THURSDAY, MARCH 27, 1890.

A SOUTH LONDON POLYTECHNIC.[1]

SOME little time ago we expressed our views on the general scheme put forward by the Charity Commissioners for the establishment of Polytechnics (we must use the word, however inapplicable) in various parts of London. Since then we have received a copy of the architect's report on the requirements of a Technical Institute for Battersea. It may be well to recall to the minds of readers the main features of the proposed scheme. The Polytechnic in Regent Street, and the People's Palace at Mile End, are to receive large endowments to enable them to continue and develop the work on which they are already engaged, a large sum is to be given to found a City Polytechnic, and series of three new Institutes are to be established in various parts of South London; whilst others, at present more or less shadowy and prospective, are talked of for other parts of the metropolis.

Of the three new Institutes, the plans for which may be said to be in an advanced condition, two will be housed in buildings already established. The Goldsmiths' Company have bought the Royal Naval School at New Cross, and are adapting and altering it so as to be ready to be opened for its new purpose in October next. The premises of the Borough Road Training College have been secured for the second of the Institutes, which is probably to be partly endowed by the Ironmongers' Company. The scheme in this case is not, we believe, yet published, and some delay may take place; but, if all goes smoothly, this Institute also may be ready to begin work before very long.

The third of the proposed South London Polytechnics is the Battersea Institute, for which we have received the draft plans. Here there is no existing building to be adapted. Everything must start *de novo*, and only the limits of the funds at their command, and their uncertainty as to the future tastes and wants of the district, need restrict the trustees in their efforts to make the Institute in every way worthy of its purpose.

And here we may at the outset congratulate the trustees on the mode in which they have determined to proceed. They have intrusted to Mr. Rowland Plumbe the task of visiting other technical schools, obtaining necessary information, and preparing a detailed statement of the requirements of the Battersea Institute, and have since circulated his draft Report among various experts, with requests for criticisms and suggestions. The plans with which the Report is illustrated are not intended to be in any way final, but merely to suggest the nature of the requirements of the Institute to the architect, whoever he may be, who is ultimately selected to design the building. It is clear that no stone will be left unturned, so far as the Committee are concerned, to make the Battersea Institute a model Polytechnic.

We may congratulate the Committee on another matter. In our former article we pointed out the inexpediency of attempting too much at once, while the whole question of the future of Polytechnics is in an experimental stage. Since then, Sir Bernhard Samuelson and other members of the Executive Committee of the Technical Association have publicly impressed similar views upon the Vice-President of the Council, into whose hands the Commissioners' scheme has now passed. We are, therefore, glad to see that Mr. Plumbe expressly states that his plans are drawn up so that the proposed building may be gradually constructed as the need arises; and though he does not conceal his own desire to have the whole building erected at once, we are glad to learn that the Committee have decided to let the institution grow as the number of students increases, and not to erect a great shell until they see more clearly the extent of the demand which it is to supply. We gather further that the sum required for the endowment of the Institute is not yet complete, and we may take it for granted that no attempt will be made to start operations until this necessary preliminary step is completed. Thus those who are anxious that the whole scheme for Polytechnics should not be imperilled by hastily founding too many at once before one new Institute has been made a success, may feel assured that the necessary interval which must elapse before the foundation-stone of the Battersea Institute can be laid will give some further opportunity to the promoters to profit by the experience which accumulates every day of the working of similar institutions elsewhere.

To quote Mr. Plumbe's Report, "The combined form of Institute . . . is a growth almost of the present day, and the subject as now presented is, with the hereinafter mentioned exception, comparatively new and *without precedent*." The exception referred to is Mr. Hogg's Polytechnic, and as this is the product of the gradual growth of seventeen years, the argument for going "slow and sure" is irresistible. The promoters of the Goldsmiths' Institute at New Cross are, we understand, equally alive to this necessity.

Mr. Plumbe has made inquiries, for the purpose of his Report, into the nature of the industries of Battersea, and has visited several of the chief Technical Institutes in London, from the Bow and Bromley Institute up to the Central Institution of the City and Guilds Institute. He might, perhaps, with advantage have extended his visit to some of the more important provincial centres, which in some ways offer examples which are not to be found in the metropolis of the kind of equipment required for a popular technical school. London has long been behindhand in the matter, except for the higher Colleges at South Kensington, which are intended to serve a purpose so different that their example may be disregarded. There are, indeed, the two existing Polytechnic Institutes, and apparently Mr. Plumbe has derived from them almost all his information as to the requirements of the Battersea Institute. The Regent Street Polytechnic he considers "most undoubtedly must serve as a model to all succeeding institutions." He presumes that the Committee will "follow to some extent the curriculum of study adopted at Mr. Quintin Hogg's Polytechnic and the People's Palace."

Without in any way challenging these conclusions, it is only fair to point out that the first-hand inquiries on which they are based are mostly derived from these very

[1] "South London Polytechnic Institutes—Report on Requirements for the Battersea Institute." By Rowland Plumbe, F.R.I.B.A.

institutions. Now it is important that in a new departure like that which it is proposed to make at Battersea we should not blindly follow in the rut of any one existing institution, and the only way to avoid this is to profit by the experience of other technical institutes in various parts of the country. Mr. Plumbe quotes the Report (now nearly six years old) of the Royal Commission on Technical Instruction, but many of the more important provincial schools have sprung up since that date, and the Commission on Elementary Education to which he refers only dealt with elementary schools. He is consequently led to the very doubtful conclusion that provincial schools offer no example for London because of the "thoroughness and great cost of the education given (which further required the whole time of the pupils for a number of years)." "I have not," he continues, "thought it necessary to spend any further time on the examination of buildings of this character, particularly as I found those of most experience with whom I conferred on the subject were distinctly of my opinion."

Who these experts were we are not told, but the above remarks are scarcely applicable to such technical schools as those at Bradford, Huddersfield, Keighley, Manchester, Bristol, and other large centres, which are doing for the artisan population of those districts much the same service as is expected from the Battersea Institute.

Whether instruction be elementary or advanced, whether it be intended for masters or for workmen, it ought to be "thorough," and thoroughness implies to some extent costliness. "To educate the industrial classes on a large scale at a comparatively nominal cost" is an attempt which looks better on paper than in practice.

And this brings us to the question of the financial aspect of the scheme. Mr. Plumbe states that his estimate of the cost of a given amount of accommodation is based on a memorandum by Mr. H. Cunynghame, in which he calculates that the building, including land, &c., ought to be erected and fitted up for £11 per student or member and that the cost of annual maintenance, in addition to fees and grants, will amount to 15*s.* per head per annum. This estimate is naturally considered by Mr. Plumbe to be "moderate in the extreme." It is much to be desired that the basis of Mr. Cunynghame's calculation should be made public, so that the materials should exist for the formation of a sound judgment thereon.

As regards the cost of building, all depends of course on the kind of building proposed; but it would be melancholy, indeed, if an institution directly designed to elevate the ideas and refine the taste of the population of dismal and ugly South London, were to be housed in a building "of the plainest and most utilitarian character"—to say nothing of the quality of materials used in its construction.

But from an educational point of view an even more important consideration is the necessary amount of endowment. The allowance of 15*s.* a head, "including repairs and maintenance," seems very meagre, if fees are to be low, and at the same time first-class teaching power and management are to be secured, *and paid for*. To base an estimate on the current expenses of the Regent Street Polytechnic is to run the risk of serious error, for it is well-known that much of the work of organization and direction has there been performed gratis, or at far below market value, thanks to the enthusiasm of a few devoted workers. Can the Committees of the new Institutes call into existence a similar amount of enthusiasm among men of leisure and means in connection with each of the proposed Institutes (not, be it remembered, of a religious character), which will justify them in relying on being permanently saved the bulk of the expenses of management? If not, it is clear that a good deal will have to be added to the estimate of 15*s.* a head.

Another matter which is of importance from a financial point of view is the question of the position to be occupied by the day-school with respect to other sections of the new Institute. On this point, the language of the Commissioners' scheme is vague almost to the point of unintelligibility. There are evident advantages in utilizing the Polytechnic buildings in the day-time for the purpose of a school which may afterwards serve as a feeder to the evening classes. But it should be an organic part of the Institute; not a mere appendage, the existence of which may be tolerated so long as it interferes with no other department of work and claims no share in the endowment. Yet such seems to be the present intention of the Charity Commission, so far as we can gather from their published statements. The language of Mr. Plumbe's Report confirms this conclusion, against which it is time to record an emphatic protest. In our opinion, the day-school, if properly conducted, should ultimately become the corner-stone of the whole educational work of the Institute, for much more systematic teaching can be done in the case of boys working all their time than can be hoped for with students devoting a couple of evenings a week to instruction and recreation. Doubtless, in Regent Street a secondary school can be made self-supporting, and even profitable, by its fees; but such an attempt would be undesirable, and indeed impossible, in the case of a school for the "poorer classes" in a poor district. A high-fee'd school might perhaps fill itself at the expense of emptying other schools in the neighbourhood, but it would not fill the gap which wants filling. Under these circumstances, to condemn the day-school to pay its way is to condemn it to become a mere grant-earning machine, neglecting all subjects which do not pay, and constructing its curriculum strictly on the lines of the South Kensington Directory. What is wanted is a good modern school with a low fee, and a large number of scholarships for competition among the scholars of elementary schools. But such a school cannot be made self-supporting, and the Battersea Committee would do well to induce the Charity Commissioners, before it is too late, to recognize this fact frankly in the scheme which they are about to draw.

Again, we should be glad to know how wide a margin Mr. Cunynghame's estimate allows for the cost of what we may term "local adaptation." For example, in Mr. Plumbe's list of local industries we find chemical works, match factories, and gas-works. From this it would seem that there is room for the teaching of chemistry in its application to various industries. But such instruction, though it is one of the chief objects with which the technical side of the Institute is started, must involve extra cost, for it will not produce grant; and Mr. Plumbe's conclusion from his inquiry, that the "science and art

classes should be carried on so that the Government grant be earned," is a *non sequitur;* at all events until the Science and Art Department award grants for distinctively technical subjects under the new Technical Instruction Act.

We cannot help thinking that if due weight is allowed to these considerations the estimate of 15*s.* a head will be largely raised (unless compensation be sought by cutting down some of the more expensive trade classes); and as we suppose the endowment cannot be much increased, the number of students to be provided for must be necessarily diminished. In fact, the whole scale on which Mr. Plumbe has calculated the requirements of the Institute may have to be somewhat revised. To those who consider large numbers all-important, this may seem deplorable, but we are convinced that the Committee of the South London Polytechnic will prefer the interests of efficiency to those of temporary display.

