behaves on compression like all other gases, and has a minimum value of pv occurring, not at some exceptionally low pressure, but at a pressure of fourteen atmospheres.

For the general representation of the four isothermals



In the sketch given of the apparatus used when the gas was cooled by means of liquid oxygen, *a* is the bulb in which the compression of the hydrogen takes place. The vessel containing this is filled with oxygen under pressure and surrounded by ethylene under evaporation, liquid ethylene being obtained by passing the gas already cooled by a mixture of ice and salt through a worm tube immersed in *r'* in a mixture of solid carbon dioxide and ether. By suddenly diminishing the pressure on the oxygen by opening the tap V communicating with the outside air, the gas is partially liquefied and the desired temperature is reached. The volume of the gas in *a* is afterwards measured by allowing it to escape into the eudiometer E.

thus obtained, Wroblewski employs an empirical formula that differs but slightly from one given by Clausius—

$$p = \frac{RT}{v - a} - \frac{K}{\epsilon^{T} v^{2}},$$

the values of the constants being in the present case $R = \frac{1}{273}$, $a = 0\cdot 00111665$, $K = 0\cdot 00051017$, and $\epsilon = 1\cdot 003892$. This equation serves for the calculation of the critical temperature, pressure, and volume of hydrogen, for which the values are found to be—

$$\theta\epsilon = \frac{8K}{27Ra}, \ \pi = \frac{RT}{8a}, \text{ and } \phi = 3a,$$

or, substituting the values for the constants, we get—

Critical temperature $\theta = 32\cdot 6$ or $-240^{\circ}\cdot 4$ C.,
,, pressure $\pi = 13\cdot 3$ atmospheres,
,, volume $\phi = 0\cdot 00335$,

from which

Critical density $= 0\cdot 027$.

Similar results were obtained by employing other formulæ than the one given above, but this was retained as being in best agreement with the experimental results.

These numbers afford at once an explanation of the ordinary behaviour of hydrogen on compression and the absence of the minimum of pv at ordinary temperatures, this being due to the fact that hydrogen possesses a very low critical temperature combined with a low critical pressure. For if, instead of taking temperature and pressure in the ordinary units, we take temperature in terms of the critical temperature, and pressure in terms of the critical pressure as units, and then with temperatures as abscissæ and pressures as ordinates construct the curve for the observed minimum points of pv, this curve will be found to be one and the same for all gases. As Wroblewski has shown, it is a continuation of the curve for the vapour pressures at different temperatures of the liquefied gases, pre-sure and temperature being expressed in terms of the critical. Drawing this curve by the aid of the observations that have already been made with ethylene, carbon dioxide, methane, and other gases, it is found that the pressure for the minimum point rapidly rises with rising temperature, and reaches a maximum of about 3π for a temperature of $1{\cdot}4\theta$. From this point, however, the pressures decrease as the temperature rises, so that, when the temperature is about 3θ, the pressure at which the minimum pv occurs is π, or the critical pressure; and if the temperature be further increased beyond this point the pressure of minimum pv is reduced below the critical, and continues still further to fall as the temperature rises.

Applying this to hydrogen at a temperature of about 3θ, the pressure of minimum pv should be π, the critical pressure, and this as a matter of fact agrees with the result of the above experiments. For 3θ is approximately $-176°$ C., at which point the required pressure should be the critical or $13{\cdot}3$ atmospheres, and observation shows that at $-183°$ C. this pressure is fourteen atmospheres, and as, the temperature being lower, we should expect the pressure to be somewhat higher, this is a very close approximation indeed. At higher temperatures the pressure falls below the critical, and this evidently takes place so rapidly that at $-103°$ C., or for about 5θ, the pressure of minimum pv is so small a fraction of the critical as to be removed outside the range of observation. The critical pressure itself being low of course assists this process.

This, then, explains the behaviour of hydrogen on compression, and why this behaviour differs from that of the other gases. For a gas must be raised to a temperature of over 3θ before it will act like hydrogen, whereas gases have up to the present only been examined at temperatures not far removed from the critical.

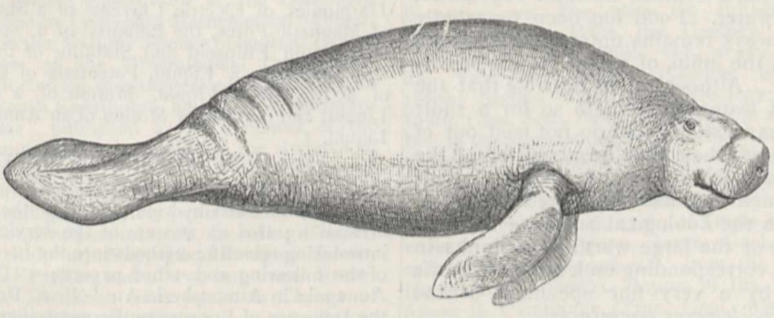
The very low critical temperature of hydrogen is remarkable. It confirms the saying of Regnault, that hydrogen at ordinary temperatures is a gas *plus que parfait*. At the same time it shows that no reliance can be put on Pictet's statement that hydrogen was liquefied at about $-140°$ C. under a pressure of 360 atmospheres; and whether the temperature attained in Cailletet's experiments was low enough to actually liquefy the gas must be looked upon as extremely doubtful. At the time of his death Wroblewski was planning experiments for the liquefaction of hydrogen, the only thing necessary to make his work complete.

By cooling hydrogen under a pressure of 110 atmospheres to $-213{\cdot}8°$ C. by the evaporation of liquid nitrogen, and then suddenly diminishing the pressure, as low a temperature as $-223°$ C. was obtained, but the hydrogen still remained in the gaseous state and refused to liquefy.

H. CROMPTON.

THE MANATEE.

THE Zoological Society have added to their living collection in the Regent's Park a young specimen of the Manatee (*Manatus americanus*), which those who wish to have an opportunity of inspecting an extremely curious form of Mammalian life should take an early opportunity of visiting. The Manatees belong to the order *Sirenia* of naturalists, and are sometimes called "herbivorous Cetaceans," although it is, to say the least, very doubtful whether they have any near relationship whatever to the true Whales or order Cetacea. These creatures were abundant in former geological epochs, but since the extermination of the *Rhytina*, or Steller's Sea-cow, at the latter part of the last century, have only two representatives still living on the earth's surface, viz. the Manatee of America and Africa, and the Dugong of the Indian Ocean.



As will be seen by our outline sketch, taken from the Zoological Society's Proceedings, the Manatee is shaped more like a fish than an ordinary mammal. It is formed exclusively for aquatic life, and inhabits the estuaries and rivers of the American and African continents, where it passes its time browsing on the plants beneath the surface and adjacent to the banks. It remains mostly under the water, and only raises its head above the surface to breathe.

The present specimen, which arrived at the Gardens from Liverpool on March 2, is the second example of this singular form that has been received alive by the Society. The first specimen was acquired in August 1875, and lived about a month in the Regent's Park, where it attracted many visitors. When dead, however, it was by no means wasted, as it formed the subject of an excellent article on its anatomy read before the Zoological Society by the late Prof. Garrod, and subsequently published in the tenth volume of the Society's Transactions.[1]

In 1879, a pair of Manatees, received from the Island of Trinidad, lived for several months in the Brighton Aqua-

[1] A complete account of the anatomy of the Manatee was prepared by Dr. Murie in 1872, from the examination of a specimen of this animal imported from Surinam for the Zoological Society, which unfortunately only lived just long enough to reach England. This will be found in the eighth volume of the Zoological Transactions. The attention of residents on the Amazons should be called to the existence in that river of a second species of Manatee (*Manatus inunguis*), discovered by the great Austrian naturalist, Johann Natterer, in 1830, but as yet little known in Europe.

rium, and were the subject of some very interesting notes on their habits, prepared by Miss Agnes Crane, and published in the Zoological Society's Proceedings, from which the following particulars are extracted:—

"Lettuces and endives formed the favourite food of this pair of Manatees; six dozen of these vegetables, weighing 30 pounds, being their average daily allowance. The male would devour at a pinch leaves of the cabbage, turnip, and carrot. Both relished those of the dandelion and the sow-thistle (*Sonchus oleraceus*). Some varieties of a common river-weed were also taken; b t this food was abandoned on account of the leeches with which it was found to be infested Sometimes the animals swim gently about, and pursue the leaves floating on the water. At others, the plants are seized in their mouths, drawn down, and eaten under water, the hand-like fore-fins being employed in separating the leaves The food is invariably swallowed below the surface. The masticatory actions of the animal have been so fully and accurately described by Prof. A. H. Garrod, F.R.S. (Trans. Zool. Soc., vol. x p. 137), that further remark on that subject is unnecessary. The habits of the animals in captivity, while affording occasional evidence of the ease and rapidity with which they move in the water, do not furnish much support to the views of their capability of habitual active progression on land. Yet it must be admitted that, supplied with a sufficiency of nicely-varied food, they have no inducement to leave the water, and that the construction of their straight-walled tank precludes such efforts as a rule. The male, however, has recently been observed to make some slight attempts at terrestrial movement, turning himself round and progressing a few inches when his tank was empty. With jaws and tail-fin pressed closely to the ground, the body of the animal becomes arched, and is moved by a violent lateral effort, aided, and slightly supported, by the fore-paddles, which are stretched out in a line with the mouth. But the effect of these very laboured efforts was not commensurate with their violence; in fact, their relation to active locomotion may be compared to those of a man lying prone with fettered feet and elbows tied to side. Nor does the Manatee seem at all at ease out of water, as he lies apparently oppressed with his own bulk, while he invariably makes off to the deepest corner of his tank directly the water is re-admitted. One point may be regarded as definitely settled. Notwithstanding the predilection they have evinced for land vegetables, they never feed out of water. Food has been repeatedly offered them, but it always remains untouched, although readily devoured when the influx of water set the leaves floating on the surface. Although it is possible that the animals can get out of water and remain so for a short period, as they progress so slowly and do not feed out of water it seems as though they must be acquitted of the garden depredations and prolonged wanderings from their native element with which they have been credited."

The Manatee now in the Zoological Society's Gardens has been placed in one of the large warm water tanks in the Reptile House, the corresponding tank on the opposite side being occupied by a very fine specimen of the Snapping Turtle (*Macroclemmys temmincki*).

After inspecting the Manatee, those who wish for more information on the subject of the Sirenians should visit the Natural History Museum at South Kensington, and examine the splendid mounted skeleton of the *Rhytina*, or Steller's Sea-cow—a recently extinct gigantic representative of the same order of mammals—in the Palæontological Gallery.

THE ROYAL SOCIETY SELECTED CANDIDATES.

THE following fifteen candidates were selected on Thursday last by the Council of the Royal Society to be recommended for election into the Society. We print with the name of each candidate the statement of his qualifications:—

John Aitken.

He is an accurate, successful, and highly inventive investigator in Experimental Physics, and for the purpose of his investigations has designed and constructed many ingenious and valuable pieces of apparatus. Has carried out a valuable and instructive research regarding the relations between fog and dust in air, and in connection therewith has devised and used methods for counting the number of dust particles in air. The results of his works were given in numerous papers read by him before the Royal Society of Edinburgh, and published in the Proc. and Trans. Roy. Soc. Edin., during the years from 1875 until the present date. Received from the Roy. Soc. Edin. the Keith Prize for 1883–85, for a paper on "The Formation of Small Clear Spaces in Dusty Air" (1884), being a continuation of the subject of a former paper "On Dust, Fogs, and Clouds" (1880), and for contributions on atmospheric phenomena, the more important of these being a series of papers on "Thermometric Screens" (1884–87).

Edward Ballard, M.D. (Lond.),

Physician in H.M. Civil Service. Eminently distinguished as an Investigator of Causes of Disease, and as a promoter of scientific sanitary administration. Has published, *inter alia*, as follows:—On the Influence of Weather and Season on the Public Health, based on the Statistical Study of 272,000 Cases of Sickness (1857–68); On Vaccination and its Alleged Dangers (1868); A Local Outbreak of Enteric Fever traced to a Local Distribution of Milk (1871); Reports to the Local Government Board, year by year, on particular inquiries, local, or more or less general (1871–88). Of the latter the following may be named:—The Effluvium Nuisances which arise in various manufacturing and other branches of industry, studied as to their Effects on the Public Health, and as to their Preventability (1876–78); various Studies of Outbreaks of Disease referable to Articles of Food (1873, 1880–88); Survey of England as to the Local Preparations against Chlorea (1885–86); Studies of the Causation of Epidemic Infantine Diarrhœa in England and Wales (1882–88).

Alfred Barnard Basset, M.A.,

Barrister-at-Law. Author of a treatise on Hydrodynamics, in two volumes (1888); also papers in the *Quart. Journ. Math*, *Mess. of Math.*, *Phil. Mag*, Proc Lond. Math. Soc., Proc. Camb. Phil. Soc., Phil. Trans. Roy. Soc. (1888), and *Amer. Journ. Math.* These papers treat of the Motion of Liquids about Elliptic Cylinders, of Associated Functions and Spherical Harmonics, of Electric Currents of a Sheet rotating in a Field of Magnetic Force, the Potential of a Spherical Bowl, Motion of a Liquid Ellipsoid and Stability of this Motion, Motion of two Spheres in a Liquid, Potentials of Circular Disks, Motion of a Ring in a Liquid, Motion of a Sphere in a Viscous Liquid, and the Steady Motion of an Annular Mass of Rotating Liquid.

Horace T. Brown,

F.C.S., F.I.C., F.G.S., Brewer. Distinguished as an investigator of the Carbohydrates, and of the Phenomena of Fermentation; also on account of the services he has rendered in introducing scientific methods into the brewing industry. Author of the following and other papers:—"On the Estimation of Ammonia in Atmospheric Air" (Proc. Roy. Soc., 1870); "On the Influence of Pressure on Fermentation" (Journ. Chem. Soc., Part I., 1872, Part II., 1873); "On the Electrolysis of Sugar Solutions" (*ibid.*, 1872). In conjunction with Mr. Heron:—"Contributions to the History of Starch and its Transformations" (*ibid.*, 1879); "Some Observations on the Hydrolytic Ferments of the Pancreas and Small Intestine" (Proc. Roy. Soc., 1880). In conjunction with Dr. Morris:—"On the Non-crystallizable Products of the Action of Diastase upon Starch" (Journ. Chem. Soc., 1885); "Determination of the Molecular Weights of the Carbohydrates" (*ibid.*, 1888).