One other matter which we notice with some surprise and regret is the apparent omission in the plans to provide committee-rooms and other accommodation which can be utilized by local working men's organizations. We referred in our former article to the importance of making the Institutes real working-class centres, and the reply of the Charity Commissioners to the deputation from the London Trades Council on the subject was supposed to be favourable to the provision in connection with each Institute of rooms which could be utilized on moderate payment by various working-class societies which now too often have to meet in public-houses. The omission of any such provision in the plans for Battersea is a serious blemish on the scheme, which, however, can easily be corrected, as soon as pointed out.

The Committee will have a great opportunity, which it is to be hoped they will use aright, of providing the inhabitants of South London with a technical and recreative Institute, which in its close adaptation to local needs may serve as model for all such Institutes in the future.

A GEOLOGICAL MAP OF THE ALPINE CHAIN.

Geologische Übersichtskarte der Alpen. Entworfen von Dr. Franz Noë. Mit einem Begleitworte. (Wien : Ed. Hölzel, 1890.)

GOOD, and in some cases even elaborate, geological maps exist for parts of the Alps; but one to exhibit the chain as a whole, without being on a scale so large as to be unwieldy or so small as to be indistinct, has been hitherto a desideratum. This has now been supplied by Dr. Noë. The scale adopted is 1 in 1,000,000, or about 16 miles to the inch, which very well satisfies both the above conditions. A glance at the list of authorities which have been consulted indicates that Dr. Noë has had no easy task; for in Alpine geology there are indeed consellors enough, but their multitude is not strength, for they are so often at variance.

At the present stage of knowledge, the chartographer must be content, in dealing with the crystalline schists (using that term in a rather wide sense), to colour his map petrographically—that is to say, he must, as far as possible, record facts and avoid theories. Dr. Noë has endeavoured, though not with complete success, to render his maps petrographical in the parts where doubt might arise, viz. those occupied by that crystalline series which, whatever may be its age, in the Alps always underlies any sedimentary rock to which a date can be assigned. The principle of coloration agrees very nearly with that suggested by the International Geological Congress at Bologna. Crimson denotes the deep-seated igneous rocks of the more acid type, dull green the more basic; two slightly different shades of red represent respectively the older (and in most cases more acid) volcanics and the newer volcanics. Four colours are employed to express the "crystalline schist" series: one, for the Central gneiss and some of the oldest mica-schists; another, for the less coarsely crystalline (and probably newer) mica-schists, together with calc-schists, chlorite-schists, &c.; a third, for certain crystalline schists, phyllites, and clay-slates of uncertain geological age; and marbles are indicated by a deep blue. Palæozoic rocks (exclusive of Permian) are coloured purple, the different series being distinguished by symbols; pale brown denotes Permian; tints of blue represent the Triassic and Jurassic strata; green signifies Neocomian and Cretaceous; orange the older Tertiary, flysch having a separate tint; one shade of yellow is used for Miocene and Pliocene; another for Diluvial and Alluvial deposits—the former a word of misleading origin, which ought to have long since disappeared from geological nomenclature.

Very wisely, Dr. Noë has included in his map something more than the Alps. Not only do we find the Jura, but also this region is extended far enough in the direction of Dole to exhibit the remarkable exposure of the old crystalline floor, north of that town. On the right bank of the Rhine, in the neighbourhood of Sackingen, a considerable strip of crystalline rock is shown, the end of the great Schwarzwald *massif;* and north of the Eastern Alps we find the crystalline rocks indicated as they uprise from beneath the Miocene on the left bank of the Danube, as, for example, near Linz, and again at Pressburg. The geological colours also are carried down the east coast of the Adriatic as far as Spalato, so that the connection of the Istrian and Dalmatian Alps with the main chain is made perfectly clear. Unfortunately, however, Dr. Noë has not applied the same treatment to the Apennines, though their connection with the Alpine chain cannot be of less geological importance, for he brings the colours to an abrupt end a few miles west of Savona.

In one or two respects the above system of coloration seems open to criticism. The tint and the lines used to indicate mountain land are productive of some confusion, and increase the difficulty of identifying the colours, without, as we think, producing a compensating advantage. The use of three colours for the Trias-Rhætic seems a disproportionate subdivision when only one is allotted to Neocomian-Cretaceous. We are, however, disposed to differ more seriously—though only occasionally—from Dr. Noë as to his use of the colours for the divisions of the crystalline schists. One of these is made too inclusive, because it is applied to clay-slates and phyllites as well as to rocks which must be admitted to be crystalline schists. Granted that there is sometimes a difficulty in separating these in the field, we fail to see the propriety of deliberately effacing the distinction. Fortunately, however, this confusion, owing to the scale of the map, does not

seriously mislead the student, but we are more perplexed to discover the reasons which have led in some cases to the separation of the crystalline members of this group from certain of those in the other, and presumably older group, which is defined as consisting of "mica-schists calc-mica-schists, chlorite-schist, &c. To the latter are referred the schists—calcareous, micaceous, and chloritic—near Windisch-Matrei; to the former the great belts north and south of the Tauern range, which, for instance, occur respectively near Mittersill and Lienz. We cannot understand on what grounds these are distinguished. Further, the great group of schists which sweeps along on the eastern flank of the watershed of the Franco-Italian Alps, as, for example, near the Mont Genèvre, has the same colour as those of Windisch-Matrei; but petrographically they appear to us inseparable from the other group. By some geologists, as is well known, the "lustrous schists" have even been mapped (erroneously no doubt) as altered Trias.

Still, though we venture to dissent occasionally from Dr. Noë, and think that in all probability a wider personal knowledge of the Alps would have led him occasionally to modify a conclusion and to avoid some slight inconsistencies, we cannot conclude this notice without expressing our sense of the very great value of his work. He has placed a really good general map of the Alps within the reach of all students, for the price at which it is sold is surprisingly low. The map is accompanied by a useful descriptive pamphlet, to which Prof. Suess has written a short preface.

T. G. BONNEY.

OLD AGE.

Old Age. By George Murray Humphry, M.D., F.R.S. (Cambridge: Macmillan and Bowes, 1889.)

IN spite of pessimistic philosophies, man still regards life as worth living, and trusts to attain to a good old age, however miserable his life may seem to impartial critics. This desire, of course, is a necessary condition of human existence, and the destruction of it would entail the extinction of the human race—a contingency, however, which is never likely to arise. Hence, we have no doubt that this volume will be eagerly scanned by innocent persons who are still in hopes of finding some panacea which will enable them to attain the desired length of days.

But, alas, the number of their somatic cell generations is already fore-ordained in the germ from which they were developed; and no rule of life can increase this. No man by taking much thought can add a cubit to his stature, nor a decade to the predestined span of his existence. Yet the facts gathered together in this book may afford some hints as to the best way of attaining just this limit.

On p. 135, *et seq.*, Prof. Humphry reviews the chief characteristics in the mode of life of the favoured subjects of the work. He begins by saying that the results of the collective investigation respecting old age, "have not been such as to evolve anything very novel or startling, or to give rise to any fresh theories with regard to longevity and the means of attaining it," but only to "show that the maxims and laws which common-sense would dictate hold good, that the real *elixir vitæ* is to be found in the observance of them, and that, as a general rule, those persons live the longest who might be expected to do so."

The author also emphasizes the fact of the all-importance of inherited predisposition among the factors that tend towards producing longevity, and shows that nearly all the subjects of the returns came of a long-lived stock. In most of them, too, the body was well-proportioned and developed, brain development fair, and there was a remarkable absence of degenerative changes in the arteries and cartilages. According to the author, their essential characteristic is that all parts of the body are so well balanced, that the senile decay of function goes on in them all simultaneously, and at an equal rate, so that, *e.g.*, the vascular system is not overloaded and overworked by a too vigorous digestive apparatus, nor the vessels worn out by an over-excitable nervous and cardiac mechanism, so that if we could induce all our organs

> "to arrange
> This not to be avoided change,
> So as to change together,"

we should have gone far towards attaining the secret of long life.

Most of the persons described were temperate, taking little alcohol and meat, and lived active open-air lives. There are one or two startling exceptions to the former rule, however; such as the centenarian who "drank like a fish all his life," and several others who had always indulged pretty freely in stimulants.

Another point that Prof. Humphry lays stress on is the fact that most of these people were early risers, and could do with little sleep. It seems that the anabolic processes are more complete and regular when they are accomplished quickly. *Apropos* of this, he quotes with approval the dictum of the Duke of Wellington: "When one turns in bed, it is time to turn out."

In discussing the general aspects of his subject, he shows that old age may be said to be a product of civilization, the law of the "weakest to the wall" being altered by the growth of sympathy, and of love for others. But the continued existence of old people among communities may (partly, at all events) be accounted for on more utilitarian principles. Weismann remarks:—

"It [old age] is obviously of use to man, for it enables the old to care for their children, and is also advantageous in enabling the older individuals to participate in human affairs, and to exercise an influence upon the advancement of intellectual powers, and thus to influence indirectly the maintenance of the race."

Thus we see the production of old age could be accounted for simply on the laws of natural selection among nations.

The fertility of these long-lived individuals is also above the normal (the average of children born to each, whether man or woman, being six), and many of them seem to have borne or begotten children to an advanced age. This, again, is in accordance with the view advocated by the biologist just quoted—viz. that a lengthening of life is connected with the increase in the duration of

reproduction. The effects of this fertility of long-lived people must give their stock an advantage in the race for existence, so that one would expect their number, in proportion to the rest of the population, gradually to increase.

The last chapter gives a short account of the maladies of old people, and is chiefly of medical interest.

Besides the general account of the subject, Prof. Humphry gives all the analyses of the British Medical Association returns, which furnish the material for the book. There are several good photographic illustrations: the frontispiece, portraits of a man and his wife (both over 101 years), and others, representing sections through the neck of the thigh-bone, and the jaw of old people. With regard to the femur, Prof. Humphry points out that there is no foundation for the generally accepted idea that the head in old people sinks to or below the level of the great trochanter, and the illustration certainly bears out his criticism.

Perhaps the happiest feature of the book is its optimism. "It is satisfactory to note how many of the very aged are in good possession of their mental faculties—taking a keen interest in passing events, forming a clear judgment upon passing events, and full of thoughts for the present and future welfare of others."

An old age like this is worth striving to attain, although one may never be free from the dread of dying "from the head downwards," and so lingering on in

> "Second childishness and mere oblivion,
> Sans teeth, sans eyes, sans taste, sans everything."

E. H. S.

THE ELEMENTS OF ASTRONOMY.

The Elements of Astronomy. By Prof. C. A. Young, Ph.D., LL.D. (Boston and London: Ginn and Co. 1890.)

THIS is a valuable addition to the existing text-books of astronomy for the use of those who intend to study the subject seriously. It has much in common with the same author's larger work on "General Astronomy" (see NATURE, vol. xxxix. p. 386), but we are assured that it is not merely an abridgment, but has been worked over with special reference to a high-school course. It is assumed that the students have mastered the ordinary elementary subjects, and are acquainted with elementary algebra and geometry.