Latimer Clark,

C.E., F.R.A.S., F R G.S., Electrical Engineer. Past President of the Institution of Electrical Engineers. Author of:—"Description of the Britannia and Conway Tubular Bridges;" chapter on "Tides of the Menai Straits," in E. Clark's book on the Britannia and Conway Bridges; "Elementary Treatise on Electrical Measurement;" and (jointly with R. Sabine) "Electrical Tables and Formulæ." Author of various papers on Electric Measurement, and on various branches of Engineering Science, published in Report of the Brit. Assoc., the Government Report on Submarine Cables, and the Engineering Journals. Introduced a standard voltaic cell of great importance and value for promoting accurate measurement of electric potentials, and presented a paper on this subject to the Royal Society, which was read June 19, 1873. From 1848–51 was Resident Assistant Engineer at the Britannia Tubular Bridge, under the late Robert Stephenson. In 1851 became Engineer to the Electric and International Telegraph Company, and remained in this service for 20 years, part of the time as Engineer-in-Chief. Made important observations on the passage of electricity through long underground lines, of which the results were the subject of Faraday's Bakerian Lecture of 1854, and are given in his "Experimental Researches," with Faraday's own experiments and theory. In 1854 introduced the system of transmitting messages through "pneumatic-despatch tubes" in the Electric Telegraph Company's service. The system is continued in the Postal Telegraph system of the Government, having been found admirably successful and useful.

DAVID DOUGLAS CUNNINGHAM, M.B., C.M. (Edin.).

F.L.S., Surgeon-Major, Beng. Med. Service, Honorary Surgeon to the Viceroy of India. Professor of Physiology, Medical College, Calcutta. Fellow of the University of Calcutta. Distinguished as the author of numerous original scientific memoirs in connection with Animal and Vegetable Physiology and Pathology, among which may be noted:—"On certain Effects of Starvation on Vegetable and Animal Tissues;" "On the Development of certain Microscopic Organisms occurring in the Intestinal Canal;" "On the relation of Cholera to Schizomycete Organisms;" and (in conjunction with the late Dr. T. R. Lewis, F.R.S., elect.) of the following papers relating to the Etiology of Cholera and other Diseases:—"A Report of Microscopical and Physiological Researches into the Nature of the Agent or Agents producing Cholera;" "The Soil in its Relation to Disease;" "Cholera in Relation to certain Physical Phenomena;" "The Fungus Disease of India;" Leprosy in India;" &c., &c. Distinguished as an eminent Indian Physiologist and Pathologist.

LAZARUS FLETCHER, M.A. (Oxon),

F.G.S., F.C.S., Memb. Phys. Soc. President of the Mineralogical Society. Late Scholar of Balliol College, and Fellow of University College, Oxford. Late Millard Lecturer on Physics, Trinity College, and Junior Demonstrator at the Clarendon Laboratory at Oxford. Senior University Mathematical Scholar, 1876. Late Examiner in the Natural Science Schools in Oxford and Cambridge. Keeper of the Mineralogical Department, British Museum. Conducted the re-arrangement of the Minerals in the new Museum at South Kensington, and by his descriptions of these in the "Guides" published by the Trustees of the British Museum, has contributed valuable aid to the students of Crystallography and Mineralogy. Is the Author of many memoirs in the Journal of the Crystallological Society, and recently that of the Mineralogical Society (with which the former Journal has been united) on various minerals, including Copper, Silver, Gold, Bismuth, Sulphur, Nagyagite, Realgar, Zircon, Skutterudite, and Copper Pyrites, and of two important mathematical memoirs on the Dilatation of Crystals on Change of Temperature, in *Phil. Mag.* 1880 and 1885.

WILLIAM BOTTING HEMSLEY,

A.L.S. Assistant for India in the Herbarium of the Royal Gardens, Kew. Entered the Kew Herbarium in 1863; assistance acknowledged by G. Bentham, F.R.S., in preface to Flora Australiensis, 1863; A.L.S., 1875; Lecturer on Botany at St. Mary's Hospital, 1876; author of numerous papers on Systematic Botany, which, together with his larger works, have given him an authoritative position in this branch of science; author of the Botany (5 vols., 4to) of the "Biologia Centrali-Americana," 1879–88; joint author with Brigade-Surgeon Aitchison, F.R.S., of memoirs on the botanical collections of the several Afghan expeditions (Journ. Linn. Soc., xviii. pp. 29–113, 1880; xix. pp. 148–200, 1883; Trans. Linn. Soc., 2nd Ser. III. pp. 1–139, 1888); engaged by sub-committee of the Government Grant Committee to prepare the "Index Floræ Sinensis," an enumeration of all known Chinese plants (in course of publication, Journ. Linn. Soc., xxiii. 1886–88, *et seq.*).

CHARLES THOMAS HUDSON, M.A.,

LL.D. (Cantab.). President of the Royal Microscopical Society (1888). Was 15th Wrangler, 1852. Joint author of Hudson and Gosse's "Rotifera." Discoverer of *Pedalion mirum*, and of numerous new genera and species of Rotifera, described in papers published in the Journ. Roy. Micros. Soc., *Quart. Journ. Micros. Sci.*, and the *Ann. and Mag. Nat. Hist.* from 1869 to the present year. Specially distinguished for his knowledge of the Rotifera, concerning which he is the chief living authority. ["The genus Pedalion discovered and described by Dr. Hudson is one of the most remarkable and important contributions to animal morphology of the past twenty years."—E. R. L.]

THOMAS MCKENNY HUGHES, M.A.

F.G.S., F.S.A. Professorial Fellow of Clare Coll. Camb. Chev. Ord. SS^rum Maur. et Lazar. Ital. President Brit. Committee, Internat. Geol. Congress. President Chester Nat. Hist. Soc. Hon. Memb. Soc. Géol. de Belg. Memb. Soc. Géol. de France. Memb. Soc. Geol. d'Italia, &c., &c. Woodwardian Professor of Geology, Cambridge. Author of the following papers:—"On the Junction of the Thanet Sand and the Chalk," &c. (Quart. Journ. Geol. Soc. 1866, vol. xxii. p. 402); "Geology of Parts of Westmoreland and Yorkshire" (Proc. Geol. and Pol. Soc. W. Riding, Yorks. 1867); "Break between Upper and Lower Silurian Rocks, Lake District" (*Geol. Mag.* 1867, p. 346); "The Two Plains of Hertfordshire and their Gravels" (Quart. Journ. Geol. Soc. 1868, vol. xxiv. p. 283); "Part of the Geology of the London Basin" (Mem. Geol. Surv. iv. 1872). Memoirs Geol. Surv.—Explanation of Quarter Sheet 98, N.E., and of ditto S.E. (1872). "Man in the Crag" (*Geol. Mag.* 1872, vol. ix. p. 247); "Exploration of Cave Ha, Yorkshire" (Journ. Anthrop. Inst. 1874); "Felstone Implements in Pontnewydd Cave" (*ibid.*); "Classification of the Sedimentary Rocks" (Brit. Assoc. Rept. 1875); "Geological Measures of Time" (Royal Inst. March, 1876); "Silurian Grits, Corwen, N. Wales" (Quart. Journ. Geol. Soc. 1877, vol. xxxiii. p. 207); "Evidence afforded by Gravels and Brick-earth" (as to remains of Man) (Journ. Anthrop. Inst. 1877); "Pre-Cambrian Rocks of Bangor" (Quart. Journ. Geol. Soc. 1878, vol xxxiv. p. 137); "Relation and Duration of Forms of Life on the Earth to the Breaks in the Sedimentary Rocks" (Proc. Camb. Phil. Soc. 1879); "Silurian Rocks of the Vale of Clwyd" (Quart. Journ. Geol. Soc. vol. xxxv. p. 694); "The Pre-Cambrian Rocks of Caernarvon" (*ibid.*, p. 682; "Transport of Fine Mud, &c., by Conferva" (Camb. Phil. Soc., Feb. 1880); "The Altered Rocks of Anglesea" (*ibid.*); "Evidence of Later Movements of Elevation and Depression in British Isles" (Vict. Inst., March, 1880); "On the Geology of Anglesea" (Quart. Journ. Geol. Soc. 1880, vol. xxxvi. p. 237); "Geology of the Vale of Clwyd" (Chester Soc. Nat. Sci., Nov. 1880); Second Paper on "Geology of Anglesea" (Quart. Journ. Geol. Soc., 1882, vol. xxxviii. p. 16); "On the Brecciated Bed in the Dimetian at St. David's" (*Geol. Mag.* 1883, p. 306); "Report of Excursion of the Geol. Assoc. to Bangor, Snowdon, Holyhead, &c." (Proc. Geol. Assoc. vol. viii., July 1883); "Fossils in Pleistocene Gravels, Barnwell, near Cambridge" (*Geol. Mag.*, 1883, p. 454); "Tracts of Terrestrial and Freshwater Animals" (Quart. Journ. Geol. Soc., 1884); "On so-called '*Spongia paradoxica*' from the Red and White Chalk, Hunstanton" (*ibid.*); Report of the Excursion of the Geol. Assoc. to Cambridge (Proc. Geol. Assoc. 1884); "On some Perched Blocks" (Quart. Journ. Geol. Soc., 1886); "On Caves" (Vict. Inst., 1887); "Drifts of the Vale of Clwyd, in relation to the Caves" (Quart. Journ. Geol. Soc., 1887); "Some Brecciated Rocks in the Archæan of Malvern" (*Geol. Mag.* 1887); "On Bursting Rock Surfaces" (*Geol. Mag.*, Nov. 1887).

EDWARD B. POULTON, M.A. (Oxon.),

F.L.S., F.Z.S., F.G.S. Tutor of Keble College. Lecturer in Natural Science, Jesus College, Oxford. Distinguished as a zoologist, and especially for investigations upon the colours of insects. Author of the following, among other papers:—"The Tongue of *Perameles nasuta*" (*Quart. Journ. Micros. Science*, January 1883); "The Tongue of *Ornithorhynchus paradoxus*" (*Quart. Journ. Micros. Science*, July, 1883); "On the Tongues of Marsupialia" (Proc. Zool. Soc., December, 1883). Papers relating to the subject of colour and marking in insects, in

Trans. Entom. Soc., April 1884, August 1885, and June 1886; Proc. Roy. Soc., No. 237, 1885, and No. 243, 1886; "The Experimental Proof of the Protective Value of Colour and Markings in Insects in reference to their Vertebrate Enemies" (Proc. Zool. Soc., 1887); "An Inquiry into the Cause and Extent of a special colour-relation between certain exposed Lepidopterous Pupæ and the surfaces which immediately surround them" (Phil. Trans., 1887); "Notes in 1886 on Lepidopterous Larvæ" (Trans. Entom. Soc., 1887).

WILLIAM JOHNSON SOLLAS, D.Sc. (Cantab.), Hon. LL.D. (Dubl.)

F.R.S.E., F.G.S. Late Fellow of St. John's College, Cambridge. Professor of Geology in the University of Dublin. Author of numerous papers on Geology, Palæontology, and the Natural History of the Sponges, among which the following may be specially enumerated:—"On the Silurian District of Rhymney, &c." (Quart. Journ. Geol. Soc., vol. xxxv. p. 475); "On a New Species of Plesiosaurus, &c." (*ibid.*, vol. xxxvii. p. 440); "On the Structure and Affinities of the Genus *Siphonia* (*ibid.*, vol. xxxiii. p. 242); "On *Stauronema*, a New Genus of Fossil Hexactinellid Sponges" (*Ann. and Mag. Nat. Hist.*, Ser. 4, vol. xix. p. i.); "On the Flint Nodules of the Trimmingham Chalk" (*ibid.*, Ser. 5, vol. vi. p. 384); "On the Sponge Fauna of Norway" (*ibid.*, Ser. 5, vol. v. p. 130, 5 parts).

CHARLES TODD, M.A. (Camb.), C.M.G.,

F.R.A.S. Postmaster-General, Superintendent of Telegraphs, and Government Astronomer. He has executed important astronomical observations extending over thirty-eight years, including Transit of Venus, Jupiter's Satellites, Determination of Australian Longitudes, &c. He has conducted Meteorological Observations in South Australia extending over thirty years. He has written a Treatise on the Meteorology of South Australia, and other works. He has contributed papers to the Royal Society of South Australia, and was responsible for the erection of the telegraph line across the interior of Australia from Adelaide to Port Darwin, 2000 miles in length, and to Western Australia, 1000 miles in length.

HERBERT TOMLINSON, B.A. (Oxford),

Formerly Junior Student of Christ Church, Oxford. Whitworth Exhibitioner, 1870. Demonstrator of Natural Philosophy in King's College, London. Author of numerous papers on physical subjects published in the Phil. Trans., Proc. Roy. Soc., *Phil. Mag.*, &c., the most important of which relate to the influence of stress and strain on the Physical Properties of Matter. The following may be enumerated:—(1) "Effect of Magnetization on the Electrical Conductivity of Iron" (Proc. Roy. Soc., 1875); (2) "Increase in Resistance to the passage of an Electrical Current produced in certain wires by Stretching" (*ibid.*, 1877); (3) "Alteration of Thermal Conductivity of Iron and Steel caused by Magnetism" (*ibid.*, 1878). The following papers relate to the influence of Stress and Strain, &c.:—(4) "Moduli of Elasticity" (Phil. Trans., 1883); (5) "Electrical Conductivity" (*ibid.*); (6) "Relations between Moduli of Elasticity, Thermal Capacity, and other Physical Constants" (Proc. Roy. Soc., 1885); (7) "Alteration of the Electrical Conductivity of Cobalt, &c., by Longitudinal Traction" (Proc. Roy. Soc., 1885); (8) "Internal Friction of Metals" (Phil. Trans., 1886); (9) "Co-efficient of Viscosity of Air" (*ibid.*); (10) "On Certain Sources of Error in Connection with Experiments on Torsional Vibrations" (*Phil. Mag.*, 1885); (11) "Temporary and Permanent Effects on some of the Physical Properties of Iron produced by raising the Temperature to 100° C." (*ibid.*, 1886); (12) "Effect of Change of Temperature on the Internal Friction and Torsional Elasticity of Metals" (abstr. in Proc. Roy. Soc., 1886); (13) "Effect on Magnetization on the Elasticity and the Internal Friction of Metals" (Phil. Trans., vol. clxxix. p. 1); and other papers.

GERALD F. YEO, M.D. (Dubl.),

F.R.C.S. Professor of Physiology, King's College, London. Researches:—"On the Physiology of the Central Nervous System" (with Prof. Ferrier) (Proc. Roy. Soc., 1881; Phil. Trans., 1884); "On the Physiology of Muscle and Nerve" (with Dr. Cash) (Proc. Royal Soc., 1882 and 1883; Journal of Physiol., 1884); (with Mr. Herroun) (*ibid.*, 1884); "On the Composition of Human Bile" (with Mr. Herroun) (Journ. of Physiol., 1884); "On the Cause of the First Sound of the Heart" (with Dr. Barrett) (*ibid.*, 1884). On Pathological Subjects:—"Diseases of the Kidney" (Dubl. Path. Soc., 1865); "Lymph Glands" (*Med. Jährb. d. Aertze*, in Wien, 1871); "Pleuropneumonia in Cattle" (Report for Roy. Agric. Soc., 1878); and of numerous other papers (Proc. Dubl. Path. Soc.; *Irish Hospital Gazette; Dubl. Journ. Med. Sci.*, 1872 to 1875). Author of "Manual of Physiology."

THE SHOOTING-STARS OF APRIL.

IN recent years this meteor group has not developed exceptional activity, nor have its annual returns attracted such general observation as the *Perseids* of August; but it is nevertheless a stream that is entitled to a considerable amount of interest, as some of its displays appear to have been noticed in ancient times, and it is identified with the comet described by Thatcher on April 4, 1861. The modern displays of this shower have not justified the anticipations formed of it in regard to its richness because of its periodic character. Of late years the special region of the orbit where the meteorites are clustered in the richest profusion has probably been far removed from the earth. The apparent feebleness of the shower may therefore be regarded as merely temporary. The *Leonids* of November have during the last fifteen years similarly offered a poor spectacle to those who have encouraged the hope that they might attain a prominent degree of activity. But with the parent comet (I. 1866), in distant parts of its path, it is not surprising that comparatively very few of these meteors have been seen. The same remark equally applies to the April meteors. They are chiefly condensed near the comet of 1861, which is now traversing a section of its orbit sufficiently remote from the earth to have withdrawn all the richer parts of the stream from our cognizance. The meteorites lately encountered by the earth upon crossing the node of this comet on about April 20 are simply the outlying and more scattered remnants of the system. It is highly probable, however, that the distribution of the particles is to some extent irregular, and that in certain years the shower attains a more pronounced aspect than the conditions would indicate. Thus in 1884 there was a rather conspicuous display, the number of meteors visible being about 22 per hour for one observer; but this, though representing a striking degree of productiveness relatively to the minor showers, yet falls much below the character of a meteor-stream of first-class importance.

In the present year, the Lyrid showers, if visible, will be most favourably witnessed in the early part of the night, as moonlight will interfere in the morning hours. On April 19 the moon rises at 11h. 53m., on the 20th at 13h., and on the 21st at 13h. 55m. The north-eastern sky should be watched before our satellite emerges from the horizon. The most essential features to be noticed during the progress of the display will be the following:—

(1) The position of the radiant-point on each night of observation. It is very important to note whether this point becomes rapidly displaced to the eastwards, as in 1885 (NATURE, vol. xxxii. p. 5).

(2) The horary number of meteors appearing to one observer, and the proportion radiating from Lyra.

(3) The paths and visible peculiarities of the largest meteors. It is necessary that such data be gathered and utilized in computations of the real paths of those meteors which may be recorded at more than one station.

(4) The duration of the individual meteor-flights. This is an element extremely difficult to estimate with tolerable precision, especially in respect of swift-moving meteors like the Lyrids.

(5) The positions of radiants of the minor streams which furnish meteors at this epoch. Subjoined are the

places of some of the principal of these, which have been ascertained during the last fifteen years :—

No.	R.A.	Decl.	No.	R.A.	Decl.
1	213	+ 53	5	286	+ 24
2	227	− 1	6	293	+ 43
3	231	+ 17	7	296	± 0
4	272	+ 21	8	302	+ 23

The centre of emanation of the Lyrids is at 270° + 32½°, which lies between the constellations of Hercules and Lyra. It will be very interesting to secure additional observations this year as to the strength and character of this stream, and of the many lesser contemporary displays which manifest themselves at this period. Fortunately the weather is often propitious in the vernal season, and enables researches of this nature to be successfully prosecuted.

W. F. DENNING.

NOTES.

OUR readers may remember that, last autumn, *apropos* of a great patent case of colossal dimensions which was then before the Courts, we published an article urging that, in the interests of speedy justice, no less than for the dignity of science and its professors, it was most desirable that advantage should be taken of the provisions which already exist in our law, and especially in the Judicature Act of 1873 and its amending statutes, and in the rules of the Supreme Court framed under them, for the employment of scientific assessors or experts to aid the judge in strictly scientific cases. It may be remembered that, even in the very case on which we then commented, the tardy employment of Prof. Stokes to aid Mr. Justice Kay was productive of most satisfactory results. We are glad, therefore, to notice that, in a case of some difficulty which came before Lord Coleridge last week, the same eminent man was again called in, and again with the result of relieving the Court from the task of hearing a mass of expert evidence with which no judge and jury are competent to deal satisfactorily. The whole question at issue was whether a certain anemometer, of which one of the parties was patentee and the other the purchaser, came up to the description of its qualities given by the vendor. A considerable array of counsel appeared on both sides, and it was arranged that the services of Prof. Stokes should be called in to the aid of the Court. Seven of the anemometers were submitted to him, and, after an investigation by him, his report was read, and upon it judgment was given. The result is, that the report of the case occupies less than a third of a column of the *Times*. Without the services of Prof. Stokes, or some similar sworn expert, we should have had half-a-dozen or more expert witnesses on one side contradicted by half-a-dozen expert witnesses on the other side; a case which would have lasted three or four days before a wearied judge, conscientiously striving to understand purely technical details, and a perplexed and confused jury; great loss to both parties; an unsatisfactory result; and, as we think, no little scandal to science and scientific men. All this has been prevented by the very simple expedient of calling in an eminent man of science to make a sworn report on the purely technical details, and leaving the rest to the ordinary administration of our Courts. Herein, we are persuaded, lie the proper functions of scientific men in the administration of public justice.

Two years ago the Dutch Congress of Science and Medicine was founded, and it was decided that it should meet every two years. The first meeting was held at Amsterdam in September 1887. The second meeting will take place at Leyden from the 25th to the 27th of April. The President of the Congress is Prof. Suringar (Leyden), who will deliver the opening address. A large attendance is expected.

THE meetings of the Institution of Naval Architects, last week, were in every way most successful, and the Institution is to be congratulated on the importance and the wide range of the subjects discussed. At the first meeting, on Wednesday, April 11, a remarkable paper on the designs for the new first-class battle-ships was read by Mr. W. H. White, the Director of Naval Construction. The principal object of this paper was to describe the main features of the approved designs for these battle-ships, and to contrast their protection, armament, speed, and coal-endurance with the corresponding features in other battle-ships designed during the last twenty years. Incidentally, Mr. White sought to show that there are good reasons why these ships surpass in size any previously constructed vessels of the Royal Navy. The reading of the paper was followed by a discussion, in which Sir E. J. Reed, Lord Charles Beresford, and others took part. On Thursday, Sir N. Barnaby, late Director of Naval Construction, read a paper on the protection of buoyancy and stability in ships. The next paper was by Captain Penrose Fitzgerald, on the protection of merchant steamers in time of war. The cruiser, *Piemonte*, built for the Italian Government, at Elswick, was described by Mr. P. Watts, of Elswick, her designer; and Mr. J. I. Thorneycroft read a paper on water-tube boilers for war-ships. On Thursday evening, technical papers were read by Mr. John Scott, Mr. J. Macfarlane Gray, and Mr. V. B. Lewes. On Friday, the first paper read was by Mr. Beauchamp Tower, describing an apparatus for providing a steady platform for quick-firing or machine-guns, or a telescope, or a search-light, on board ships at sea. The second paper was by Prof. V. B. Lewes, on the corrosion and fouling of steel and iron ships. Two papers by Mr. R. E. Froude followed, one on the part played in the operations of propulsion by differences in fluid pressure, and the other on Prof. Greenhill's theory of the screw propeller. Technical papers were likewise read by Mr. W. Rundell and Mr. A. F. Hill.

THE general meeting of the Institution of Mechanical Engineers will be held on Wednesday evening, May 1, Thursday evening, May 2, and Friday afternoon, May 3, at 25 Great George Street, Wastminster, by permission of the Council of the Institution of Civil Engineers. The chair will be taken by the President, Mr. Charles Cochrane, at half-past seven p.m., on Wednesday and Thursday evenings, and at half-past two p.m. on Friday afternoon. He will deliver his inaugural address on Wednesday evening. The following papers will be read and discussed as far as time permits:—"Research Committee on Marine-Engine Trials: Report upon Trials of the s.s. *Meteor*," by Prof. Alexander B. W. Kennedy, F.R.S., Chairman; and "Description of an Apparatus for Drying in Vacuum," by Mr. Emil Passburg, of Breslau (Friday afternoon). The anniversary dinner will take place on Friday evening, May 3.

THE public funeral of M. Chevreul, which took place in Paris, on Saturday last, was one of great splendour. This was due in part, no doubt, to the interest excited by M. Chevreul's extraordinary age; but it must also be taken as a striking indication of the respect felt in France for men who achieve eminence in science. In front of the house in which M. Chevreul died, beside the Jardin des Plantes, a tent was fitted up as a chapel; and here the body was placed in state. The procession to the Cathedral of Notre Dame was headed by a detachment of police, who were followed by a platoon of cuirassiers, the 103rd Infantry Regiment, with flags, and a band of ushers, carrying wreaths presented by the Stearine-makers of France, the Stearine-makers of Lyons, the Friendly Society of Natives of Anjou, living in Paris, and a large number of other public and private bodies. Last of all came a wreath sent by the Gobelin Works, surrounded by a woollen fringe dyed by M. Chevreul himself. The pall-bearers were MM. Fallières, Minister of Public Instruction, Louis Passy, President of the Society of Agriculture, Chaumeton, President of the Students' Association, Des Cloizeaux, of the Academy of Sciences, Quatrefages, of the Academy of Sciences, Chautemps, President of the Municipal Council of Paris, and Roy, Manager of the Society of Arts and Manufactures. Next came the members of M. Chevreul's family, grandchildren and great-grandchildren; and they were followed by the representatives of the President of the Republic, by several of the Ministers, the Presidents of the Senate and the Chamber, and representatives of all the great educational and scientific bodies and administrative departments. At Notre Dame there was an impressive religious service. The interior of the church was hung with black, and over the porch, which was also hung with black, was a scroll bearing the dates "1786-1889." In the centre of the choir was a catafalque resting on silver columns, and surmounted by a canopy with bands of ermine. After the religious ceremony, the body was removed to L'Hay, and interred in the family vault. In compliance with M. Chevreul's last wishes, no speech was made over his grave.

MR. FRANCIS ARTHUR HERON, B.A., of New College, Oxford, has been appointed, after competitive examination, to the Assistantship in the Geological Department of the British Museum, vacant by the resignation of Mr. Arthur Dendy, now Demonstrator of Biology in the University of Melbourne.

WE are glad to see that female art students have now the opportunity of studying the scientific basis of their profession, as Bedford College for Ladies has instituted a well-arranged course of lectures to be given this spring by the Professor of Physics, Mr. Wornack, on light and colour. That an artist should have, at least, an elementary knowledge of the physics of light and colour there can be no doubt.

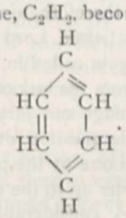
THE Liverpool Marine Biology Committee have arranged to have a four days' dredging expedition at Easter in the Liverpool Salvage Association's steamer *Hyæna*. The ground expected to be covered on this cruise is from the south end of the Isle of Man southwards to Anglesey, and along the north coast of Anglesey to Puffin Island. The submarine electric light will again be used as an attraction in tow-nets let down to the bottom, and this method of capturing some of the more active Crustacea which appear to escape the dredge, will be tried in considerably deeper water than in last year's *Hyæna* Expedition. Mr. Hoyle's new tow-net, which can be opened and closed at any required depth, and Mr. W. S. McMillan's large bottom net, will also be used.

THE extraordinary meeting of the Société Géologique de France, which will be held this year in Paris, beginning on August 18, promises to be one of great interest. During the week devoted to the meeting, the collections in Paris will be visited, and there will be a series of excursions to places of interest within easy reach of that city. In the week following the meeting, excursions will be made to more distant localities—among others to the Auvergne and Brittany, that to the former district under the guidance of M. Michel-Lévy, and that to Brittany conducted by M. C. Barrois. Arrangements will be made with the railway authorities for a reduction of 50 per cent. upon the fares; but in order to secure this advantage the names of persons intending to attend must be sent to the secretaries of the Society before July 1. British geologists, and especially Fellows of the Geological Society of London, are cordially invited to be present.

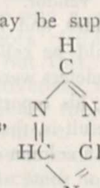
THE April number of *Himmel und Erde*, the magazine of the Gesellschaft Urania (Berlin), contains an interesting article on the Norwegian North Sea Expedition, by Prof. Mohn, Director of the Norwegian Meteorological Institute, Christiania. There is also a good article on the famous hot springs of the Yellowstone Park, by Prof. Zittel, which is illustrated by a map of the neighbourhood and a beautiful photogravure of the terraces. The Copernican theory is discoursed upon by Dr. William Meyer, and two drawings comparing the supposed paths of Mars on the old and new theories very forcibly illustrate its beauty and simplicity. Dr. Ernst Wagner contributes an article on the eruption of Krakatão, particularly referring to the work of the Krakatão Committee of the Royal Society. Besides these, there are also particulars of the various astronomical phenomena for the month.

PROF. KIKUCHI, of Tokio, Japan, has completed his work (in Japanese) entitled "Elements of Plane Geometry" by a second volume, which contains "Book iv., Ratio and Proportion; Book v., Geometrical Applications."

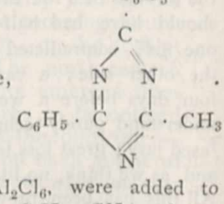
A SERIES of derivatives of the unknown tri-hydrocyanic acid, $H_3C_3N_3$, have been prepared by Prof. Krafft and Dr. von Hansen, of Heidelberg. Tri-cyanogen chloride, $C_3N_3Cl_3$, and the corresponding bromide have long been known, and the radicle C_3N_3 is supposed to exist in the ferro- and ferri-cyanides. Hence it has been expected that some day the hydride itself would be obtained, and although this has not yet been accomplished, a very close approach has been effected by the Heidelberg chemists, who have succeeded in preparing derivatives containing organic radicles instead of hydrogen. Tri-cyanogen hydride may be regarded as bearing the same relation to prussic acid as benzene does to acetylene. On passing a current of acetylene gas through a considerable length of platinum tubing heated to redness, condensation occurs, and benzene, together with other heavier hydrocarbons, is produced; three molecules of acetylene, C_2H_2, become locked up together in the closed chain of C_6H_6,



. In the same way three molecules of prussic acid, HCN, may be supposed to condense into the closed chain of $H_3C_3N_3$,



. The first compound of the new series is methyl-diphenyl tri-cyanide,



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Two parts of aluminium chloride, Al_2Cl_6, were added to a mixture of five parts of benzonitrile, $C_6H_5 . CN$, and two parts of acetyl chloride, $CH_3 . COCl$, keeping the temperature down to 0° C. The mixture was warmed upon a water-bath, when the aluminium chloride gradually passed into solution, and hydrochloric acid gas was copiously evolved. The yellow liquid thus obtained was poured into iced water, upon which a yellowish waxy substance separated endowed with a powerful tear-producing odour. The dried wax was next dissolved in ether, and after filtration of the solution and subsequent evaporation of the ether, was subjected to fractional distillation under reduced pressure. A quantity of benzonitrile passed over first; then benzoic acid, and finally, at a pressure of 15 millimetres and temperature of 220°-230°, corresponding to 370° under ordinary pressure, methyl diphenyl tricyanide, which solidified in the receiver to a white mass of crystals. By recrystallization from alcohol, it was obtained in long needles. About 50 grammes were obtained for every 100 grammes of acetyl chloride used. The crystals melted at 110°. When hydrochloric acid gas was passed through a solution of the needles in benzene, crystals of the hydrochloride separated. Upon similarly treating a warm alcoholic solution, and adding a warm solution of platinum chloride in alcohol, ruby-red crystals of the platinochloride were obtained on cooling, analyses of which confirmed the above formula, which had been independently established empirically by analyses of the base itself. A vapour-density at 444° also pointed to the corresponding molecular weight. The proof of its constitution was afforded by the products of saponification, which were found to be simply acetic and benzoic acids and ammonia. When propionyl chloride was substituted for acetyl chloride, the corresponding ethyl compound was obtained, and likewise the propyl compound by use of normal butyryl chloride.