The book covers quite as much ground as can be expected for an elementary course, although many of the subjects are merely glanced at. Practically everything, with the exception of the more difficult problems of mathematical astronomy, is considered more or less. The opening chapters deal with definitions, the geometry of the sphere, and the determination of latitude and longitude. Chapters on the earth's dimensions and motions, the moon, sun, planets, comets, stars, and nebulæ, then follow. An appendix includes topics which might be considered beyond an elementary book, but are still of sufficient importance to form part of a high-school course.

Astronomical physics receives a fair share of attention, but here the book is necessarily more open to criticism than in the parts dealing with well-established facts and principles. There are few general text-books which treat this important branch of astronomy in a satisfactory manner, and it is perhaps not to be wondered at, as the constantly increasing number of new observations necessitate considerable changes in our ideas. As far as a consideration of the facts is concerned, however, Prof. Young has done his work admirably, but this cannot be said of his treatment of the various conclusions which have been drawn from them. In his introduction, Prof. Young tells us that he has tried to treat every subject in such a way as "to discourage narrow and one-sided ways of looking at things, and to awaken a desire for further acquisition." However he may succeed with his readers, it does not seem that he has altogether taken this lesson to heart himself, for we find him dismissing suggestions without a complete hearing. For instance, in connection with the theory that sun-spots are formed by the down-rush of cool materials into the photosphere (p. 130), he states that it is not easy to reconcile this view with the distribution of the spots over the sun's surface. Further enquiry on his part, however, would have shown him that the theory in its extended form suggests that the spot-forming material is mainly formed of vapours which have condensed in the cool outer layers of the sun's atmosphere (in the same way as water-vapour condenses in our own), and also gives an explanation of the way in which the material may be localized over the spot-zones. The author is notably cautious with regard to new things, but we are surprised to find that he continues to adopt Secchi's classification of star spectra (p. 317), seeing that it does not satisfactorily treat bright-line stars like γ Cassiopeiæ, and those of Orion which give almost continuous spectra. The classifications suggested by Vogel and Lockyer both have the advantage of detail, and the latter is certainly the most philosophical. On p. 318 it is stated that stars of Secchi's fourth type usually "show a few bright lines," in addition to the carbon absorption bands, an idea of Secchi's which was shown to be erroneous several years ago.

The book is abundantly illustrated, and most of the diagrams are excellent. Fig. 119, however, gives a very bad impression of the spectrum of a nebula, the three bright green lines being represented as almost equidistant, whereas they practically form a triplet. A useful "Uranography" is given at the end. This embraces the more important celestial objects in the northern hemisphere and some degrees south, and is accompanied by a series of star maps. In the maps a convenient system of indicating magnitudes is adopted, but it has the disadvantage of destroying the appearances of the constellations for rapid identification. A. F.

OUR BOOK SHELF.

Physiology of Bodily Exercise. By Fernand Lagrange, M.D. (London: Kegan Paul, Trench, and Co., 1889.)

THIS book at first sight reminds one of the saying that a German takes a year to make a research, and a week to write an account of it, while a Frenchman takes a year to write a book on one week's work. The only original part consists of a few experiments on the influence of fatigue in producing increased excretion of urates in the urine. The author ascribes most of the ill effects of

fatigue to the presence of uric acid in the blood—in fact, considers a fatigued man to be in exactly the same condition as a gouty man. His observations, however, seem to have been very few in number, and the analyses were all made for him by a friendly chemist. Still, it is unfair to the book to regard it as a contribution to the advance of physiological science. It is really an excellent little account of the physiology of bodily exercise, and its *rôle* in the maintenance of health, by a medical practitioner. It seems to be chiefly culled from the standard French works on general physiology, and on the physiology of movement. The author has digested his materials well, and so produced a very readable and lucid account of his subject. For a book of its class, it is remarkably free from mistakes, though physiologists might not agree with him in his account of the production of breathlessness or the causation of gout.

The style is simple, and the book is well adapted for popular use, and ought to find favour with our exercise-loving countrymen. E. H. S.

Boilers—Marine and Land. By Thomas W. Traill, F.E.R.N., M.Inst.C.E. Second Edition. (London: Charles Griffin and Co., 1890.)

THIS volume is a second edition of a work noticed in these columns last year. It was then a pleasure to express the opinion that the work would be useful to all connected with this particular branch of mechanical engineering. The author has found it necessary to extend the tables of scantlings, &c., from 160 to 200 pounds pressure per square inch. This in itself is sufficient evidence of the continued increase of steam pressures used in marine and stationary engines—probably the only practicable direction in which greater economy of fuel is to be obtained. These increased steam pressures have also the advantage of diminishing the gross weight of machinery on board ship.

The greater use made of mild steel by engineers generally is interesting, considering the fight the steel manufacturers had a few years ago to get it used at all in place of iron for many purposes. Mr. Traill observes that, "notwithstanding the peculiarities of mild steel, it is a material which may be used with safety and advantage, if proper precautions be taken and due consideration given to these peculiarities; possibly it has fewer infirmities than iron; and there can be no doubt that it is a better and more serviceable material for general use in the construction of boilers." This is the experience of most engineers intimate with the general behaviour of the material when being worked up into boilers and other constructions. To the many tests and safeguards specified to prevent the use of a brittle and bad steel in any erection is due the present excellence of this material, nor should they now be in any way relaxed, for to accept material, either iron or steel, on any particular brand is a mistake.

The general utility of the work has been increased by the addition of other matter and tables. The volume cannot fail to be of very great use to engineers. It is nicely printed, got up in a handy size, and strongly yet pliably bound. N. J. L.

The History and Pathology of Vaccination. Edited by Edgar M. Crookshank, M.B. Two Vols. (London: H. K. Lewis, 1889.)

THE arguments adopted in this work belong to a mental attitude identical with that displayed by anti-vaccinators in their clamorous treatment of the subject. They are sophistical from beginning to end, and even as a book of reference the volumes are not without drawbacks.

Firstly, the argument is that cow-pox is to be regarded as akin to syphilis rather than to small-pox, and that therefore cow-pox is no protection against small-pox. On this hypothesis ulcerated arms sometimes occurring after vaccination are to be regarded as reversions to type, rather than as due to the ill-treatment by over-anxious mothers not content to let Nature alone in her progress towards recovery. Having assumed that vaccination is no protection against small-pox, the book goes on to show that the only means we have of controlling the devastations of this disease is by attention to sanitary arrangements and by isolation, perhaps combined with judicious inoculation. The latter, the book assures us, is a more scientific procedure than the inoculation of cow-pox. Next, the author is very angry with Jenner for calling vaccinia, "cow-pox" or "variola vaccinia." To this stroke of dexterity by Jenner is to be attributed, says Prof. Crookshank, all the credit that vaccination has attained; thus for a single happy thought Parliament gave Jenner £30,000 as a consequence of his conceit, and England has been made to submit to the most tyrannical of laws.

This carping at the pioneer of new knowledge, and more especially at those forecasts of his which necessarily could only be verified by the lapse of time, is certainly not calculated to shake the faith of those who now fully comprehend not only the immense value of vaccination, but also the small amount of mischief which it has ever done.

The best that can be said for Prof. Crookshank's work is that it is well published. The printing is bold and clear, and the lithographs, such as they are, well reproduced.

Vol. ii. contains reproductions of original papers, most if not all of which are out of print, and cannot now be obtained except at fancy prices.

Had Prof. Crookshank been satisfied with editing these, and had he refrained from expressing his opinions, we should have been grateful to him. The book does not pretend to be a practical work on the subject of which it treats; and for the rest it might have been compiled by the average anti-vaccinator. ROBERT CORY.

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.*]

The Transmission of Acquired Characters, and Panmixia.

I SUPPOSE that a correspondent has no claim to limit the scope of a discussion in such a journal as NATURE. At the same time I feel it to be a rather severe burden when I am called upon to expound, in answer to one letter after another, the merest common-places of the subject under discussion, and to retail in this place the substance of books like Weismann's "Essays" and Wallace's "Darwinism" (to which the attention of your readers has been already drawn by reviews), not to mention the "Philosophie Zoologique" and the "Origin of Species." It seems to me that there might be interest and profit in opening your columns to the statement of newly observed cases which seem to tell in favour of either the Lamarckian or the anti-Lamarckian theories, or to novel criticisms of any cases which have already been discussed elsewhere; but surely the repeated citation of familiar exploded "cases," and the reiteration of arguments and beliefs which have long since received attention, is not fair to the writers who have dealt with these cases and these arguments in admirable treatises which are well known (I am happy to think) to nearly all serious students of these questions.

When I saw the distinguished name of Mr. Herbert Spencer at the end of a letter in your issue of March 6, I anticipated some real contribution to the discussion as to whether acquired characters are transmitted or not. Mr. Spencer some few years ago expounded his convictions in favour of Lamarck in one of the monthly reviews. His present letter is not only disappointing, but is unfortunately likely to mislead the uninformed. Mr. Spencer states what we all know, viz. that Mr. Darwin considered that the effects of habit and of use and

disuse are transmitted from the affected generation to its offspring. He refers by chapter and page to the instances which Mr. Darwin considered as examples of the transmission of the effects of habit or of use and disuse. He then says: "Clearly the first thing to be done by those who deny the inheritance of acquired characters is to show that the evidence Mr. Darwin has furnished by these numerous instances is all worthless." I entirely disagree with this way of putting the matter. It is not necessary to show that anything Mr. Darwin wrote was "worthless," but it is necessary to show that certain facts cited by Mr. Darwin admit of another interpretation or explanation than that which he gave to them. Naturally those who have taken up the anti-Lamarckian position have done long ago what Mr. Herbert Spencer says is the first thing for them to do. Of course the cases cited by Darwin were the first to be dealt with. It is extremely unfortunate that Mr. Spencer has not come across the work in which this is done. Otherwise, instead of a well-meant direction from Mr. Spencer as to what we ought to do, we might have the advantage of reading what he has to say after considering what has been done. It is seven years since Prof. Weismann published his essay on heredity; last spring this and other essays appeared in English under the auspices of the Clarendon Press. In that particular essay Darwin's cases are dealt with at length. Am I to reproduce Prof. Weismann's essay or a *précis* of it in this letter? Will not Mr. Spencer and others who are interested in these matters read Weismann's "Essays"? I think that those who will take the trouble to do so will see that Mr. Spencer's injunction was superfluous.

It is, however, apart from other branches of the question, important that a correct appreciation of Mr. Darwin's position in this matter of the "transmission of acquired characters" should be arrived at. Mr. Herbert Spencer's letter is, I think, likely to produce an erroneous conception on this matter. We know from his letters published since his death that Darwin held the "Philosophie Zoologique" to be "veritable rubbish"—"extremely poor; I got not a fact nor an idea from it." The notion that his own view was a modification of Lamarck's appeared to Darwin absurd. The "obvious view" was propounded by Lamarck, he says, "that if species were not created separately they must have descended from other species, and I can see nothing else in common between the 'Origin' and Lamarck." This was Mr. Darwin's attitude of mind to Lamarck's theory, and the cases in which he attributes importance to the effects of use and of disuse, and to acquired habit, and consequently to the Lamarckian principle of the transmission of acquired characters, are clearly to be regarded as concessions or admissions on his part, given with increasing generosity in the later editions of the "Origin"; but always treated as of quite subordinate importance. It is not going too far to say that Mr. Darwin never troubled himself very much with the question as to whether acquired characters are transmitted or not. It was the object of his works to show that the main effective principle in the origin of species is the natural selection in the struggle for existence of congenital characters. He explicitly states that he believes other causes to be at work; one of which at least, viz. sexual selection, he himself investigated at length. It must be remembered that no evolutionist in Darwin's life-time had prominently challenged the truth of the Lamarckian assumption that acquired characters are transmitted. For Darwin it was sufficient to show that, granting such a process to take place, it would not account for much; he was content to accept it as a subordinate factor. His view is best stated in his own words in the "Origin of Species": "On the whole we may conclude that habit, or use and disuse, have, in some cases, played a considerable part in the modification of the constitution and structure."

Whilst it is true that Mr. Darwin in various parts of his works alludes to cases which he interprets as due to the transmission of characters acquired by parents through habit, use, or disuse, it is obvious, when we read what he has to say in each case (as in the examples cited by Mr. Herbert Spencer), that he preferred, where it occurred to him another interpretation. Thus, after referring to the wings of the logger-headed duck and the domestic Aylesbury duck as dwindled by the transmission in successive generations of the effects of disuse, he interposes his own explanation by natural selection of the wingless beetles of Madeira, prefaced by the words: "In some cases we might easily put down to disuse modifications of structure which are wholly or mainly due to natural selection." He refuses to regard the defective anterior tarsi of dung-beetles as due to inherited mutilation, though he supposes they may have become deficient through disuse. He regards the defective eyes of cave-animals as due to the inheritance of the effects of disuse. I can scarcely doubt that, had it occurred to him, he would have preferred an explanation similar to that given by him of the wingless island beetles, viz. that a natural selection of animals with defective eyes takes place in a cave; since ultimately only those remain in a cave and breed in it which, in the course of their wanderings, are unable to see the faint light which penetrates to a great distance from the mouth, and must guide all those but the congenitally blind or weak-sighted to the exterior. The defective eyes of moles are ascribed by him not merely to disuse but to the selective action of inflammation. The case of the silkworm caterpillars with defective instincts (which is one of those given by Mr. Spencer) does not appear to me to bear on the present question. Of acquired characters, other than those due to disuse, Mr. Darwin accepts very few as being transmitted. He accepts the statements of Brown-Séquard as to the transmission of the effects of mutilations of guinea-pigs only so far as to "make us cautious in denying such transmission." He regards the dislocation of the eye of flat-fishes as due to the inheritance in successive generations of an increasing displacement caused by muscular effort. Besides these two instances (noted by Mr. Spencer) there is one other prominent passage in which Darwin asserts his belief in the inheritance of an acquired character which is not merely the result of disuse. I am anxious to separate those cases which Darwin speaks of as "due to the effects of disuse," for a reason which will appear below. The additional passage not noted by Mr. Spencer is this ("Origin of Species," p. 206, sixth edition):—"If we suppose any habitual action to become inherited—and it can be shown that this does sometimes happen—then the resemblance between what originally was a habit and an instinct becomes so close as not to be distinguished. If Mozart, instead of playing the pianoforte at three years' old with wonderfully little practice, had played a tune with no practice at all, he might be truly said to have done so instinctively. But it would be a serious error to suppose that the greater number of instincts have been acquired by habit in one generation and then transmitted by inheritance to succeeding generations. It can be clearly shown that the most wonderful instincts with which we are acquainted—namely, those of the hive bee and of many ants—could not possibly have been acquired by habit."

The cases of the epileptic guinea-pigs, the eyes of flat-fishes, and of some acquired habits, have been discussed by Weismann and by Wallace. I will not now allude further to those classes of cases. But I am anxious to draw attention to the special subject of the "effects of disuse" as set forth by Mr. Darwin. This phrase is not only used by him in regard to special instances, but, in treating of the large subject of rudimentary organs, he frequently refers to the "effects of disuse." He says, "It appears probable that disuse has been the main agent in rendering organs rudimentary" ("Origin," p. 401).

Now I am anxious to point out three things in regard to the "effects of disuse." (1) There are other possible effects of *disuse* of an organ than the dwindling of that organ in one generation, and the inheritance of the organ in a diminished size by the next generation. (2) The anti-Lamarckians attribute a very great effect to disuse, although they do not attribute to it the particular result which Lamarck did. (3) The particular way in which, according to the anti-Lamarckians, disuse acts so as to lead to the dwindling or complete loss of the disused organ has been called by Weismann by a convenient name—"panmixia." The doctrine of panmixia is already indicated by Darwin himself, and in view of this fact we must suppose that, when he attributed the loss or dwindling of an organ to "disuse" or the "effects of disuse," he did not necessarily (though probably he frequently did) refer to the Lamarckian *modus operandi* of disuse, but may very well have had in mind the results which are attributed to disuse by the anti-Lamarckian doctrine of panmixia.

The doctrine of panmixia is this. When there is no longer, owing to changed conditions of life, any use for an organ, it will cease to be the subject of natural selection. Consequently all possible variations of the organ will have (so far as the now lapsed use of the organ is concerned) an equal chance. Amongst the possible variations there will be the variation in the direction of increased size, and its exact complement—the variation in the direction of diminished size. Prof. Weismann has stated briefly that this equal survival of all possible variations must lead to the

dwindling and ultimate loss of the organ. I would, however, venture to supplement what he has said by the following: viz., given the state of panmixia, it is apparent that variations in the direction of excessive size will be injurious—both as taxing the nutriment of the organism, and often as mechanical encumbrance. On the other hand, variations in the direction of greatly diminished size will be advantageous, as causing a diminished tax on the resources of the organism. Now it is a demonstrable fact that excessive variations in both directions *do* naturally though rarely occur—probably more often than is supposed, since we do not see all the young born. If the variations in the direction of excessive diminution of a useless organ (as, for instance, tailless cats or hornless sheep) survive as being less taxed—whilst the complementary variations in the direction of excessive size tend in the struggle to die without reproducing, owing to their awkwardness and their relatively greater burden in life—then it is clear that panmixia may lead rapidly to the dwindling and eventual extinction of a disused organ without any transmission of *acquired* parental character. The fact that there is no use for an organ—or, in other words, the "effect of disuse"—is that the congenitally small varieties of the organ survive, and are even favoured in the struggle for existence.

Whilst Weismann has the merit of having insisted on a form of his doctrine as the effective reply to those who argue in favour of Lamarck's theory of the transmission of acquired qualities from instances of "disuse," it is yet the fact that Mr. Darwin himself recognized and formulated the doctrine of panmixia in the last (sixth) edition of the "Origin of Species," published in 1872; and he even went further than Weismann, for he associated the principle of the economy of material with the principle of the cessation of selection. It is therefore, it seems to me, not at all improbable that when Darwin refers, here and there throughout his works, to a reduced or rudimentary condition of an organ as "due to disuse," or "explained by the effects of disuse," he does not *necessarily* mean such effects as the Lamarckian second law asserted and assumed (though often he does appear to mean such); but he may mean, and probably had in his mind, the effects of disuse as worked out through panmixia and economy of growth.

The passages in Darwin which seem to me to have been missed or neglected by those who think panmixia altogether a new idea are as follows:—

(1) "If under changed conditions of life a structure before useful, becomes less useful, its diminution will be favoured for it will profit the individual not to have its nutriment wasted in building up a useless structure." After an example in point from the group of the Cirripedia, Darwin conttinues: "Thus, as I believe, natural selection will tend in the long run to reduce any part of the organization as soon as it becomes, through changed habits, superfluous, without by any means causing some other part to be largely developed in a corresponding degree" ("Origin of Species," sixth edition, p. 118).

(2) "Organs, originally formed by the aid of natural selection, when rendered useless, may well be variable, for their variations can no longer be checked by natural selection. . . . It is scarcely possible that disuse can go on producing any further effect after the organ has once been rendered functionless. Some additional explanation is here requisite, which I cannot give. If, for instance, it could be proved that every part of the organization tends to vary in a greater degree towards diminution than towards augmentation of size, then we should be able to understand how an organ which has become useless would be rendered, independently of the effects of disuse, rudimentary, and would at last be wholly suppressed; for the variations towards diminished size would no longer be checked by natural selection. The principle of the economy of growth explained in a former chapter [cited in quotation No. 1], by which the materials forming any part, if not useful to the possessor, are saved as far as possible, will perhaps come into play in rendering a useless part rudimentary" ("Origin of Species," sixth edition, pp. 401–402).

I had written thus far, and intended to finish this letter by asking if the anti-Lamarckians are not really carrying out the spirit of Darwin's doctrines, although not the absolute letter, when I received your issue of March 13, containing a long letter from Mr. George Romanes, headed "Panmixia." In that letter Mr. Romanes, whilst amending (as I have done above) Prof. Weismann's statement of the principle of panmixia, makes the definite assertion that "it is remarkably strange that this principle should have been overlooked by Mr. Darwin."

Probably your readers will be as much astonished as I was when they read the extracts I have above given from the "Origin of Species" by the side of Mr. Romanes's letter.

After dismissing Mr. Darwin, Mr. Romanes proceeds to say: "In this connection, however, it requires to be stated that the idea first of all occurred to myself, unfortunately just after the appearance of his last edition of the 'Origin of Species.'"

Now, inasmuch as the idea in question is (as I have shown above) formulated in the last edition of the "Origin of Species," I confess that I do not think it requires to be stated that the idea occurred to Mr. Romanes shortly after the publication of that work. What more natural? The idea occurred to me also shortly after the passages above quoted from Mr. Darwin were published. It certainly never appeared to me "unfortunate" that this was the case, and I cannot see where the misfortune comes in in regard to Mr. Romanes. As soon as the matter had taken root in his mind, Mr. Romanes published in NATURE, March 12, April 7, and July 2, 1874, an exposition of the importance of the principle of cessation of selection as a commentary upon a letter by Mr. Darwin himself (NATURE, vol. viii. pp. 432, 505) in which Mr. Darwin had suggested that, with organisms subjected to unfavourable conditions, all the parts would tend towards reduction. Mr. Darwin, with his usual kindly manner towards the suggestions of a young writer, gives at p. 309 of vol. ii. of "Animals and Plants under Domestication" (second edition), Mr. Romanes's view, "as far as it can be given in a few words." The view, as it there appears in Mr. Darwin's words, is certainly *not* the same as that which Mr. Romanes has expounded in NATURE of March 13, 1890 (p. 437), and since it represents what Mr. Darwin had been able to gather from Mr. Romanes's letters to NATURE of 1874, it is not at all surprising that Mr. Darwin did not recognize any resemblance between it and his own statement, viz. that "the materials forming any part, if not useful to the possessor, are saved as far as possible," thus "rendering a useless part rudimentary." Whether this is, or was, Mr. Romanes's view or not, it is Darwin's, and is the essence of the anti-Lamarckian view of the effects of disuse.