SEVERE oscillations of the ground were noticed at Athens during the evening of April 3.

IN the *Meteorologische Zeitschrift* for March, Dr. J. Hann summarizes the results of the meteorological observations made during the French International Polar Expedition to Cape Horn in 1882-83. These observations are specially interesting, both on account of the locality and of their fulness, as they embrace several subjects not generally included in the other expeditions. The principal features of the climate are a relatively mild temperature, a high degree of humidity, precipitation in the form of rain, snow, and hail at all seasons, an almost continually cloudy sky, and sudden and very violent storms, especially in summertime. Storms occur in summer every four or five days, and decrease in number and intensity as winter advances. Nine times out of ten they approach from between north-west and south-south-west. Storms from the north-east are very rare. Thunderstorms rarely occur; distant thunder was only heard five times during summer, and lightning was seen only twice. No observations were made at Orange Bay during the month of September, but Dr. Hann has interpolated values from observations taken at Ushuaia, about a degree further northward.

THE New England Meteorological Society, following the custom of the Royal Meteorological Society of London, held an Exhibition of Instruments at Boston, in January last. Among the more interesting articles exhibited we may mention: (1) A registering actinometer, by Richard Brothers, of Paris, consisting of a bright and black globe, each containing a thermometer which registers on a drum. (2) A Watkin aneroid for mountain use, in which the hand travels three times round the dial in registering from 23 to 31 inches, so that the open scale is not sacrificed to the size of the instrument. (3) A portable anemometer, as designed by Mr. F. Galton for the Meteorological Office. In it, the Robinson cups are geared to a dial, but can be disconnected by inverting a sand-glass after a run of two minutes, and the wind's velocity in miles per hour can be read off at leisure. (4) A form of the Jordan sunshine-recorder, modified by Prof. Pickering. It consists of two half-cylinders, each with its axis parallel to the earth's axis. The sun shines through holes, the latter being shifted slightly each day, so that one sheet of sensitized paper lasts a week. (5) The Chief Signal Office exhibited a very delicate anemometer, with conical cups made of aluminium, used to determine the constants of the anemometers of the service. Among the curiosities of the Exhibition were a bottle and a saucer fused together by lightning, and a piece of window-glass which had been ground translucent by the sand-bearing winds of Cape Cod.

MR. C. CARUS-WILSON writes to us that he has devised a simple and effective dry method by which the denser minerals—zircon, rutile, tourmaline, &c.—may be separated from sand. A piece of cardboard about 2 feet long is bent in the form of a shoot or trough (it must not be allowed to break), and held in this form by elastic bands at either end; this must then be held, or fixed, at an angle sufficiently inclined to allow the sand to travel slowly down the shoot on being gently tapped. A small quantity of the sand to be treated is now placed at the head of the trough, which is then tapped with the finger. When the trough is tapped, the sand travels slowly down, and in doing so, the denser grains lag behind, forming a dark mass in the rear of the stream; this dark mass increases as the sand flows on, and must be collected and placed in a receptacle just the moment before the last tap would cause it to fall off the trough. When a sufficient quantity of this denser sand has been thus collected, it should be placed in the lid of a cardboard box (about 12 inches by 6), and gently shaken to and fro at a slightly inclined angle, the mass being at the same time gently blown upon with the breath. The finer quartz grains will thus be blown away, and hardly any but the denser grains will remain.

AT a recent meeting of the Northern Antiquarian Society of Copenhagen, Dr. L. Zinck drew attention to the remarkable graves from the Stone Age found in the northern part of Seeland. In one grave 52 bodies were found, and upwards of 175 ornaments. From the number of graves in one locality he came to the conclusion that the occupants had dwelt there. Certain bone implements showed that they had reared sheep, whilst their cooking-pots were exactly like those now in use by the peasants, called "Jutland" pots.

DURING last year the archæological researches that have been carried out in Norway were extended as far north as 70° 15′ lat. N. The results appear to show that the islands and the coast were well populated in prehistoric times, but that the cultivation of the soil did not begin until a late date. Numerous burial-places were found, and among the weapons and implements discovered were schist arrow-heads, knives of three kinds, and chisels. No stone axes like those found in the south were discovered. From the fact that no bronze objects have ever been found in the north of Norway, it is concluded that the inhabitants of the Stone Age, on coming in contact with those of the early Iron Age, adopted the use of iron, and never learnt the use of bronze. It is worthy of note that all the implements from the Stone Age are of schist, none being of flint, as in the south.

ATTENTION has lately been called by an American physician (Dr. Lindsey) to the therapeutic value of regions below the sea level, for asthmatical or consumptive patients, who there have continuously higher atmospheric pressure than at the sea-level. Excellent effects have been thus obtained in the valley of Conchilla, near Los Angeles in California, about 273 feet under the sea (barometric pressure only about 7 mm. higher). The most noteworthy place of the kind on the earth's surface is probably the Dead Sea district (– 1289 feet), and the following are some others: Lake Asal in East Africa (– 639 feet), the oasis of Araj in the desert of Lybia (– 270 feet), the Arroyo del Muerto in California (– 230 feet), the oasis of Siwah in Lybia (– 123 feet), the borders of the Caspian (– 86 feet).

IN the Report of the Acting Administrator of British Bechuanaland for the past year, presented to the Houses of Parliament, it is said that the forests of that region are of considerable extent, but they are being rapidly destroyed for the timber and firewood required at Kimberley. Both natives and Europeans are engaged in denuding one of the finest forest tracts in the world, which might be protected by a small yearly expenditure. The system at present employed is that any person on payment of a small fee is allowed to cut down timber without any check being put upon him. The Surveyor-General suggests that a ranger be employed by the Crown to sell, on behalf of the Crown, fuel and timber that has reached maturity. With regard to the trigonometrical survey of the country, the piles built extend over 4000 square miles, and the final results deduced from observations made over 2600 square miles have been recorded. It was intended to commence a geological survey during the past year, with the object chiefly of examining the districts in which gold, coal, lead, and other minerals have been found, but considerations of economy have led to the abandonment of this scheme for the present.

THE present state and the history of the flora of the province of St. Petersburg were lately the subjects of a very interesting communication by Dr. R. Regel at a meeting of the St. Petersburg Society of Naturalists (*Mémoires*, vol. xix.). The influence of man in the introduction of new species is most marked in so populous a province. Several species have been unconsciously imported by man from South-Eastern Europe, the Mediterranean coast, and Asia; and many garden plants, such as *Bellis perennis*, *Impatiens parviflora*, and *Aster præcox*, have become regular members of the wild-growing flora. Some of them have spread with astonishing rapidity. The recently imported *Erigeron canadense* has now penetrated as far as the Altai Mountains; the *Matricaria discoidea*, imported from America thirty years ago, is found all over the region; while the *Sambucus racemosa* grows even in the wildest marshes of Schlusselburg. Plants imported by man are dispersed by birds, water, and wind over a wide space, and a great many species, such as *Elodea canadensis*, *Corydalis bracteata*, *Scilla cernua*, &c., have spread during the last ten years. Dr. Regel insists upon the necessity of such species being carefully mentioned, because a few years after their introduction the botanist may not be able to explain how they appeared in the region, and may suppose that they have been me.ely overlooked.

ANOTHER interesting feature of the St. Petersburg flora which has been pointed out by Dr. Regel, is the frequency of white colour in the case of such flowers as are coloured pink or blue in Central Europe. The prevalence of white in the north is thus confirmed. The *Polygala vulgaris*, *Lychnis viscaria*, *L. Flos-cuculi*, *Centaurea phrygia*, *Jasione montana*, *Campanula glomerata*, *C. Trachelium*, *C. latifolia*, *C. rotundifolia*, *C. patula*, *Calluna vulgaris*, *Arctostaphylos Uva-ursi*, *Thymus serpyllum*, *Brunella vulgaris*, *Gymnadenia conopsea*, *Orchis maculata*, *O. Traunsteineri*, and others were found with white flowers. In accordance with Dr. Masters's views, Dr. Regel sees in this fact a pathological phenomenon due to unfavourable climatic conditions. The colouring pigment does not disappear, but more intercellular spaces appear, and being filled with air, they permit the full reflection of light. In fact, several white flowers of *Campanula patula* became blue when dried, the pressure exerted upon them evidently having compressed and reduced the intercellular spaces.

THE following are the lecture arrangements at the Royal Institution after Easter, so far as they relate to science:—Prof. E. Ray Lankester, four lectures on some recent biological discoveries; Mr. Eadweard Muybridge, of Pennsylvania, two lectures on the science of animal locomotion in its relation to design in art (illustrated by the zoopraxiscope); Prof. Dewar, five experimental lectures on chemical affinity; Prof. W. Knight, of St. Andrews, three lectures on (1) the classification of the sciences, historical and critical; (2) idealism and experience, in philosophy and literature; (3) idealism and experience, in art and life (the Tyndall lectures). The Friday evening meetings will be resumed on May 3, when a discourse will be given by Sir Henry Roscoe, M.P., on aluminium; succeeding discourses will probably be given by Prof. Dewar, Prof. Silvanus P. Thompson, the Rev. S. J. Perry, Prof. D. Mendeleef, Mr. A. Geikie, Mr. C. V. Boys, and other gentlemen.

THE Registrar of the University of London desires us to call attention to the fact that the June examination for matriculation is, in the present and future years, to be held a week earlier than heretofore.

IN the list of English and American Corresponding Members of the French Academy of Sciences, printed in NATURE, January 24 (p. 312), Prof. A. Agassiz was inadvertently omitted from the list of names under "Anatomy and Zoology."

THE additions to the Zoological Society's Gardens during the past week include a Green Monkey (*Cercopithecus callitrichus*) from Barbadoes, presented by the West Indian Natural History Exploration Committee; a Kinkajou (*Cercoleptes caudivolvulus*) from Demerara, presented by Mrs. Marian FitzSimons; a Grey Squirrel (*Sciurus griseus*) from North America, presented by Miss Vokes; a Shag (*Phalacrocorax gracilis*), British, presented by Mr. Henry Reynold's; a Black Tortoise (*Testudo carbonaria*) from Trinidad, a —— Cayman (*Jacare*, sp. inc.) from Demerara, presented by Colonel Fielden, F.Z.S.

OUR ASTRONOMICAL COLUMN.

MELBOURNE OBSERVATORY.—The twenty-third Annual Report of the Board of Visitors to this Observatory, together with the Annual Report of the Government Astronomer, have just reached us. The visitation took place on October 4, 1888, and the Astronomer's Report is for the year ending June 30, 1888. The principal points of interest in the Reports are those referring to the great reflector and to the new photographic telescope. The mirrors of the former instrument had become so dull that their repolishing was rendered imperative, and the work was to be done at the Observatory itself, the risk and cost of sending them to England being prohibitory. With a view to this important operation, a number of small mirrors have been repolished, in order that the necessary experience might be acquired before the great mirrors were taken in hand. The new telescope for the photographic survey was well advanced, and Mr. Ellery expected that Melbourne would be ready to enter on her share of the work as soon, if not sooner, than the other associated Observatories. The Government of Victoria, besides supplying the necessary funds to enable the Observatory to take part in the photographic survey, had granted £2300 for the erection of a dwelling-house for the Director within the Observatory grounds. The new transit-circle and the two equatorials had been in constant use, and were in good order; 2962 observations of right ascension, and 1434 of Polar distance, having been obtained with the former during the year. The photoheliograph had been subjected to a slight alteration, the front lens of the secondary magnifier having been previously too close to the primary focus, so that much trouble was caused from the magnified images of any particles of dust which might lodge upon it. The sun-pictures had, in consequence of the time employed over this alteration, not been so numerous as usual, a record of the sun's surface being only obtained on 129 days. With the great telescope, eighty-one nebulæ were observed or searched for.

Mr. Ellery reports that the meteorological department, especially with regard to the Inter-Colonial Weather Service, increases in importance and efficiency every year, and that he proposed to call a conference of the several Meteorological Directors of the Australian Colonies, with the view of assimilating their methods of reporting, and of still further improving meteorological work in Australia.

COMET 1889 *b* (BARNARD, MARCH 31).—Herr von Hepperger has computed the following elements and ephemeris for this object from observations of dates March 31, April 4 and 8:—

$$T = 1889 \text{ July } 27{\cdot}4812 \text{ Berlin M.T.}$$

$$\left.\begin{aligned} \omega &= 257^\circ\ 27'\ 28'' \\ \Omega &= 308\ \ 29\ \ 41 \\ \iota &= 162\ \ 46\ \ 20 \end{aligned}\right\} \text{Mean Eq. } 1889{\cdot}0.$$

$$\log q = 0{\cdot}29519$$

Error of middle place (O – C.).

$$\Delta\lambda \cos\beta = -11''. \quad \Delta\beta = 0''.$$

Ephemeris for Berlin Midnight.

1889.	R.A. h. m. s.	Decl. ° ′	Brightness.
April 18	5 10 18	15 30·6 N.	0·92
22	5 8 57	15 22·9	0·91
26	5 7 53	15 15·2	0·91
30	5 7 4	15 7·5 N.	0·90

The brightness at discovery is taken as unity.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1889 APRIL 21–27.

(For the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on April 21

Sun rises, 4h. 53m. ; souths, 11h. 58m. 35·0s. ; sets, 19h. 5m. : right asc. on meridian, 1h. 57·6m. ; decl. 12° 1′ N. Sidereal Time at Sunset, 9h. 5m.