March 15. E. RAY LANKESTER.

Exact Thermometry.

SHORTLY after the publication of my second letter on this subject (NATURE, January 23, p. 271) I received a letter from M. Guillaume, who very kindly called my attention to a paper by Prof. J. M. Crafts (*Comptes rendus*, xci. p. 370), in which the "plastic theory" is discussed. Prof. Crafts states that he has subjected thermometers to prolonged heating at 355° C., under various conditions as regards pressure, the internal pressure being in many cases considerably greater than the external, but that there was invariably a rise of the zero-point. The experiments were carried out in very much the same manner as that described in my first letter (NATURE, December 19, 1889, p. 152), and had I known at the time of the earlier work of Prof. Crafts, I should of course have referred to it. Prof. Crafts also describes and quotes experiments with air-thermometers, the temperature in one determination by Regnault being as high as 511° C., and the internal greater than the external pressure; in every case the bulb diminished in volume. From these results, Prof. Crafts concludes that it is not proved that pressure plays any part in the contraction of the glass.

My experiments can therefore be regarded as little more than confirmatory of the earlier work of Prof. Crafts and others, but as such it may be worth while to give the results. The method adopted was fully described in my first letter, and it is therefore only necessary to repeat that in thermometer A the external pressure exceeded the internal, while in thermometer C there was considerable internal pressure, but no external. According to the plastic theory, therefore, the zero-point of A should have risen, while that of C should have fallen. The results previously described were regarded as insufficient by Prof. Mills, and I have therefore continued the heating for a much longer time.

I have also made similar experiments with two other thermometers belonging to the same batch, at a temperature of about 356°, the thermometers being heated in the vapour of boiling mercury. During the first three hours, the two thermometers *a* and *b* were treated in precisely the same manner, as regards pressure, as A and C, and it will be seen that the zero-point of *b* showed a slightly greater rise than that of *a*. Afterwards, air was admitted into thermometer *a*, so that there was an excess of internal over external pressure in both thermometers, but the excess was greater by one atmosphere in *b* than in *a*.

The results obtained are given in the following table :—

Temperature 280°.

Total time in hours.	Duration of each heating.	Zero-point of A.	Rise of zero.	Zero-point of C.	Rise of zero.	Mean rise of zero per hour.
		°	°	°	°	°
0 ...	— ...	0·15 ...	— ...	−0·1 ...	— ...	—
2 ...	2 ...	0·5 ...	0·35 ...	+0·3 ...	0·4 ...	0·187
7·5 ...	5·5 ...	1·3 ...	0·8 ...	1·1 ...	0·8 ...	0·145
12 ...	4·5 ...	2·0 ...	0·7 ...	1·8 ...	0·7 ...	0·156
17 ...	5 ...	2·3 ...	0·3 ...	2·05 ...	0·25 ...	0·055
22·5 ...	5·5 ...	2·6 ...	0·3 ...	2·15 ...	0·1 ...	0·036
29 ...	6·5 ...	2·95 ...	0·35 ...	2·5 ...	0·35 ...	0·054
35 ...	6 ...	3·15 ...	0·2 ...	2·8 ...	0·3 ...	0·042
86 ...	51 ...	4·1 ...	0·95 ...	3·95 ...	1·15 ...	0·021
133 ...	47 ...	4·8 ...	0·7 ...	4·9 ...	0·95 ...	0·018
201 ...	68 ...	5·25 ...	0·45 ...	5·5 ...	0·6 ...	0·008
369 ...	168 ...	6·5 ...	1·25 ...	6·8 ...	1·3 ...	0·008

Temperature 356°.

		a		*b*		
		°	°	°	°	°
0 ...	— ...	0·4 ...	— ...	0·05 ...	— ...	—
3 ...	3 ...	6·0 ...	5·6 ...	6·1 ...	6·05 ...	1·942
6 ...	3 ...	8·0 ...	2·0 ...	8·1 ...	2·0 ...	0·667
12·5 ...	6·5 ...	10·3 ...	2·3 ...	10·35 ...	2·25 ...	0·350
15 ...	2·5 ...	10·95 ...	0·65 ...	11·1 ...	0·75 ...	0·280
66 ...	51 ...	16·1 ...	5·15 ...	16·1 ...	5·0 ...	0·100
113 ...	47 ...	18·45 ...	2·35 ...	18·3 ...	2·2 ...	0·048
181 ...	68 ...	20·1 ...	1·65 ...	20·0 ...	1·7 ...	0·025
205·5 ...	24·5 ...	20·75 ...	0·65 ...	20·6 ...	0·6 ...	0·025
221·5 ...	16 ...	20·9 ...	0·15 ...	20·7 ...	0·1 ...	0·008
292 ...	70·5 ...	21·8 ...	0·9 ...	21·7 ...	1·0 ...	0·013

The last result at 356° is a little uncertain, owing to a breakage of the apparatus.

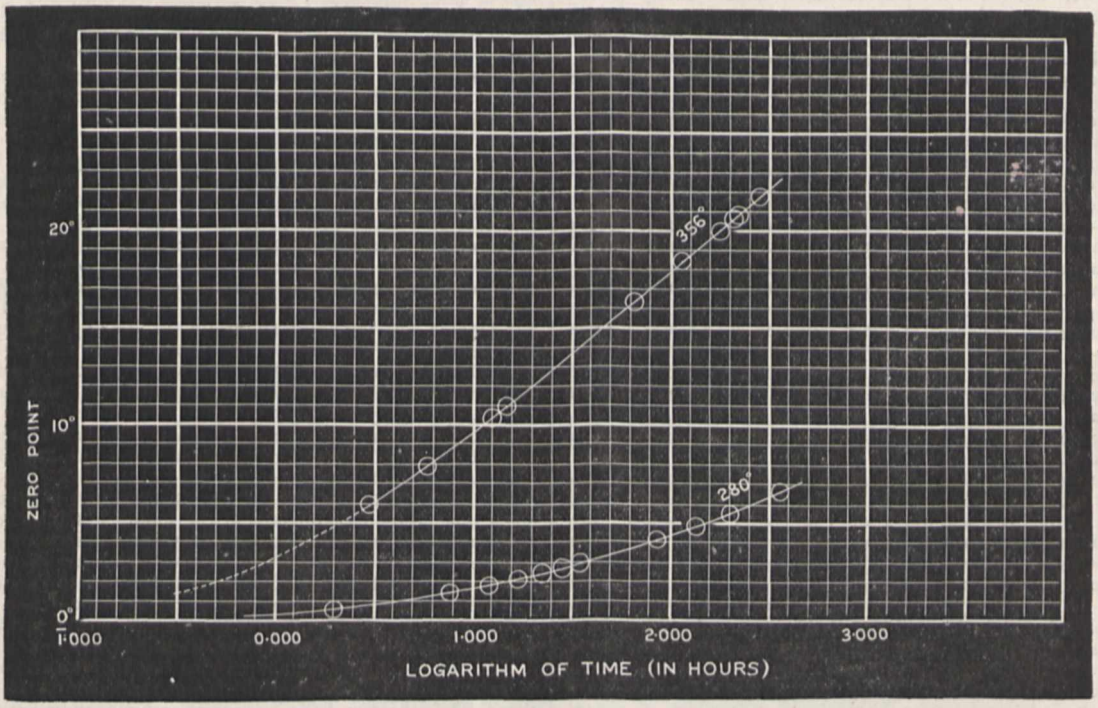
I may also mention that M. Guillaume has informed me that M. Tonnelot has heated several thermometers to 450°, and that, notwithstanding a considerable internal pressure, a rise of the zero-point was observed in every case.

All these results seem to lead unmistakably to the conclusion that pressure has little or no effect on the rise of the zero-point.

Three questions remain to be discussed—

(1) Would the total rise of the zero-point be different if two similar thermometers were subjected to sufficiently prolonged heating at different temperatures? At first sight, it would certainly appear that at 356° the total rise with my thermometers must be greater than at 280°, but I do not feel satisfied that the proof is sufficient. If we map the observations of zero-point against the time of heating, curves are obtained which appear as if they might become horizontal after a few weeks or, possibly, months; but if, instead of the actual times, we take their logarithms—as in the diagram—as abscissæ, there is no appearance of an approach to the final state at either temperature. But while at 356° the curve has become almost a straight line, at 280° there appears to be an increasing tendency towards the vertical direction. I do not for a moment argue that the curves indicate that the maximum rise would be the same at both temperatures if the experiments were carried on for a sufficiently long time; but, at the same time, I do not think that they afford any convincing proof that the total rise would be different. The results merely tend to increase my scepticism as to the value of the determination of the maximum rise at 0° obtained by extrapolation of the curve constructed from observations at that temperature. It does not appear to me that it would be justifiable to extrapolate these curves at all, and I am afraid that they do not throw much light on the total rise of zero-point at either temperature. Very much more prolonged heating would be necessary before arriving at a definite conclusion.

(2) With regard to the causes of the contraction of the bulb, I have no hesitation in admitting that—as shown by M. Guillaume—the removal of the condition of strain caused by the



more rapid cooling of the *outer parts* of the glass, is insufficient to account for the results. No doubt we must also take into account the too rapid cooling of the glass *as a whole*, which prevents the molecules from assuming the position of greatest stability, perhaps in the same sort of way that the assumption by sulphur of the monoclinic or the more stable rhombic form depends on the rate at which solidification takes place. That there are other causes besides these two does not at present appear to me to be proved.

(3) Lastly, there is the question raised by Mr. Tomlinson, as to whether repeated heating and cooling between wide limits of temperature is more effective in raising the zero-point than prolonged heating at the higher temperature. The points representing the individual observations fall very fairly on the curves constructed from them, and do not seem to indicate any noticeable difference in the effect of long or short heating. The results can hardly, however, be regarded as decisive.

University College, Bristol, March 1. SYDNEY YOUNG.

Foreign Substances attached to Crabs.