Moon (at Last Quarter on April 22, 14h.) rises, 1h. 0m. ; souths, 5h. 0m. ; sets, 9h. 0m. : right asc. on meridian, 18h. 58·1m. ; decl. 22° 38′ S.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Right asc. and declination on meridian. h. m.	° ′
Mercury	4 50	11 43	18 36	1 42·5	9 35 N.
Venus	4 37	12 48	20 59	2 47·7	22 45 N
Mars	5 25	12 59	20 33	2 57·7	17 4 N.
Jupiter	0 42	4 38	8 34	18 35·9	22 55 S.
Saturn	11 25	19 5	2 45*	9 5·2	17 54 N.
Uranus	17 44	23 12	4 40*	13 12·8	7 0 S.
Neptune	6 12	13 57	21 42	3 56·3	18 46 N.

* Indicates that the setting is that of the following morning.

April.	h.	
24	23	Jupiter stationary.
25	7	Mercury in superior conjunction with the Sun.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·5	81 17 N.	Apr. 21,	2 53	*m*
			,, 26,	2 33	*m*
R Canis Majoris	7 14·5	16 11 S.	,, 22,	20 46	*m*
δ Libræ	14 55·1	8 5 S.	,, 23,	0 23	*m*
U Coronæ	15 13·7	32 3 N.	,, 24,	21 37	*m*
S Herculis	16 46·8	15 8 N.	,, 24,		*m*
U Ophiuchi	17 10·9	1 20 N.	,, 21,	20 19	*m*
			and at intervals of	20 8	
U Aquilæ	19 23·4	7 16 S.	Apr. 26,	23 0	*M*
R Vulpeculæ	20 59·5	23 23 N.	,, 26,		*M*
S Cephei	21 36·6	78 7 N.	,, 28,		*M*

M signifies maximum ; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near ζ Ursæ Majoris	206	57 N.	Slow ; bright.
,, β Libræ	228	5 S.	Swift.
,, β Serpentis	233	16 N.	Very swift.
,, π Herculis	256	37 N.	Swift.
	272	20 N.	Swift.

GEOGRAPHICAL NOTES.

To the current number of the Proceedings of the Royal Geographical Society, Mr. George Taylor contributes a valuable paper on Formosa and its aborigines. Mr. Taylor, while resident on the south coast of Formosa, had good opportunities of studying the natives, and the information which he has otherwise collected renders his paper the best summary of our knowledge of Formosa which we have at present. Mr. Taylor thus summarizes the geography of Formosa. On the western side, the land is composed of low level plains, extending from the sea-shore to some distance into the interior, the country appearing flat up to the more pronounced elevations which precede the steeper mountain slopes. The splendid watershed from the central mountains shows in the numerous rivulets which spread like a network over the plains, and renders them especially suitable for the cultivation of rice and sugar-cane. The western sea-board partakes of the nature of the land, the coast being lined with mud and sand-sanks intersected by channels, this formation extending some distance out to sea. Within, Formosa is comparatively hilly, but large areas are covered with tea plantations, which form the principal industry. The east coast is rugged, precipitous, and exposed to the full fury of the north-east monsoon, which blows hard throughout eight months of the year ; therefore, except in the Pilam plain and a few small valleys, little attempt is made at cultivation. To the south, the land terminates in huge masses of coral limestone, and coral branches may be traced in peaks elevated 2000 feet above sea-level. The sea-shore is lined with a semi-vitrified conglomeration of clay, sand, and coral, which presents a serrated surface so sharp and ragged as to be impassable to all beasts ; and the natives, when fishing, are obliged to protect their feet with sandals composed of many folds of boar-skin. Mr. Taylor's account of the aborigines is specially valuable. While the pure aborigines from the interior are of an essentially Malayan type, still there is extraordinary diversity of features, indicating a considerable mixture of types. Among the Paiwang, probably the earliest settlers, head-hunting prevails. The Tipuns, again, seem to be of northern origin. To the naturalist—whether geologist, botanist, or zoologist—the interior of Formosa offers an almost virgin paradise.

Accounts are to hand of M. W. Delcommune's recent exploration of the Lomami, one of the most important southern tributaries of the Congo. Both Cameron and Wissmann met with the Lomami far to the south, and the latter connected it with the Sankuru. M. Delcommune, however, navigated the river from its mouth in the Congo, about 100 miles below Stanley Falls, for a distance of 580 miles, to a point only three days' journey from Nyangwé in the Lualaba. The river is reported to traverse a magnificent country, to be free from all obstructions, and to all appearance it continues to be navigable for some distance beyond M. Delcommune's farthest point.

Messrs. W. and A. K. Johnston have sent us a copy of the third edition of their small map of Central Africa, in which Mr. Stanley's recent route is laid down in red. The next edition ought to have the Lomami delineated in accordance with M. Delcommune's recent exploration.

Africa fills a large place in the new number of *Petermann's Mitteilungen*. Dr. K. W. Schmidt has an article which deserves serious attention on the surface or soil conditions of German East Africa. Dr. Schmidt writes from careful personal observation, and his estimate of the capabilities of the German sphere is not very encouraging. Freiherr von Steinächer contributes some useful notes on German South-West Africa, with a map of Herreo Land and neighbouring regions. Dr. R. Lüddecke describes at some length the features of the new map of Africa, in six sheets, which has been prepared for the new edition of Stieler's "Hand-Atlas."

In an interesting account in *Les Missions Catholiques* of a missionary's journey through Ecuador, it is stated that of the many towns and village , as Archidona, Canelos, &c., the names of which appear on maps of the country, scarcely one exists. The natives do not live in villages, and even where there is a church, they live miles away in the forest in small solitary communities. Hitherto the missionaries have failed in inducing the natives to take to communal or social life.

M. Rogozinski, who has been in Europe for some time, has returned to Fernando Po, and intends to resume his explorations in the Cameroons region, and especially to endeavour to ascertain the existence or non-existence of the Lake Liba, which still figures mysteriously in maps of Africa.

The death is announced of M. V. A. Malte-Brun, son of the great geographer of that name, and who himself for the last forty years had been a student of and writer on geography.

AFFORESTATION IN CHINA.

The question of afforestation in China is at the present time attracting a great deal of attention. China is a treeless country, and to this, perhaps, are due the devastating floods which work such ruin there, and the fearful seasons of drought, which are almost as destructive as the floods. The timber used in various ways is all imported—chiefly from the United States of America, and from Hainan and Formosa. Till the overflow of the Yellow River some time ago, no one paid the least attention to this question; but now a proclamation of the liberal Viceroy, Li Hung Chang, to the people of his thickly-populated provinces, shows that the subject will receive the attention it deserves. His Excellency says that one of the first principles in governing a State is to watch over the agriculture of the State, so that it may benefit both the individuals who till it and the State. In one of the provinces over which he rules—namely, that of Chihli—arboriculture is rendered especially easy by the softness and fertility of its alluvial plains. If we omit the various species of fruit-trees, such as the apple, pear, and apricot, other kinds of trees are very rarely seen, and in consequence vast tracts of fertile plains are left barren. Some slight attempts have been made to plant these extensive tracts with forest trees; but the strong northerly winds which prevail soon uprooted trees which had not been planted to a sufficient depth nor in well-chosen places. Amongst the peasants, the Viceroy says, the principles of arboriculture are unknown, and therefore their previous efforts have only resulted in labour and money uselessly expended. In recent years the Viceroy has ordered the planting of willow-trees along the banks of the streams and rivers in Chihli, with the object of protecting and strengthening the embankments.

If successful methods, His Excellency asks, have been found for cultivating trees in salt lands, how much more easy ought they to be found in the rich level plains of Chihli? Accordingly, the authorities of the various prefectures and sub-prefectures of Chihli are instructed to procure the necessary seed trees, and to inform the people in their respective districts of the eight directions for tree-planting and the ten benefits to be derived from the same. Steps are to be taken by the authorities to encourage the people in their efforts at planting, but official agents, who might oppress the people, are not to be sent among them. At the end of each year a statement is to be submitted to the authorities, by every person who has tried planting, of the number of trees he has received, the number successful, the species which have thriven best, &c., so that the Government may reward those who are most successful in these experiments in arboriculture, as well as gather information to guide them in the future. Instructions are given to the local anthorities to deal severely with any person who steals or cuts down the trees of others. The Viceroy says that his intentions in issuing this proclamation are to afford another source of livelihood to the peasants, to help in preventing droughts and checking floods, to regulate the rainfall, and to beautify the country.

The eight directions and the ten benefits are worth recording. The directions are as follow:—(1) To fortify the roots against injury from cold, which, on account of the loose nature of the soil near the surface, readily injures the roots, a fertilizer, made by burning a mixture of dung and grass, should be used when planting trees, and when the fertilizer is put in, the roots should be carefully covered. (2) When a tree has been securely planted, a small cumulus of earth should be placed around it, 6 or 7 inches high, and should be renewed before winter sets in every year till the close of the third year. By this means the wind and cold cannot reach the roots, nor will the necessary natural nourishment in the earth escape. (3) In places exposed to high winds the trees should be planted to a depth of at least 3½ feet; at this depth the rich part of the soil is reached. In case of willows and other such trees, the outspreading and dependent branches are to be carefully pruned. (4) Rich earth, with a suitable fertilizer, is to be added to poorer soils. (5) To prepare the ground for the reception of the seeds of such trees as the oak, elm, poplar, cypress, &c., which are shed every year, a trough is to be dug round each tree and filled with water to keep the soil moist. (6) Willow and mulberry trees should be planted in the spring, when there is rain. Before planting the young shoots, the soil should be well loosened and fertilized, and grafting should always take place after the rain, and the graft-trees should be well watered every alternate day. (7) In transplanting trees, the greatest care should be taken to preserve the three vertically-projecting roots, which every tree has, from the wind and sun. When there is rain, a small hole is to be dug by the side of the tree, cutting away one of these roots; this operation is to be repeated in a fortnight if there is rain; if not, a month must elapse before the second root is cut, and similarly in the case of the third root. When the roots are cut away, innumerable little roots will be thrown out. If there is no rain, the ground must be well watered before any transplanting is attempted. (8) In raising trees from the seeds of the oak, mulberry, &c., some fertile spot should be prepared just as it would be for a crop of grain, and the seeds are planted in the same way as grain is planted. Spring-time is the best, and while there is rain. When the young trees spring up and grow to the height of one or two feet, they can easily be transplanted as directed above.

The ten benefits of planting trees are thus enumerated by His Excellency:—(1) By planting trees at the river-banks the loose and sandy soil is strengthened by the roots, and the banks increase in height. (2) A large and profitable industry will spring up if pine, elm, willow, &c., are planted in the mountains on the borders. (3) The planting of trees around fields and farms will do away with the superfluous moisture and preserve a fair equilibrium of wind and fluid influences. (4) Where trees are in abundance, droughts will be unknown. (5) Abundance of trees also help to ward off epidemics, and in thickly-populated districts trees should be specially planted for this purpose. (6) Where there is abundance of trees, travellers and families can find rest and shelter in the summer. (7) The operations of highwaymen and banditti are hindered where trees and forests are plentiful. (8) The snows on the mountains of the border will be absorbed by forests. (9) The poorer peasants will have sufficient fuel from the branches, which are pruned every year. (10) Many of these trees, as the *Quercus mongolica*, afford food to the silk-worm, which, in the mountainous regions, weaves a cocoon which makes much cheaper and more durable silk than that of the mulberry silk-worm.

SUPERSTITION AND SORCERY IN NEW GUINEA.

IN the Report to the Colonial Office of the Special Commissioner for British New Guinea during the past year, there is a long and very interesting account of some of the superstitions of the natives of that country, written by Mr. H. H. Romilly. One of the most sacred obligations, he says, on the relatives of a deceased man is to place in his grave, and in his accustomed haunts, food and water for the spirit of the departed. It is thought that this spirit is all that remains of the deceased, and the human appetites take possession of it, or, rather, remain in existence, just as if the body had not died. If, however, he is killed in battle, there is not the same necessity of constantly feeding his spirit; the head of one of the tribe or race who killed him is sufficient. If the slayer is a white man, the angry spirit can be laid by a large payment of goods to the relatives of the deceased, and this constantly happens. Dreams are, to them, voices from the land of spirits, telling them what to do, for whom to work, from whom to steal, and what to plunder. White men are always attended by a familiar spirit, which is blamed for any mischief that befalls the natives in a locality where a white man happens to be. If the white man is a friend of theirs, they merely demand compensation, which he will pay, says Mr. Romilly, if he is a wise man; if he is unfriendly to them, the unfortunate white man may prepare for the worst. His attendant spirit will not help him, for it flies at the sound of a gun. On the death of a relative, there is a great drumming and burning of torches to send the spirit safely and pleasantly on its travels. In some parts of the country, certain trees have spirits, and on feast-days a portion of the food is set apart for these spirits. It is worthy of remark that all their spirits are malignant, and these have to be overcome by force of arms, by blessings, or by cursings. They cannot grasp the idea of a beneficent spirit, but regard them all as resembling Papuans generally—that is, vindictive, cruel, and revengeful. Consequently, these spirits are much feared; though they cannot be seen, yet they constantly use arrows and spears when they are vexed. The great opposer of spirits is fire, and hence, on every possible occasion, bonfires and torches are employed. Strange to say, though fire is thus all-powerful with them, they have no god or spirit of the fire. In this they are at least true to their belief, for no spirit can be, with them, beneficent. Sorcerers are implicitly believed in, and they generally do a good trade in the sale of charms, which are made, not on any fixed principle, but according to the freaks of fancy of the sorcerer or the purchaser. Sometimes it is a bit of bark, sometimes a crab's claw worked in the most fantastic way. These are protectors against all injuries or accidents that may happen to a man. A sailor will wear one as a protection against shipwreck, another charm saves its wearer from wounds in battle, another from disease, and so on. Besides being a sorcerer, that personage is also a physician and surgeon, and usually the astrologer and weather prophet of his district. It can hardly be said that he is skilled in these professions. An unvarying mode of treatment of a patient who is suffering pain from any cause whatever is to make a long, and sometimes a deep, incision over the abdomen. As may be imagined, this is not a very safe remedy. In one instance Mr. Romilly mentions, a woman, who was suffering severely from several spear-wounds, was thus treated by the native sorcerer, who, in pursuit of his profession of surgeon, inflicted by far the most severe wound the poor woman received, thus destroying the chance of life which she had before he attended her. Many of the tribes are, through the influence of the missionaries, shaking off these superstitions. "But even these people," says Mr. Romilly, "the most civilized in New Guinea, and many of them professed Christians, in times of great excitement revert to their old habits. This was shown during the autumn of 1886. At that time a severe epidemic raged along the south coast. The people were dying, by hundreds, of pneumonia, and were beside themselves with fear. The usual remedies for driving away spirits at night were tried, remedies which had been in disuse for years; torches were burnt, horns were blown, and the hereditary sorcerers sat up all night cursing; but still the people died. Then it was decided that the land spirits were working this harm, and the whole population moved their canoes out in the bay and slept in them at night; but still the people died. Then they returned to their village, and fired arrows at every moving object they saw. . . In course of time the epidemic wore itself out; but while it lasted the civilized Motuans were as superstitious as any of their neighbours could have been."