SINCE *Hyas* is one of the most abundant Crustaceans found off the east coast of Scotland, Mr. Holt must adduce considerably more than two instances before it can be admitted that the attachment of Simple Ascidians to this crab is at all a usual occurrence. If it is, I should still be anxious to inquire whether the crab does not—in spite of the apparent difficulty of the operation—place the Ascidians upon its back with its own nippers. I may cite Gosse's well-known experiment with *Pagurus prideauxii* and *Adamsia palliata*, described in his "Year at the Shore," for the purpose of analogy. But Mr. Holt will find a case, probably quite similar to that which he mentions, in Bell's "Stalk-eyed Crustacea." Two specimens of *Hyas araneus* were found with oysters attached to their backs, that on the larger crab being three inches in length, and five or six years old, probably a much more "serious incubus" than Mr. Holt's Tunicates. The crab's carapace was but two and a quarter inches in length. Hence, despite the "world of weight upon its shoulders," Mr. Thompson concluded that "the presence of this oyster affords interesting evidence that the *Hyas* lived several years after attaining its full growth." Probably the larvæ of the oysters, and of the Ascidians also, happened to alight upon the crabs at the end of their free-swimming existence, although six or seven years seems to me to be a remarkably long age for a *Hyas*.

Barnacles upon the backs of *Maia*, *Carcinus*, &c., are also due to the same, as it were, accidental cause.

But, whatever the explanation, these exceptional cases do not alter the fact that the foreign bodies found upon *Hyas* are usually fixed there by the crab itself. The specimens I have seen have been covered with fragments—not living colonies—of Algæ, Hydroids and Polyzoa, which are fastened by the hairs of the crab's carapace and legs exactly as in *Stenorhynchus*, and in this crab the process of attachment has been frequently observed here and accurately recorded.

At the same time I by no means hold that the two groups which were defined in my previous letter are absolutely marked off from one another. The hermit crabs make use of both methods of protection. Bits of Sponges may frequently be seen upon the carapace of *Maia*, *Stenorhynchus*, and *Inachus*, and I have occasionally found colonies of *Leptoclinum* and *Didemnum* upon both *Maia* and *Inachus*. In these cases the inconspicuous appearance is not lost, but the attachment of small Sponges and Didemnids is probably an additional protection against the numerous night-feeding fishes, which hunt their prey by the senses of smell and touch.

As to the inedibility of *Tunicata*, I did not—as Mr. Holt states—"assume" it. I have experimentally found it to be a fact (as I stated in my letter) that the odour and taste of "*Tunicata*, and especially Compound *Tunicata*," are almost invariably sufficient to prevent fishes from eating them. Exceptions do not disprove the rule, and it is quite possible that *Pelonaia* is not distasteful. But this is not established by a few specimens having been taken on one or two occasions from the stomachs of Cod, Haddock, and Dab; and although Mr. Holt quotes Prof. McIntosh as speaking of the "abundant" occurrence of *Molgula arenosa* in the stomachs of Cod and Haddock, he will find upon reading Prof. McIntosh's words again, that they are open to a different interpretation.

In my previous letter I omitted to mention that a species of hermit crab also, *Eupagurus lucasii*, takes advantage (regularly?) of the distastefulness of Compound Ascidians. Mr. Harmer has, with much kindness, examined for me a specimen in the Cambridge Museum. The crab inhabits a univalve which is covered with *Distaplia magnilarva*.

Mr. Holt's statement that "*Actinia mesembryanthemum* is certainly a favourite food of the Cod" is so astonishing that I hope he will adduce the evidence for his assertion. Mr. Brook had not found this to be so when he reported upon the food of this fish for the Scottish Fishery Board, and indeed only the youngest Cod ever frequent the tidal waters to which *A. mesembryanthemum* is confined. Further, although *Pagurus bernhardus*, when *not* associated with an Anemone, is very frequently found in the stomachs of Cod and Haddock, I do not know a single instance of its having been found in the stomachs of the same fish when associated with one.

I am informed by Mr. Poulton that, in a work which is shortly to appear, he has included such animals as *Stenorhynchus* and *Caddis worms*, which disguise their appearance with foreign bodies simply in order to escape identification by enemies, in a group to which he gives the very convenient name "allocryptic." Animals which trust rather to the offensive than to the inconspicuous character of the foreign bodies with which they associate themselves he terms "allosematic" (σῆμα, a sign).

It is obvious that the allosematic method of protection is all but perfect, since it is largely free from the loss due to experimental tasting attendant upon the method of a purely warning appearance ("autosematic"). WALTER GARSTANG.

Plymouth, March 21.

Sea-bird Shooting.

Is it not time that something more was done to stop the wholesale slaughter of our sea-birds? During the past winter the havoc has been terrible, and unless some restraint is imposed we may expect before long to find our shores denuded of their white wings. When the birds had no value, there was a limit, though a wide one, to their destruction, because of the cost of killing them; but recently a large demand has sprung up for their skins, and an organized traffic is now carried on in the carcases.

The shooter gets from threepence to sixpence per bird from the amateur dealer, and for the sake of this paltry sum (surely the birds are worth more to us alive than this!) there is not a sporting lounger on the coast who can possess himself of a gun who does not kill every bird which can be reached either from the shore or from a boat. The gulls are pursued, I am told, even as far as the Dogger Bank.

The beautiful kittiwake is the greatest sufferer. One of the dealers boasted to me the other day that he had passed "nearer ten than nine thousand dead birds through his hands this season, chiefly kittiwakes." He added that he had got *804 carcases in one batch from one sportsman.*

From inquiries, I judge that this person's trade represents about one-third of the dead birds which have been sent away from our little town this season. I know the traffic is carried on at other points, and no doubt this is but an example of what is going on all round our coast. When we consider that the carcases which can be secured represent only a fraction of the birds killed or injured, we gain some idea of the extent of the mischief. Indeed, during the past month it has been possible to take a long walk along our shore without seeing a single seagull. Who wishes to see a blank seascape?

Now, surely, we all have equal rights in these graceful birds, and the numerous class who love to see them alive deserve as much consideration as the mischievous minority whose pleasure it is to destroy them! It is not as though these latter were worthy persons, compelled to a cruel employment for their daily bread: they are, on the contrary, nearly all of a class who deserve no sympathy—of a comfortable class who, I verily believe, would shoot their next-door neighbours if they could do so with impunity, and could dispose of the carcases! Just imagine the new variety of "sport" which one of them described to me not long ago! He said you could catch the gulls at sea by baiting a floating fishing-line with liver, and in this way, though you did not get quite so many as with a gun, you had far better *fun*, especially from the kittiwakes, as they are wonderfully "game," and, when they feel the hook, "flacker about and scream like a child"!

Is it too much to ask that our Legislature, which has spent so much time in the past on laws in the interests of the so-called "preservers" of game, will do something, and that speedily, in the interests of those who would fain be truly preservers of the sea-birds? At least they should extend the protection afforded to "game" to these noble birds, and order that those who shoot them shall pay a heavy license for their despicable sport, and those who deal in the dead carcases a still heavier.

And nothing in this matter must be left to local authorities. In seaside places self-interest vitiates the sentiment on this question. The fisherman finds it easier to earn money by letting his boat to the "sportsman" than by his legitimate productive industry; the tradesman fears to lose these men's custom; and the gentry, mostly supporters of "sport," are perhaps not sorry to have such an excellent safety-valve for guns which might otherwise poach on their preserves; and besides, there is in Yorkshire a semi-political aspect to the matter. Thus it has happened that of late years the clause in the (so far as it goes) excellent "Sea-birds Preservation Act" of 1869, which permits a lengthening of the close time under certain conditions, has been rendered

nugatory through the action of our county magistrates, who have refused to present the requisite petition to the Home Office. They must have been aware that their action doomed innumerable young birds to death by starvation, since the cliff-climbers collect the eggs until July (a perfectly legitimate industry, by the way, carried on by hard-working men, and producing valuable food), and thus render it impossible for the majority of the birds to get their young reared by the 1st of August.

And, in consequence, whenever during August I go on the shore under the great cliffs where the birds breed, my ears are filled with the melancholy "piping" of the starving helpless young, dying slowly on the ledges, whose parents have been shot—for sport, or threepence. G. W. LAMPLUGH.

Bridlington Quay.

Locusts.

WITH reference to the flight of locusts which passed over the steam-ships *Golconda* and *Clyde* in the Red Sea about November 25 last, it would be interesting to ascertain to what species they belong. The past year, 1889–90, has been marked in India by the invasion of locusts belonging to the species *Acridium peregrinum*, which, starting, it is believed, about the end of the hot weather (May or June), from the sand-hills of Western Rajputana, have, during the past six months, spread in vast numbers over the whole of Sind, Rajputana, the Punjab, North-West Provinces, and Oudh, besides penetrating sporadically into Guzerat, Ahmedabad, Baroda, Khandesh, and parts of Central India, a stray flight even appearing in the Kistna district of the Madras Presidency.

This insect, which is supposed to be the *locust* of the Bible, and which is undoubtedly the one that periodically invades Algeria from the Sahara, though it is altogether distinct from the locust *Stauronotus maroccanus*, of which so much has been heard in Algeria during the past two years, is likely to be the species which was observed in the Red Sea. To ascertain the point, however, with certainty, it is essential that specimens, which I am told fell upon the deck of the ship *Clyde* in considerable numbers, should be examined and determined entomologically, and my object therefore in addressing you is to endeavour to obtain some of the specimens for comparison with those which have invaded India.

It is worthy of notice that in 1869 when Rajputana suffered considerably from locusts, vast swarms were also observed by ships passing through the Red Sea, and it would therefore be interesting to learn to what extent 1869 and 1889 were years of locust invasion in the intervening countries of Arabia, Persia, and Biluchistan. It is much to be regretted that in 1869 neither the locusts found in Rajputana nor in the Red Sea appear to have been preserved or determined, and their identity therefore cannot be definitely established. E. C. COTES.

Indian Museum, Calcutta, February 28.

THE ROYAL METEOROLOGICAL SOCIETY'S EXHIBITION.

THE eleventh Annual Exhibition of the Royal Meteorological Society was held at the Institution of Civil Engineers on March 18 and three following days. Each Annual Exhibition is devoted to some special branch of meteorology, which is illustrated by specimens of all known instruments (or drawings and descriptions of the same) that have been employed in its investigation. This year's Exhibition was illustrative of the application of photography to meteorology. Photographic meteorological instruments are not numerous, and those used for recording the indications of the barometer, thermometer, and electrometer are very costly and delicate, and are only made to order. The number of instruments in the Exhibition was consequently less than in previous years, but this deficiency was fully made up by the large and highly interesting collection of photographs of meteorological phenomena.

The earliest application of photography for the continuous registration of the barometer, &c., was made by Mr. T. B. Jordan, of Falmouth, in 1838. His plan was to furnish each instrument with one or more cylinders containing scrolls of photographic paper. These cylinders were made to revolve slowly by a very simple connection with a clock, so as to give the paper a progressive movement behind the index of the instrument, the place of which was registered by the representation of its own image.