THE MUSEUM OF COMPARATIVE ZOOLOGY, HARVARD COLLEGE.

THE Annual Report of Prof. A. Agassiz for 1887–88 has been issued. It gives the usual interesting account of the various courses of instruction which have been provided at the Museum during the academic year, and of the reports from the several officers about the collections under their care. Excellent progress has been made with the extensive addition to the Museum building, in which there will be ample accommodation for the geological and geographical departments. While numerous specimens have been sent to specialists, a number of applications have from necessity been refused, as the Museum staff is very far from being large enough to meet the demand on its time which attention to all such applications would require. For the future, the very reasonable rule has been laid down that only single specimens for special study can be sent out from the Museum, so that the larger collections must be studied at the Museum, where, we may add, they may be examined with every advantage. In an appendix, a list of the publications of the Museum during the past year will be found, and there is also a most important list of all its publications from the commencement: the Annual Report from 1859, the Bulletin from 1863, the Memoirs from 1864. In a footnote comment is made on some remarks appearing in the preface to the *Zoologischer Jahresbericht* for 1886, on the irregular way in which the publications of the Museum appear. We only allude to this to express our hope that no criticisms will alter the present arrangement, which is one that allows of the prompt publication of the various new facts brought to light by the band of workers at Harvard. We can conceive that by a librarian, simply as such, the publication of a volume in parts is held in abhorrence, and the publication of parts of two or three volumes of a series, at the one time, fills him with dismay; but to the working student it is very different, and such owe a great deal of gratitude to the Curator of the Museum at Harvard, for the speedy publication of the Museum Memoirs as well as for the great liberality with which these are immediately posted to Europe on their issue from the press. The following paragraph we read with mingled feelings of regret and pleasure:—"In the past fifteen years I have been in the habit of supplying deficiencies for such expenditures as seemed to me essential for the rapid development of such an establishment. But it has now become evident that, while such a policy may have been useful in the early stages of the Museum, it has of late been rather a detriment to it than otherwise, as it was fast coming to be regarded as my personal establishment. The demands upon my time for the administration of the affairs have become so great, that I must retire from active duty to devote myself to scientific work, which I have too long neglected for the sake of bringing the Museum to the point it has reached. It is high time that I should withdraw, and that a younger man, more in sympathy with the prevailing tendency of science in this country, should endeavour to develop the Museum by increasing the interest of the friends of the University in its behalf." We fail to comprehend how any man living could be more in sympathy with modern science than Alexander Agassiz, but we recognize as a fact that he has original work to finish, while it is yet day, and it is universally acknowledged that he has established such a museum at Harvard as may employ the energies of many workers for years to come.

RESULTS OF EXPERIMENTS UPON THE GROWTH OF POTATOES AT ROTHAMSTED.

DR. GILBERT has, in the form of a lecture recently delivered at the Royal Agricultural College, given a *résumé* of twelve years of experimental work in connection with the growth of potatoes. The subject is in itself highly interesting, including, as it does, a large number of important questions relating to the propagation of new varieties, the proper cultivation of the ground, the potato-blight, as well as the best fertilizers for the crop. Dr. Gilbert at once disclaims all idea of entering upon the larger questions involved in potato-cultivation, and confines himself entirely to that of fertilizers, and in regard to this point he is not able to throw much fresh light upon the usual practices of growers. The old story of the value of a due apportionment of nitrogenous and mineral substances is clearly shown to be required for the growth of potatoes, as for all crops. The value of farmyard manure is also well indicated in a manner which, on the whole, supports the present practice of all good farmers. The meagre results obtained from mere mineral manures, unassisted by nitrogenous manures, are also well brought out. The practice of employing liberal dressings of dung, superphosphate, and potash salts, or of substituting nitrate of soda or sulphate of ammonia for farmyard dung, is simply indorsed by Dr. Gilbert's results, and, beyond this, no new light is shed upon the subject of fertilizers for potatoes.

The effect of liberal applications of nitrogenous and mineral manures in increasing the proportion of diseased tubers, in years in which the blight is prevalent, is too familiar to need further proof; and as a matter of fact, the wisest course appears to be to balance the advantages of a heavy crop against an increased liability to disease.

A point is made by proving very conclusively that the continuous growth of potatoes upon the same land does not render the crop more liable to disease, but rather the reverse. For example, the percentage of diseased tubers during the first four years of potato-growing ranged in the various plots from 5·14 to 12·82, the largest amount of disease occurring upon the land manured heavily with dung and nitrogenous dressings. In the second four years, the average amount of diseased potatoes ranged from 1·63 to 4·95 per cent., while in the third series of four years it was reduced to from 1·43 to 1·73 per cent. No fluctuations of season can overturn these figures. They have an important bearing upon the question of the propagation of the disease, and appear to detract from the value of suggestions that the blight continues to exist in the form of resting spores in the ground. If such was the case, the disease, when once established, would surely tend to greater virulence in the case of constantly repeated growths of diseased crops. Practical agriculturists would scarcely be induced, from these results, to take special measures for destroying diseased tubers, for carefully preventing their introduction into manure-heaps, or for gathering diseased haulm off the land—all of which precautions students of potato-disease have advised agriculturists to take.

The composition of the tubers, after manuring with the various fertilizers employed, is strikingly similar, with the exception that the heavier crops are rather more watery in character—a result which may always be looked for in luxuriant vegetation. The general result of these experiments is encouraging, in so far as they show that the methods in general use for manuring the potato crop are the best that can be devised for the growth of potatoes.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 28.—"On certain Ternary Alloys. I. Alloys of Lead, Tin, and Zinc." By C. R. Alder Wright, D.Sc., B.Sc., F.R.S., Lecturer on Chemistry and Physics, and C. Thompson, F.C.S., F.I.C., Demonstrator of Chemistry in St. Mary's Hospital Medical School.

It is well known, that quite apart from a tendency to separate more or less completely into different mixtures during solidification, certain mixtures of molten metals show a tendency to separate into two alloys of different densities on standing fused for some time. Lead and zinc and bismuth and zinc have been shown by Matthieson and V. Bose to form two such mixtures; the authors find that aluminium and zinc or aluminium and bismuth also behave in the same way; in each case two different alloys are formed, one consisting of the heavier metal with a little of the lighter one dissolved therein, the other of the lighter metal containing a small quantity of the heavier one.

On the other hand, *tin* will alloy indefinitely in all proportions with any of the four metals, lead, bismuth, zinc, or aluminium, the mixtures exhibiting no particular tendency to separate into two different alloys on simply remaining at rest in a fused condition, although in certain cases more or less separation is apt to occur *during solidification*, owing to partial formation of eutectic alloy. Various other metals, *e.g.* cadmium, antimony, silver, &c., appear to behave like tin in this respect.

It seemed to be of interest to examine the behaviour under similar conditions of ternary mixtures where two of the ingredients are not miscible together in all proportions (like aluminium and lead), whilst the third is miscible indefinitely with either of the other two (like tin). It might be expected that with certain proportions a single stable alloy would result, whilst with others the mass would divide into two different ternary mixtures. In point of fact this is precisely what occurs.

For a variety of reasons the authors selected the alloys of lead, tin, and zinc for their first experiments.

These led to the conclusion that the greater the proportion of tin present (provided it does not exceed the limiting amount beyond which no separation takes place) the more zinc is contained in the heavier alloy, and the more lead in the lighter one; but that the distribution of the tin throughout the entire mass is by no means uniform, the lighter alloy containing the greater percentage when the proportion of tin in the total mass is low, and *vice versâ* when it approaches towards the limiting amount; so that with a particular proportion of tin in the total mass uniform distribution as regards weight percentage occurs, but with no other proportion.

The authors next attempted to find out whether a moderately large variation in the temperature at which the mass kept molten had any great influence on the end result; for if not, obviously much laborious work would be saved. Two series of compound ingots (forty in all) were accordingly prepared, one at a temperature close to 565° C., the other at near to 689° C. From the analytical results obtained, three noteworthy curves are deducible—

(*a*) When the tin percentages in the heavier alloy are plotted as abscissæ and the zinc percentages as ordinates.

(*b*) When the tin percentages tin the lighter alloy are plotted as abscissæ and the lead percentages as ordinates.

(*c*) When the tin percentages in the heavier alloy are plotted as abscissæ and excesses of the percentage (+ or −) in the lighter alloy over those in the heavier one as ordinates.

These three curves respectively represent approximately the solubility of zinc in lead containing tin, that of lead in zinc containing tin, and the relative distribution of tin in the two alloys formed simultaneously. The three curves obtained from one series are practically identical with the corresponding curves from the other series, so that it may be fairly concluded that the effect of variation in temperature from 565° to 689° is negligible as compared with the experimental errors, more especially those due to imperfect separation by gravitation of the two alloys from one another.

The curves representing the tin distribution are remarkable. As long as the tin percentage in the total mass is less than about sixteen the lighter alloy contains more tin than the heavier one; at about this point (representing some 14 per cent. in the heavier and 18 per cent. in the lighter alloy) the difference becomes a maximum, after which the difference diminishes, until at about 28 per cent. the same percentage of tin is contained in both alloys. After this the heavier alloy contains more tin than the lighter, the difference continually increasing.

Certain irregularities were observed due to the existence of some cause interfering with the proper separation by gravitation of the heavier from the lighter alloy: this was ultimately traced to convection currents set up through unequal heating of the walls of the containing vessel at different levels, and it was found that the imperfect separation could be almost completely obviated by so heating the mass as to avoid this inequality of temperature. This was finally effected by employing crucibles very long in proportion to their diameter (large test-tubes moulded on a core from a plastic mixture of fireclay and syrupy silicate of soda, diluted with about three times its weight of water), heated by immersion in a bath of molten lead some 6 or 7 inches deep, contained in an iron cylindrical vessel (the lower two-thirds of a mercury bottle), surrounded by a concentric clay jacket and heated by a number of bunsen burners playing into the annular interspace. Several series of compound ingots were thus prepared, containing lead and zinc in ratios different for each series (2 to 1, 1 to 1, 1 to 2), some at a temperature near to 650°, others at about 750°. From the results of the analysis of upwards of 130 different alloys thus obtained, the following conclusions are drawn:—

When a mixture of lead, tin, and zinc in the molten condition is well stirred up by mechanical means and then left to itself for some hours at as nearly as possible a uniform temperature, a single homogeneous alloy results if the proportion of tin present is not less than three-eighths of the whole; but if materially less tin than this is present, the mass divides itself into two different ternary alloys, lead predominating in the heavier one and zinc in the lighter one. This phenomenon is entirely distinct from the segregation of alloys during solidification, in consequence of formation of eutectic or other differently fusible alloys.

If there is little or no inequality of temperature at different parts of the mass, separation by gravitation only is complete in a few hours, at any rate when tolerably pure metals are employed; but if the mode of heating is such that convection currents are set up, the separation is greatly interfered with, and in extreme cases almost entirely prevented.

The heavier alloy is a saturated solution of zinc in lead containing tin, and the lighter one a similar solution of lead in zinc containing tin. No matter what the relative proportions between lead and zinc in the original mass, the two alloys always correspond to two conjugate points on the solubility curves of zinc in lead-tin and of lead in zinc-tin.

But little, if any, difference in the way in which a given mass divides itself is noticeable, whether the temperature which the molten mass maintained is below 600° C. or above 700° C.

The tin contained in the mass does not distribute itself equally in the two alloys except when present in one particular proportion, which varies with the ratio of the zinc to the lead in the entire mass. With less tin than this the lighter alloy, and with more the heavier one, takes up the higher percentage of tin.

Curves drawn representing the tin present in the heavier alloy as abscissæ, and the (+ or −) excess of tin in the lighter alloy over that in the heavier one as ordinates, are found to differ with the ratio of zinc to lead in the entire mass. They always possess the same general features, viz. rising from the origin to a maximum elevation, then sinking down again to the base line, and crossing it so as to become negative; but the position and height of the maximum, the crossing point, and the general dimensions of the curve, vary with the ratio of zinc to lead in the mass.

As a result of this, whilst an indefinite number of different mixtures may be prepared, each one of which will give the same heavier alloy, the lighter alloy simultaneously formed will be different in each case; and conversely.

When no tin is present, lead dissolves zinc to such an extent as to form an alloy containing 1·24 per cent. of zinc, and zinc dissolves lead forming an alloy containing 1·14 per cent. of lead; the higher values found by previous observers being slightly incorrect through imperfect separation.

Nothing abnormal appears to characterize the solubility curves of zinc in lead-tin and of lead in zinc-tin; in each case the amount of one metal dissolved by the other increases as the quantity of tin present increases, in such a way that the curves are somewhat concave upwards.

Royal Society, April 4.—"On the Magnetic Inclination, Force, and Declination in the Caribee Islands, West Indies." By T. E. Thorpe, Ph.D., F.R.S.

The following determinations of the magnetic elements among the Caribees or Windward Islands were made in

August 1886, on the occasion of the Eclipse Expedition of that year to Grenada.

The instruments employed were magnetometer Elliott No. 61, and Dip Circle Dover 83, belonging to the Science and Art Department.

The method of observation was similar to that adopted in the Magnetic Survey of the British Isles for epoch January 1, 1886, for which these instruments were also employed.

The results may be thus summarized:—

Station: August 1886	Inclination	Force		Declination
		Horizontal	Total	
St. George, Grenada ...	40° 54′·7	3·1093	4·1144	0° 41′·5 E.
Hog Island, Grenada ...	41 14·1	3·1000	4·1223	0 51·5 E.
Island of Carriacou ...	—	3·0771	—	0 16·3 E.

Linnean Society, April 4.—Mr. Carruthers, F.R.S., President, in the chair.—Mr. D. Morris exhibited a specimen of the hymenopterous insect, *Eulema cayennensis*, concerned in the fertilization of *Coryanthes macrantha* (see Crüger, Journ. Linn. Soc., viii. 129), and obtained from Mr. Hart of Trinidad. Referring to the illustrations of the structure of the flowers, given in the *Gardener's Chronicle* (xvii., 1882, 593; and xxiii., 1885, 145), Mr. Morris explained the process carried out by the insects, chiefly bees, in removing the pollinia and subsequently attaching them on the stigma. The observations of Crüger had been verified by Mr. Hart in the Botanic Gardens, Trinidad.—Sir Edward Fry exhibited and made some instructive remarks on a copy of Grisley's "Viridarium Lusitanicum," 1661, presented by Linnæus to his pupil Loefling, the author of the "Iter Hispanicum."—Prof. R. J. Anderson exhibited some photographs of educational museum cases in Queen's College, Galway.—A paper was read by Mr. Lister on the Myxomycetes, or Mycetozoa, a group of organisms on the borderland between the animal and vegetable kingdoms, and formerly classed with Fungi. His remarks were illustrated by numerous coloured drawings of representative species, and the author also exhibited under the microscope the swarm cells from the spores of *Amaurochæte* and the streaming plasmodium of *Badhamia*. Attention was especially directed to the mode of feeding of the swarm cells and observations made on those of *Stemonitis*, where large bacilli were seen to be caught by pseudopodia projected from the posterior end of the organism, and drawn into its substance and digested. An interesting discussion followed, in which the President, Prof. Marshall Ward, Prof. Howes, and Mr. Breese took part.—A paper was then read by Mr. E. W. Hoyle, on the deep-water fauna of the Firth of Clyde, embodying the results of recent investigations. The explored area, which is shut off from the Irish Sea by a submarine plateau extending from the Mull of Cantyre to the Ayrshire coast, contains seven distinct deep-water basins, in which the depth exceeds 20 fathoms, and in some cases reaches 80 or 100 fathoms. An account was given of the dredging which had been carried on, with lists of the species obtained at various depths. A discussion followed in which Messrs. John Murray, W. P. Sladen, and G. B. Howes took part.

Chemical Society, March 21.—Mr. W. Crookes, F.R.S., in the chair.—The following papers were read:—The molecular weights of metals (preliminary notice), by Prof. W. Ramsay, F.R.S. The molecular weights of a number of metals have been determined by Raoult's vapour-pressure method, viz. by ascertaining the depression of the vapour-pressure of the solvent produced by a known weight of dissolved substance, the relation between molecular weight and depression being expressed by the equation, $W = \frac{W' \times P \times p}{100 \times d}$, where W is the molecular weight to be found; W′ the molecular weight of the solvent; P/100 the percentage weight of the dissolved substance in solution; p the vapour-pressure of the solution; and d the depression in the vapour-pressure of the solvent produced by adding the substance dissolved. The solvent employed was liquid mercury; the temperatures 260° and 270° for a few substances, and the boiling-point of mercury for most. The results obtained are as follows:—

Element.	Atomic weight.	Molecular weight.		Molecular formula.
		Found.	Calculated	
Lithium . . .	7·02	7·00	7·02	Li_1.
Sodium . . .	23·04	12·1	11·52	$Na_{\frac{1}{2}}$.
Potassium . .	39·14	28·57	?	K_1 (?).
Silver	107·93	109·0	107·93	Ag_1.
Gold	197·22	204·3	197·22	Au_1.
Barium . . .	137·0	74·45	68·5	$Ba_{\frac{1}{2}}$.
Magnesium . .	24·3	20·33	24·3	Mg_1.
Zinc	65·34	60·85	65·43	Zn_1.
Cadmium . . .	112·1	100·0	112·1	Cd_1.
Gallium . . .	69·9	68·1	69·9	Ga_1.
Thallium . . .	204·2	183·5	204·2	Tl_1 (?).
Tin	119·1	114·9	119·1	Sn_1.
Lead	206·93	204·1	206·9	Pb_1.
Antimony . .	120·2	134·2	120·3	Sb_1.
Bismuth . . .	208·1	209·2	208·1	Bi_1.

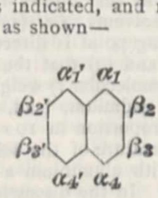
These numbers represent some of the actual results. Nevertheless, they must not be taken as absolute; although in many cases they are conclusive as to the molecular weight of the metal, still further experiments are needed. As an instance of what occurs, the metals thallium and antimony may be chosen. With thallium, for example, the following results were obtained:—

Percentage of thallium in amalgam.	Molecular weight.	
	Found.	Calculated.
0·8191	157·4	204·2
1·666	183·5	204·2
2·894	174·3	204·2
3·290	183·9	204·2

No appreciable change is produced on concentration. But with antimony, the molecular weight increases proportionately to the amount present, thus—

Percentage of antimony in amalgam.	Molecular weight.	
	Found.	Calculated.
1·117	134·2	120·3
1·526	155·4	120·3 to 240·6
2·257	193·4	120·3 to 240·6
3·289	294·6	240·6 to 481·2?

Here an association of atoms is evidently in progress. The results are based on the assumption that the molecular formula of mercury is Hg_1, in favour of which strong reasons can be adduced.—The application of Raoult's depression of melting-point method to alloys, by Messrs. C. T. Heycock and E. H. Neville. As a result of some preliminary experiments on the change in the solidifying point of tin caused by the addition of small quantities of other metals, the authors conclude that the dissolution of a metal in tin follows the same laws as that of compounds in other solvents, *i.e.* (1) that the fall in temperature of the solidifying point is directly proportional to the weight of metal added; and (2) that the fall of temperature is inversely as the atomic (molecular?) weight of the metal added. With tin, copper, silver, cadmium, lead, and mercury, the dissolution of one atomic proportion in 100 atomic proportions of tin caused a fall in temperature of the solidifying point varying from 2°·16 to 2°·67, with aluminium a fall of 1°·34, and with antimony a rise of 2°·0. In the discussion which followed the reading of these papers, Prof. Armstrong said that notwithstanding the apparent regularity and simplicity of the results, he was not prepared to accept them as in the least degree final. There was not sufficient evidence in his opinion that the effect observed was not in part at least the outcome of a change in the molecular composition of the solvent. The results obtained by Raoult's methods were, he thought, comparable with those obtained by determining the specific heats of the elements; in the latter case the observations were undoubtedly made with masses of molecules, which probably were of varying degrees of atomic complexity, and yet the results were found to be such as to justify conclusions being drawn as to the relative magnitudes of their fundamental constituents—the atoms. In the same way it was possible that the results obtained by Raoult's method by means of observations on the behaviour of molecular complexes might afford the means of deducing the relative magnitudes of the fundamental molecules comprising the complexes, but not of the actual complexes operated with. Mr. Crompton drew attention to Beckmann's recent experiments on the lowering of the freezing-point; these show that the true molecular weight was only obtained when solutions were used the concentration of which was allowed to vary only within certain narrow limits; and that if the solutions were too dilute the molecular weight obtained from the lowering of the freezing-point was too low, while if the solutions were too concentrated, it was too high. In some cases the variation of the number obtained with the concentration was enormous. Prof. Carey Foster remarked that much depended on the definition given of a molecule, whether it is defined as that smallest quantity capable of existence *per se*, or as that quantity which produces a given effect in depressing vapour-pressure, or freezing-point, &c. The two magnitudes were not necessarily the same. The relation observed could hardly be accidental; yet he thought that the value obtained might be a quantity connected with the molecular weight but not necessarily identical with it. Prof. Ramsay, in replying, said that substances in dilute solutions must be regarded as in the gaseous state, their molecules being so far distant from each other as not to exert appreciable attraction on each other; and as occupying but a small portion of the space they inhabit. It has long been argued that the molecular complexity of the gases, hydrogen, oxygen, and nitrogen, must be the same, inasmuch as these elements have equal coefficients of expansion within the widest limits of temperature. A similar argument applies to substances in dilute solutions; it is much more probable that they have a simple and similar molecular structure than that the molecules, if complex, dissociate to an equal extent on equal rise of temperature, or on equal alteration of concentration. As regards the empirical nature of Raoult's laws, it is paralleled by the empirical nature of Boyle's and Gay-Lussac's laws—that is, such laws are merely approximations to truth, and depend on the fact that the molecules are sensibly beyond the sphere of each other's attraction, and themselves occupy no appreciable space. Hence their inapplicability at high concentrations.—Some compounds of tribenzylphosphine oxide, by Dr. Collie.—Contributions to our knowledge of the isothiocyanates, by Dr. A. E. Dixon.—The constitution of primuline and allied sulphur-compounds, by Mr. A. G. Green.—The determination of the constitution of the heteronucleal $\alpha\beta$- and $\beta\beta$-di-derivatives of naphthalene (second notice), by Prof. H. E. Armstrong and Mr. W. P. Wynne. Three heteronucleal α-chloro-β-naphthylaminesulphonic acids can be obtained when 1 : 2-α-chloro-β-naphthylamine hydrochloride is sulphonated with four times its weight of an acid containing 2 per cent. of SO_3. Acid No. I. is the chief product when the sulphonation is effected at 70° during six hours; acid No. II. is almost the sole product when the sulphonation is allowed to continue for a further six hours at 100°; and acid No. III. is obtained, together with acid No. II., when the sulphonation is effected at 160° during six hours. The determination of the constitution of the heteronucleal $\alpha\beta$- and $\beta\beta$-di-derivatives of naphthalene is arrived at from a study of these acids in the following way. Adopting the conventional symbol for naphthalene, with the α- and β-positions indicated, and numbering the positions 1, 2, 3, 4, 1′, 2′, 3′, 4′, as shown—



it is obviously possible to determine the relative positions of the three radicles, Cl, NH_2, and SO_3H, in a heteronucleal chloronaphthylaminesulphonic acid by determining the relative positions of the three pairs of radicles, Cl and NH_2, Cl and SO_3H, and NH_2 and SO_3H, and on this result to base the absolute orientation of the radicles, provided that it can be shown how the radicles are situated in any one of the two pairs of hetero-di-derivatives obtainable from the tri-derivative. No absolute method, free from reproach, has yet been devised for determining the constitution of any known hetero-di-derivative of naphthalene, but in the case of the hetero-$\alpha\alpha$-di-derivatives arguments may be advanced which are of such weight as to leave but little room for doubt that the $\alpha\alpha$-di-derivatives corresponding in constitution with ζ-dichloronaphthalene (m.p. = 83°) have the constitution 1 : 1′; the $\alpha\alpha$-di-derivatives corresponding in constitution with γ-dichloronaphthalene (m.p. = 107°) having then, by exclusion, the alternative formula 1 : 4′. The constitution of α-chloro-β-naphthylamine, and consequently the relative positions of the radicles Cl and NH_2 in the three sulphonic acids derived from it, was determined by the authors to be 1 : 2 (cf. NATURE, December 13, 1888, p. 166); the relative positions of the radicles Cl and SO_3H in the three acids were determined by replacing the NH_2 radicle by H by von Baeyer's hydrazine method, and converting the resulting heteronucleal chloronaphthalenesulphonic acids into the corresponding dichloronaphthalenes by treatment with phosphorus pentachloride, and the relative positions of the radicles NH_2 and SO_3H were ascertained by replacing the Cl by H by reduction with sodium amalgam, and converting the resulting heteronucleal naphthylaminesulphonic acids, first into the corresponding chloronaphthalenesulphonic acids by Sandmeyer's method, and finally into the corresponding dichloronaphthalenes. Acid No. I. yields, by displacing NH_2 by H, a chloronaphthalenesulphonic acid corresponding in constitution with γ-dichloronaphthalene, and therefore contains the radicles Cl and SO_3H in the positions 1 : 4′; it follows then, since the radicles Cl and NH_2 are in the positions 1 : 2, that the radicles NH_2 and SO_3H must be in the positions 2 : 4′. The naphthylaminesulphonic acid obtained from No. I. acid by reduction was found to be identical with Dahl's modification of β-naphthylamine-α-sulphonic acid, and to yield a dichloronaphthalene identical with so-called η-dichloronaphthalene (m.p. = 48°), so that these and all corresponding heteronucleal $\alpha\beta$-di-derivatives are proved to have the constitution 2 : 4′. Acid No. III., on displacing NH_2 by H, yields a chloronaphthalenesulphonic acid corresponding in constitution with the Badische modification of β-naphthylamine-α-sulphonic acid and with the heteronucleal $\alpha\beta$-dichloronaphthalene melting at 63°·5, and this must, by exclusion, be the 1 : 2′-compound, since the only alternative formula for a heteronucleal $\alpha\beta$-di-derivative, viz. 1 : 3′ or 2 : 4′, has been proved above to belong to $\alpha\beta$-di-derivatives corresponding in constitution with η-dichloronaphthalene (m.p. = 48°). Inasmuch, then, as acid No. III. contains the radicles Cl and SO_3H in the positions 1 : 2′, and the radicles Cl : NH_2 in the positions 1 : 2, it follows that the radicles NH_2 and SO_3H must be in the positions 2 : 2′. The naphthylaminesulphonic acid obtained from No. III. acid by reduction was found to be identical with Bayer and Duisberg's modification of β-naphthylamine-β-sulphonic acid, and to yield a dichloronaphthalene identical with δ-dichloronaphthalene (m.p. = 114°), so that these and all corresponding heteronucleal $\beta\beta$-di-derivatives are proved to have the constitution 2 : 2′. Acid No. II., on displacing NH_2 by H, yields a chloronaphthalenesulphonic acid convertible into η-dichloronaphthalene; it follows, then, that it contains the radicles Cl and SO_3H in the positions 1 : 3′, and since the radicles Cl and NH_2 are in the positions 1 : 2, the radicles NH_2 and SO_3H must be in the positions 2 : 3′. The authors could not, however, succeed in isolating this naphthylaminesulphonic acid owing to the peculiar behaviour of acid No. II. on reduction with sodium amalgam, but they have been able by other methods to place it beyond doubt that the acid when isolated would be found identical with Brönner's β-naphthylamine-β-sulphonic acid, and would yield a dichloronaphthalene identical with ϵ-dichloronaphthalene (m.p. = 135°), hence these and all corresponding heteronucleal $\beta\beta$-di-derivatives have the constitution 2 : 3′. These results not only render it possible to determine the constitution of the heteronucleal $\alpha\beta$- and $\beta\beta$-di-derivatives of naphthalene, but also afford a method of ascertaining the constitution of the two heteronucleal sulphonic acids obtained on sulphonating 1 : 2 dichloronaphthalene, and of the three trichloronaphthalenes which have been obtained from the three chloronaphthylaminesulphonic acids; the method is being extended by the authors to all the known chloronaphthylamines for the purpose of determining the constitution of the sulphonic acids obtained by them in characterizing the corresponding dichloronaphthalenes. The results, moreover, establish the correctness of the opinion, long held and frequently expressed by the authors, based on the higher melting-points of the "uniform" ϵ-di-derivatives (*i.e.* di-derivatives containing two similar radicles) in comparison with the isomeric δ-di-derivatives, that the ϵ-di-derivatives are symmetrically constituted; this conclusion, in fact, is probably the most important outcome of the experiments, since it affords conclusive proof of the influence of symmetry as the determining cause of high melting-point, slight solubility, &c., in the case of naphthalene derivatives.—Contributions to the knowledge of citric and aconitic acids, by Mr. S. Skinner and Dr. S. Ruhemann.