In 1846, Mr. Charles Brooke and Sir Francis Ronalds each brought forward a method for the registration of magnetic and meteorological instruments by means of photography. The methods are those now in use, the former at the Royal Observatory, Greenwich, and the latter at the Observatories of the Meteorological Office.

Although these instruments were not shown, they were fully illustrated by photographs and drawings. A number of the barograms and thermograms were exhibited by the Astronomer-Royal and the Meteorological Council, showing the passage of storm centres, and sudden changes of temperature and humidity. A set of barograms from various parts of the world was exhibited by the Meteorological Council, showing the barometric oscillation due to the Krakatão eruption, August 1883. The thermogram at Kew on May 8, 1871, showed a fall of about 20° of temperature during a thunderstorm at 4 p.m.

Mr. Symons exhibited a photographic scale showing the intensity of sunlight during the solar eclipse of July 18, 1860; and the Kew Committee showed the chemical photometer devised by Sir H. Roscoe in 1863. Mr. J. B. Jordan exhibited his experimental instrument for recording the intensity of daylight, and also the three patterns of his sunshine recorder. Similar instruments designed by Dr. Maurer, of Zürich, and Prof. McLeod, were also shown. Prof. Pickering sent a photograph of his Pole-star recorder, in use at the Harvard College Observatory, U.S.A., for registering the cloudiness during the night. This instrument consists of a telescopic objective attached to a photographic camera and directed to the Pole-star; the camera is provided with very sensitive plates which are inserted in the evening, and a shutter, worked by an alarm clock, is closed before dawn. If the sky be clear during the night, the plate, after development, shows a semicircle traced by the revolution of the star around the North Pole, but if clouds have passed across the star, the trace is broken.

The photo-nephograph designed by Captain Abney for the registration of the velocity and direction of motion of clouds was exhibited by the Meteorological Council, as well as a model showing the manner in which the pair of photo-nephographs are mounted for use at the Kew Observatory. One of the instruments is placed on the roof of the Observatory, the other being at a distance of 800 yards; the observers at each end are in telephonic communication. Both cameras being oriented with reference to the same point of the horizon, the distant observer is instructed as to the direction and elevation of his instrument. The chief observer controls the exposure, both cameras being exposed simultaneously; another pair of plates are exposed after an interval of one minute. A slide rule designed by General R. Strachey for obtaining the height and distance of clouds from the pictures yielded by the cloud cameras was also exhibited, as well as photographs of an experimental apparatus designed by Mr. G. M. Whipple for the same purpose.

The Exhibition included a large and interesting collection of photographs of clouds. Padre F. Denza sent a set of 80 cloud photographs which had been taken during the past twelve months at the Specula Vaticana, Rome. M. Paul Garnier exhibited a magnificent set of 17 large photographs of clouds taken at his observatory, Boulogne-sur-Seine, Paris. These are the best photographs of clouds that have been seen in this country, and they were consequently very much admired. M. Garnier has not yet explained the method he adopts for obtaining such beautiful pictures. Dr. Riggen-

bach, of Basle, showed some photographs of cirrus clouds taken by reflection from the surface of the Lake of Sarnen. In this case the surface of the water acts like a polarizing mirror, and extinguishes the sky light. Photographs of clouds were also exhibited by Mr. Clayden, Dr. Drewitt, Dr. Green, Mr. Gwilliam, Mr. Harrison, Mr. McKean, Messrs. Norman May and Co., Mr. H. C. Russell, and Mr. Symons. Mr. H. P. Curtis, of Boston, U.S.A., sent a valuable and highly interesting collection of photographs, showing the devastation caused by the tornadoes at Rochester, Minnesota, on August 21, 1883, and at Grinnell, Iowa, on June 17, 1884. After seeing these photographs, some idea can be formed of the immense destruction wrought by these terrible scourges, which so frequently visit various parts of the United States. Mr. Curtis also exhibited three photographs of the tornado cloud; two of these were taken at Jamestown, Dakota, on June 6, 1887, when the cloud funnel was 12 miles to the north; the third, which was taken in New Hampshire, during the storm on June 22, 1888, shows the spiral-shaped funnel trailing at a considerable altitude in the air.

Many interesting photographs illustrating meteorological phenomena were exhibited. These included floods, snow-drifts, hoar-frost, frozen waterfalls, &c. A large number of photographs of flashes of lightning taken during the last twelve months were also shown, as well as some photographs of electric sparks, taken by Mr. Clayden and Mr. Bidwell, which explain the formation of dark images of lightning-flashes.

Mr. Clayden exhibited a very interesting and instructive working model, showing the connection between the monsoons and the currents of the Arabian Sea and the Bay of Bengal.

Mr. Dines showed a model of the whirling machine used by him at Hersham for testing anemometers and for experiments on wind-pressure; he also exhibited a remarkable curve showing the normal component of the wind-pressure upon a sloping surface 1 foot square, the normal pressure being taken as 100, and the pressure at various angles of inclination being expressed proportionately. Mr. Munro sent two instruments which he has recently constructed in conjunction with Mr. Dines. The first is for showing the velocity of the wind. The shaft of an anemometer is connected with the shaft of the instrument, and in turning works a small centrifugal pump, thus raising the level of the mercury in the long cistern. The deflection of the pendulum from the vertical position is proportional to the rate of turning, and thus gives a uniform scale. The second instrument is for showing the pressure of the wind from a velocity anemometer. The arrangement is the same as in the preceding instrument, but the fall of the float in the small circular cistern is proportional to the square of the velocity and therefore to the wind-pressure, thus giving a scale of pressure with the divisions at uniform distances.

Mr. Hicks exhibited Draper's self-recording metallic thermometer; a mercurial minimum thermometer with lens front; and a radial scale thermometer. Mr. Long showed Trotter's compensating thermometer for taking temperatures at any distance; and Mr. Denton exhibited his clinical thermometer case with new spring-catch.

WILLIAM MARRIOTT.

THE ORIGIN AND COMPOSITION OF THE FLORA OF THE KEELING ISLANDS.

AT intervals I have contributed to NATURE the results of the more recent investigations of insular floras, more especially in relation to the dispersal of plants by ocean currents, birds, and winds; and now, through the courtesy of the author and Captain Petrie, Honorary Secretary of the Victoria Institute, I am able to furnish a commentative summary of a lecture[1] by Dr. H. B. Guppy, on the flora of the Keeling Islands.

It is hardly necessary to mention that Darwin visited these islands in 1836, except in connection with the fact that Dr. Guppy's visit was in a measure an outcome of that event. In 1878, Mr. H. O. Forbes spent some time there, and extended our knowledge of the flora. Primarily, no doubt, the coral-reef question took Dr. Guppy to the scene of Darwin's early labours, though he was probably not less interested in the flora, having been stimulated by practical botanizing in the Solomon Islands a few years previously; and a stay of nearly ten weeks enabled him to elucidate many points that were either obscure or conjectural.

Mr. John Murray, of the *Challenger* Expedition, found funds for Dr. Guppy's mission, and he presented to the Kew Herbarium the collections made of dried plants and drifted seeds and fruits; and there, such of them as were not already familiar to Dr. Guppy, and of which the material was sufficient, were named, and a set incorporated.

For the sake of brevity it will be better to describe what Dr. Guppy has accomplished, rather than follow him through his account of it.

Specimens were taken of all the different species of plants found in a wild state in the islands; notes made of the conditions under which they occurred, of their relative frequency, of their chances of propagation, and of their natural enemies, besides other particulars. In addition to seeds, or fruits containing the seeds, of the plants actually established on the islands, many others were picked up on the beach, where they had been deposited by the waves. Whilst most of these were in various stages of decay, others were actually germinating, and the question arose, Why had they not succeeded in obtaining a footing? As we shall presently learn, this question was easily answered.

Another point on which we had little trustworthy information was the length of time various seeds of essentially littoral and insular plants would bear immersion, or, rather, flotation, in sea-water without losing their vitality. With the exception of a few isolated instances of seeds having germinated after having been carried across the Atlantic to the western coast of Europe, very little was known, because the majority of the seeds experimented with by botanists at home did not belong to this class of widely-spread plants. Dr. Guppy instituted experiments on the spot, and although his time was too short to determine the extreme limits of endurance of the various seeds, he was able to prove that certain kinds germinated freely after being thirty, forty, or fifty days in sea-water. Again, he observed that some seeds that do not readily float, or only for quite short periods, are conveyed hither and thither in a variety of ways—such as in the cavities of pumice-stone, and in the crevices of drift-wood.

From all available evidence, it is almost absolutely certain that there were no permanent inhabitants of the Keeling Islands till about the end of the first quarter of the present century; and from the most trustworthy accounts the islands were covered with vegetation, the coco-nut largely preponderating in the arboreous element. Indeed, as the outer part was almost entirely coco-nut, it seemed, as Darwin says, at first glance to compose the whole wood. But there is evidence that there were large "forests" in the interior of the islands, consisting mainly of the iron-wood, *Cordia subcordata*. The largest island is said to be only about five miles long; and the group is between 600 and 700 miles from the nearest land, excluding the small Christmas Island.

Already at the time of Darwin's visit in 1836, the islands were in the possession of Captain Ross, the

[1] "The Dispersal of Plants, as illustrated by the Flora of the Keeling or Cocos Islands." A Paper read at a meeting of the Victoria Institute on Monday, February 3, 1890, by Dr. H. B. Guppy.

grandfather of the present proprietor, and coco-nut planting was progressing. Since then most of the available ground has been cleared of other vegetation and planted with coco-nut trees, so that the wild vegetation is nearly limited to an external fringe, and this often broken. In North Keeling, about fourteen miles distant from the main group, which was not visited either by Darwin or Forbes, there was still sufficient of the original vegetation left for Dr. Guppy to form an idea of what it was generally before it was cleared away for cultivation. Darwin's investigations had the effect of arousing the interest of Captain Ross in the natural history of the group, and this interest has been inherited by his descendants, who have greatly aided subsequent travellers by their hospitality and by their knowledge of local phenomena. Darwin collected or noted about a score of different species of wild plants, and this number has now been doubled by Forbes and Guppy.

This brings us to the results of Guppy's own investigations, the most interesting and important being those relating to the capabilities of certain plants, notably the coco-nut, to establish themselves on coral islands, as some writers of repute have strongly contested the possibility of it, and there can be little doubt that the coco-nut and other plants having large seeds obtain a footing only under exceptional circumstances, such as being buried by the sands washed over them in heavy gales.