Entomological Society, April 3.—Mr. F. Du Cane-Godman, F.R.S., Vice-President, in the chair.—Mr. Osbert Salvin, F.R.S., exhibited specimens of *Ornithoptera trojana*, Staud., and *O. plateni*, Staud., received from Dr. Staudinger, and obtained in Palawan, an island between Borneo and the Philippines. He remarked that *Ornithoptera trojana* was allied to *O. brookiana*, Wall.—Mr. R. McLachlan, F.R.S., exhibited, and made remarks on, seven examples of *Æschna borealis*, Zett., a little-known species of European Dragon-flies. He said that some of the specimens were captured by himself at Rannoch, in June 1865. The others were taken in Luleå, North Sweden, and the Upper Engadine (5000-6000 feet), in Switzerland.—Mr. W. H. B. Fletcher exhibited specimens of *Agrotis pyrophila* from various localities, including two from Portland, three from Forres of a smaller and darker form, and a melanic specimen from Stornoway at first supposed to belong to *A. lucernea*, but which, on closer examination, was seen to be referable to this species. He also exhibited series of *Triphæna orbona* from Stornoway and Forres, and *T. subsequa* from Forres and the New Forest. The specimens of *T. subsequa* from Forres were more distinctly and richly marked than those from the New Forest, and were also rather more variable in colour.—Dr. Sharp exhibited specimens of *Proculus goryi*, Kaup, found by Mr. Champion in Guatemala, prepared to show the rudimentary wings under the soldered elytra. Dr. Sharp called attention to the existence of a peculiar articulated papilla at the base of one of the mandibles; and he also showed sections of the head of *Neleus interruptus* displaying this papilla, as well as the articulated teeth on the mandibles.—The Rev. Canon Fowler exhibited specimens of *Agapanthia lineatocollis*, Don, and remarked that they were able to produce a distinct stridulation by the movement of the head against the prothorax, and of the hinder part of the prothorax against the mesothorax. He further remarked that Dr. Chapman had lately informed him that *Erirrhinus maculatus*, F., had the power of stridulating strongly developed.—Mr. Edward Saunders exhibited, on behalf of Mr. G. A. J. Rothney, in illustration of his paper on Indian Ants, specimens of the following:—*Camponotus compressus* and fragments of *Solenopsis geminatus* destroyed by it; *Camponotus* sp. (?), with a mimicking spider (*Salticus* sp.); *Pseudomyrma bicolor*, with its mimicking *Salticus*, and a new species of *Rhinopsis*, viz. *ruficornis*, Cameron, also found with it, and closely resembling its host; *Diacamma vagans; Holcomyrmex indicus*, with specimens of the grain which it stores and the chaff which it rejects; and a species of *Aphænogaster*, with the pieces of *Mimosa* with which it covers its nest.—Mr. G. A. J. Rothney communicated a paper entitled "Notes on Indian Ants."—Mr. Lionel de Nicéville communicated a paper entitled "Notes regarding *Delias sanaca*, Moore, a Western Himalayan Butterfly."—Captain H. J. Elwes communicated a note in support of the views expressed by Mr. de Nicéville in his paper.

Geological Society, April 3.—Mr. W. T. Blanford, F.R.S., President, in the chair.—The following communications were read:—The elvans and volcanic rocks of Dartmoor, by Mr. R. N. Worth.—The basals of Eugeniacrinidæ, by Mr. F. A. Bather. Although Profs. Beyrich and von Zittel had alluded to certain specimens of *Eugeniacrinus* as proving, by the course of the axial canals, that in this genus the basals had passed up into the radials, yet the two chief authorities who subsequently discussed the subject practically ignored this argument. M. de Loriol contented himself with denying any trace of basals, while Dr. P. H. Carpenter maintained that the top stem-joint represented a fused basal ring. In a previous paper the author had argued in favour of Prof. von Zittel's view without convincing Dr. Carpenter of its correctness. Such scepticism was, no doubt, warranted by the lack of detailed description and of figures. The object of the present note was to set the matter at rest by describing and figuring certain dorsal cups of *Eugeniacrinus caryophyllatus* kindly lent to the author by Prof. von Zittel. Owing to the mode of fossilization the canal system is plainly seen. The axial canal passes up into the radial circlet and gradually widens; at a short distance below the floor of the calycal cavity it gives off five interradial branches; these soon bifurcate, and the adjacent radial branches converge. Before they meet, each radial branch gives off a very short branch; this connects the radial branch with the ring-canal that contained the interradial and intraradial commissures. The evidence of all other crinoids that have these canals shows that the basals always contain the interradial branches. And in *Eugeniacrinus*, since the interradial branches have their origin in the middle of the radials, the basals must have passed up in between the radials. The President, Mr. P. Sladen, and Dr. Hinde took part in the discussion which followed the reading of this paper.—On some Polyzoa from the Inferior Oolite of Shipton Gorge, Dorset, by Mr. E. A. Walford.

Mathematical Society, April 11.—Mr. J. J. Walker, F.R.S., President, in the chair.—The Secretary read the following papers:—On the free vibrations of an infinite plate of homogeneous isotropic elastic matter, by Lord Rayleigh, F.R.S.—On the constant factors of the theta series in the general case $p = 3$, by Prof. F. Klein.—On the generalized equations of elasticity and their application to the theory of light, by Prof. K. Pearson.—On the reduction of a complex quadratic surd to a periodic continued fraction, by Prof. G. B. Mathews.—Construction du centre de courbure de la développée de contour apparent d'une surface que l'on projette orthogonalement sur un plan, by Prof. Mannheim.—Mr. Kempe and the President made short communications.

BERLIN.

Physical Society, March 22.—Prof. du Bois-Reymond, President, in the chair.—Dr. Assmann gave an account of the results he had obtained by a microscopic examination of the structure of rime, hoar-frost, and snow. In opposition to the view most usually held, that the solid condensations of aqueous vapour from the air are crystalline, he had observed some years ago, during a sojourn in winter on the Brocken, that hoar-frost consists of amorphous frozen drops, which, by their juxtaposition in rows, build up the long needles of which it is composed. He observed the same structure in some rime which he had collected from very various objects in December last during a cold which was not at all intense; in this case also the spicules of ice were composed of amorphous drops of ice frozen together in lines. In one case the little masses of ice which composed the rime were frozen together into a leaf-like structure. At the same time some small, scattered, and glittering ice-formations which had been formed in large numbers on the ground were crystalline in structure, consisting of thicker or thinner six-sided tablets or somewhat elongated prisms. On other occasions he found that the rime was itself composed of unequally developed crystalline structures, which branched at angles of 60°, and thus gave rise to a dendritic formation; at the same time the hoar-frost was also composed of crystalline structures. He had also succeeded in forming ice-flowers artificially on a pane of glass, and had satisfied himself by a microscopic examination of the same that they are always crystalline in structure. The structure of snow was investigated on the snow-garlands which had been described at a meeting of the Meteorological Society, and consisted of amorphous granules, such as compose the upper surface of a glacier. Dr. Assmann attributes the formation of rime and of hoar-frost to the existence of over-cooled drops of water, which suddenly solidify when driven by the wind against the solid substructure on which they are found. On the other hand, solid transparent ice is formed when water at 0°, or some temperature above zero, comes in contact with any solid object whose temperature is very low.—Prof. Liebreich exhibited a series of experiments intended to explain the occurrence of the inert layer in chemical reactions. Two years ago he had demonstrated to the Society the chief phenomena of its occurrence, as seen when a solution of sodium carbonate is mixed with chloralhydrate. When this is done the larger part of the mixed fluids very soon becomes milky, owing to the formation of innumerable small drops of chloroform, while at the same time a thin layer on the surface of the fluid remains clear: this clear portion is the inert layer, and is bounded above by the general meniscus of the mixture and below by a curved surface, whose convexity is turned upwards towards this meniscus. The speaker had, by means of a series of experiments, disposed of the view which had been put forward that the inert layer is only a portion of the mixed fluids from which the chloroform had evaporated. Of these experiments it may suffice to mention only one, in which the fluid was poured into a flat, open basin until it projected with a convex surface above the edges of the basin. Notwithstanding the larger fluid-surface thus exposed no inert layer was to be seen. Similarly he had been able to show, by observations under the microscpe, that the phenomenon cannot be explained by any vortex movements in the fluid. Further, the assumption that it is due to a solution of alkali from the glass, which then prevents the precipitation of the chloroform, had been excluded by using a vessel made of quartz crystal. Prof. Liebreich inclined to the view, on the basis of his past experiments, which, however, must be further followed and extended, that the suppression or slowing of the chemical reaction at the surface of the fluid, which gives rise to the inert layer, is determined by the greater solidity and resistance of this part of the liquid.

Meteorological Society, April 2.—Prof. von Bezold, President, in the chair.—Prof. Börnstein spoke on the ebb and flow of the tide. After explaining the nature of the moon's action on the fluid part of the earth's surface, and showing that the flood is essentially due to a diminution of gravity and the ebb to its increase, he passed on to the consideration of the moon's attraction as it affects the atmosphere. Many experiments have been made with a view to proving the influence of the moon on the atmosphere, and at various places observers have succeeded in establishing a daily variation in the pressure of the air dependent upon the moon, and showing two maxima and two minima; these places are Singapore, St. Helena, Melbourne, and Batavia. The amplitude of the variation amounted to from 0·079 to 0·2 mm. But opposed to these are the observations of Laplace on the variations of the barometer in Paris, as also of Kreil in Prague, and further, Bessel's observations on atmospheric refraction. All these last-named observers found that the action of the moon on the earth's atmospheric envelope was either *nil* or else the reverse of that described above. Prof. Börnstein then discussed the question whether any ebb and flow of the atmosphere could possibly be detected with the means now at our disposal, and showed that the mercurial barometer can never be able to give indications of any such action, since it is itself affected by the alterations of gravity which are due to the varying position of the moon. He explained the phenomena observed at the four stations mentioned above as due to the fact that they are situated either on the sea-coast or on islands, at places on the earth's surface at which the ebb and flow of the sea is very considerable. The ebb and flow of the sea acts secondarily on atmospheric pressure, especially by means of the alteration of surface, and give rise to corresponding increases and diminutions in that pressure. Paris, Prague, and Königsberg are, on the other hand, inland stations, at which the barometer cannot be affected by any variations in the level of the sea's surface.

STOCKHOLM.

Royal Academy of Sciences, March 14.—On the essential results of the mathematical paper for which M. Poincaré received the mathematical prize of the King of Sweden, by Prof. Mittag-Leffler.—Derivation of some independent expressions of the Bernouillian numbers, by Dr. A. Berger.—On the plane curves which, may be rectified through Abel's integrals of the first kind, by Dr. J. Brodén.—On the conform delineation of a paraboloid on a plane, by Herr H. von Koch.—On some remarkable minerals formed at a later period in the primordial strata of Sweden, by Baron Nordenskiöld.—Sur la chaleur latente de vaporisation de l'eau et la chaleur spécifique de l'eau liquide, par Dr. N. Ekholm.—New observations on the variation of the shape of the first abdominal appendices of the female crawfish, by Dr. Bergendahl.—Contributions to the anatomy of the Trematode genus *Apoblema Dujardin*, by Herr H. Juel.—Ascomycetæ from the Isle of Öland and from Östergötland, by Herr C. Starbäck.—On some triazol derivatives, by Dr. J. A. Bladin.—On bisphenyl-methyl-triazol, by the same author.—On the molecular weight of maltose and some inulinoid carbohydrates, by Dr. Ekstrand and Herr R. Manzelius.—Annotations on some European Orthotricha, i., by Lector Grönvall.—Déterminations des éléments magnétiques dans la Suède méridionale, by Herr W. Carlheim-Gyllenskiöld.—Formulas and tables for calculation of the absolute perturbations of the planets, by Herr Masal.

AMSTERDAM.

Royal Academy of Sciences, March 30.—Dr. Van den Sanden in the chair.—M. Forster stated the results of some experiments made in his laboratory, by Mr. Hunder Stuart and Mr. Fraser Ewman, on the presence of bacteria in the intestines. Mr. Stuart found that ordinary, and Mr. Ewman that typhoid, bacteria, introduced into the stomach along with the food, are discovered ter only in the lowest part of the smaller intestine, and further in the large intestine. Ordinary bacteria have, therefore, no influence on the digestive process.—By means of known properties of polar systems and of elementary reasoning about reality, M. Schoute proved geometrically that the co-variant of Hesse, belonging to a binary equation with real co-efficients, is negative for the values of the variable that correspond to the real roots of the equation, independently of the number of its real roots; this is an extension of Dr. F. Gerbaldi's theorem (compare *Rendiconti di Palermo*, tome iii. p. 22).—M. J. A. C. Oudemans read a paper on the present state of the methods for determining the parallaxes of fixed stars.

VIENNA.

Imperial Academy of Sciences, February 21.—The following papers were read:—On the specific brightness of colours, a contribution to the physiology of visual sensations, by F. Hillebrand.—On the law of the decreasing of the power of absorption at increasing thickness of absorbent layers, by W. Müller-Erzbach.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

E. Museo Lundii, Part 1 (Copenhagen, Hagerups).—The Bacteria in Asiatic Cholera: E. Klein (Macmillan).—Systematic Account of the Geology of Tasmania: R. M. Johnston (Tasmania).—Life; what it is sustained by, and Cognate Subjects: W. Boggett (Trübner).—Proceedings of the London Mathematical Society, vol. xix. (Hodgson).—Flora Orientalis, Supplementum: R. Buser (Geneva, Georg).—Jahrbuch der Meteorologischen Beobachtungen der Wetterwarte der Magdeburgischen Zeitung, 1888 (Magdeburg).—Wild Life in a Southern County: new ed., R. Jefferies (Smith, Elder).—The Structure and Distribution of Coral Reefs, 3rd edition, with an Appendix by Prof. Bonney: C. Darwin (Smith, Elder).—Statics for Beginners: J. Greaves (Macmillan).—The Anatomy of Astrangia danæ, six lithographs from drawings by A. Sonrel; explanation of plates by J. W. Fewkes (Washington).—New Zealand Meteorological Report, 1885 (Wellington).—Proceedings of the Geologists' Association, February (Stanford).—Journal of the Institution of Electrical Engineers, No. 78 (Spon).—Quarterly Journal of Microscopical Science, April (Churchill).—Brain, No. 44 (Macmillan).—Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie, Zehnter Band, v. Heft, Elfter Band, i. Heft (Leipzig, Engelmann).—Bulletin of the American Geographical Society, vol. xxi. No. 1 (N.Y.).—Bulletin from the Laboratories of Natural History of the State University of Iowa, vol. i. No. 1 (Iowa).—Journal of the Royal Statistical Society, March (Stanford).—Journal of the Royal Microscopical Society, April (Williams and Norgate).

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