Foreign coco-nuts are frequently cast ashore on the Keeling Islands, where they sometimes germinate, but the crabs invariably destroy the sprouting nut. Suppose, however, a period when crabs were less numerous, and the chances are not so very remote of some of the growing nuts escaping them. Again, Mr. Forbes cites an instance in which the crabs may even facilitate the establishment of the coco-nut, for he observed that the crabs sometimes burrow so near the surface that the nuts occasionally break through and find favourable conditions for growth. Should they escape the crabs in their earliest infancy, they are safe. Many other plants are now prevented by the crabs from establishing themselves on the Keeling Islands. Dr. Guppy says :—

"I have been informed by the proprietor that sometimes when a large amount of vegetable drift has been stranded on the beach, a line of sprouting plants may be shortly observed just above the usual high-tide mark ; but the tender shoots are soon eaten by the crabs, and in a little time every plant is gone. Many of the seeds that germinate on the beach are beans, varying in size from those of *Entada scandens* downward. They form one-third of the vegetable drift."

Indeed, the crabs are so numerous that Mr. Ross has failed in many attempts to raise plants of some of these things in his garden. One flourishing *Entada scandens* and a sickly *Calophyllum Inophyllum* were all the reward of much trouble in this direction. The huge square fruits of *Barringtonia speciosa* are often thrown up, and the seed germinates, but very few escape the crabs. This tree had not established itself in North Keeling, though in August 1888, Dr. Guppy observed two seedlings about eighteen inches high, and they owed their preservation, it was supposed, to the circumstance of the fruits having been concealed when the seeds germinated by the bed of fine drift pumice that had been deposited on the shores of the lagoon after the Krakatão eruption.

Particulars are given of the incipient germination and early destruction of *Carapa*, *Nipa*, *Cycas*, and other seeds. Of course, the clearing of the original vegetation and subsequent cultivation, and the incidental or intentional introduction of various birds and animals, and the migration of the myriads of sea-birds that formerly inhabited the islands must all be taken into consideration. Yet no species of plant ever known to grow wild there has become quite extinct, an evidence of their tenacity of life under unfavourable conditions.

Dr. Guppy's additions to the Keeling flora include the following plants, which he regards as having formed part of the original vegetation, judging from the conditions under which he found them : *Calophyllum Inophyllum*, *Thespesia populnea*, *Triumfetta subpalmata*, *Suriana maritima*, *Canavalia obtusifolia*, *Terminalia Catappa*, *Barringtonia speciosa*, *Sesuvium Portulacastrum*, *Ipomœa grandiflora*, *I. biloba* (*I. pes-caprœ*), *Premna obtusifolia*, and *Hernandia peltata*. Their general distribution fully justifies this deduction.

The experiments on the vitality of seeds after forty to fifty days in sea-water were necessarily of a limited character, but they established the fact that the following germinated : *Cordia subcordata*, *Hernandia peltata*, *Guettarda speciosa*, *Thespesia populnea*, *Scœvola Kœnigii*, *Morinda citrifolia*, and *Tournefortia argentea*. Every seed of the last named germinated after forty days', and half of the seeds of *Morinda* after fifty-three days' immersion. Dr. Guppy calculates that a surface current of only one knot an hour would convey drift a distance of 1000 to 1200 miles during these periods. From the fact that almost all the drift is thrown up on the eastern and southern coasts, it is assumed that the bulk of it comes from the Malay Archipelago, and perhaps some from the north-west coast of Australia. This is borne out by the general distribution of the established Keeling plants, as well as by the other seeds and fruits that are stranded there.

Among the latter may be mentioned *Pangium edule*, *Heritiera littoralis*, *Erythrina indica*, *Mucuna* spp., *Dioclea reflexa*, *Cæsalpinia Bonducella*, *Cerbera Odollam*, *Quercus* spp., and *Caryota*.

Carpophagous pigeons have played no recognizable part in the flora of the Keeling Islands.

In his forthcoming book Dr. Guppy will doubtless give all the details of his observations in a more connected and systematic form.

W. Botting Hemsley.

NOTES.

To-day the honorary freedom and livery of the Turners Company are to be conferred on Sir John Fowler, K.C.M.G., and Sir Benjamin Baker, K.C.M.G., "in recognition of their distinction and eminence as engineers, earned by many great works at home and abroad, especially the design and construction of the Forth Bridge, one of the greatest triumphs of British engineering in the Victorian age."

Sir John Kirk, F.R.S., and Sir William Turner, F.R.S., Professor of Anatomy in the University of Edinburgh, have been elected members of the Athenæum Club, under the rule which provides for the annual election of a certain number of persons of distinguished eminence in science, literature, or the arts, or for public services.

Mr. T. Kirke Rose, Associate of the Royal School of Mines, has obtained the appointment of Assistant Assayer at the Royal Mint, by competition among selected candidates. It is a post of some importance, and the salary rises from £350 to £450, with an official residence in the Mint. After an unusually brilliant career at the Royal School of Mines, Mr. Rose was engaged as metallurgist and assayer to the Colorado Gold and Silver Extraction Company in Denver. It is to be hoped that he will afford valuable assistance to Prof. Roberts-Austen in preserving the standard fineness of our coinage with the remarkable degree of accuracy that generations of assay masters have attained.

Sir Henry Roscoe has introduced into the House of Commons a Technical Education Bill, which is intended to clear up any doubt as to the legality of the provision of technical

and manual instruction in public elementary schools. The following are the provisions of the measure :—(1) The managers of any public elementary school may provide technical or manual instruction for the scholars in that school, either on the school premises or in any other place approved by the inspector, and attendance by the scholars of the school at such instruction shall be deemed to be attendance at the public elementary school. (2) The conditions on which Parliamentary grants shall be made in aid of technical or manual instruction in public elementary schools, shall be those contained in the Minutes of the Education Department and of the Science and Art Department in force for the time being. (3) The expression "technical instruction" and "manual instruction" shall have the same meaning as in the Technical Instruction Act (1889).

LAST week Dr. Farquharson asked the President of the Board of Trade whether he was aware that much dissatisfaction existed among scientific men as to the sufficiency of the tests used in the mercantile marine for the detection of colour-blindness, and whether he would appoint a committee of experts to advise the Government on this important question. In reply, Sir Michael Hicks-Beach said he was sensible of the importance of the matter, and had been in communication with the Royal Society upon the subject ; and he was happy to state that "that valuable institution had appointed a committee to consider the whole question of colour-blindness."

THE meetings of the Institution of Naval Architects are now being held in the hall of the Society of Arts ; the chair being occupied by Lord Ravensworth, the President of the Institution. The following is the programme of proceedings :—Wednesday, March 26, morning meeting, at 12 o'clock : (1) Annual Report of Council ; (2) election of Officers and the Council ; (3) alteration of rules relating to election of Vice-Presidents ; (4) Address by the President ; the following papers were then to be read and discussed—notes on recent naval manœuvres, by W. H. White, F.R.S., Director of Naval Construction, Vice-President ; the Maritime Conference, by Rear-Admiral P. H. Colomb, R.N. Thursday, March 27, morning meeting, at 12 o'clock : on leak-stopping in steel ships, by Captain C. C. Penrose Fitzgerald, R.N. ; strength of ships, with special reference to distribution of shearing stress over transverse section, by Prof. P. Jenkins ; steatite as a pigment for anti-corrosive paints, by Frank C. Goodall. Evening meeting at 7 oclock : on the evaporative efficiency in boilers, by C. E. Stromeyer ; on the application of a system of combined steam and hydraulic machinery to the loading, discharging, and steering of steam-ships, by A. Betts Brown ; the revolving engine applied on board ship, by Arthur Rigg. Friday, March 28, morning meeting, at 12 oclock : on the variation of the stresses on vessels at sea due to wave-motion, by T. C. Read ; spontaneous combustion in coal ships, by Prof. Vivian Lewes. Evening meeting, at 7 o'clock : on the screw propeller, by James Howden ; experiments with life-boat models, by J. Corbett.

THE Geologists' Association have made arrangements for an Easter excursion to North Staffordshire. It will last from April 3 to 8, and the head-quarters will be the North Staffordshire Hotel, Stoke-on-Trent, except on Saturday and Sunday nights, when the Association will stay at the Red Lion, Leek.

A CONFERENCE of the Camera Club, under the presidency of Captain de W. Abney, was held last week at the Society of Arts. Lord Rayleigh gave an account of instantaneous photography by the light of the electric spark. He stated that he had been experimentalizing in taking photographs of minute jets of water as from a bottle. He exhibited on the sheet, by means of the electric light, photographs of jets of water taken in less than the 100,000th part of a second. In the course of the discussion following the demonstration and explanations by Lord Rayleigh, Mr. Trueman Wood spoke of the new application of electricity to the photographic art in fixing for study natural phenomena. The chairman, in giving the thanks of the meeting to Lord Rayleigh, referred to some photographs taken in less than the 100,000th part of a second under the name of a "photographic untruth." Captain Abney dealt with the untruth of form, which photography gave when judged by light and shade, a subject which could only be explained by series of drawings on the black-board and shadows cast upon the sheet.

THE Royal Microscopical Society has received from Dr. E. Abbe, of Jena, one of the new apochromatic $\frac{1}{10}$th microscope objectives recently produced at Zeiss's optical works, Jena, under Dr. Abbe's superintendence. The aperture is the highest hitherto attained, being 1·6 N.A., whereas the highest point previously reached by Dr. Zeiss was 1·4 N.A., so that the clear gain of aperture is 20 per cent. The advantage of this increase is shown by the perfection of the images obtained in photomicrographs produced by the new objective in the hands of Dr. Henri Van Hewick, Director of the Jardin Botanique, Antwerp, specimens of whose work were exhibited at the last meeting of the Royal Microscopical Society. At this meeting it was announced that Dr. Dallinger, F.R.S., had consented to join a committee appointed by the Council of the Royal Microscopical Society, to make a special report on the new objective.

AT the fortnightly meeting of the Royal Horticultural Society, on Tuesday, M. Henri de Vilmorin, President of the Botanical Society of France, delivered a lecture on salads, mentioning that in England we neither eat nor grow so many plants for salad as in France. He dwelt upon the nutritive value of salads due to the potash salts, which, though present in vegetables generally, are eliminated in the process of cooking. He then enumerated the various plants which are used in salads in France —namely, the leaves of lettuce, corn-salad, common chicory, barbe de capucin, curled and Batavian endives, dandelion in its several forms of green, blanched, and half-blanched, water-cresses, purslane in small quantities, blanched salsify-tops of a pleasant nutty flavour, witloof or Brussels chicory, the roots of celeriac, rampion, and radish, the bulbs of stachys, the stalks celery, the flowers of nasturtium and yucca, the fruit of capsicum and tomato, and, in the south of France, rocket, picridium, and Spanish onions. Various herbs are added to a French salad to flavour or garnish it, such as chervil, chives, shallot, and borage flowers. In addition, many boiled vegetables are dressed with vinegar and oil. M. de Vilmorin then showed specimens of dandelion, barbe de capucin, and witloof, both varieties of chicory, which he recommended to the notice of English gardeners as most useful and palatable. He mentioned that from a ton to a ton and a half of witloof is daily brought to the Paris market from Brussels, where it is grown in the greatest perfection. Specimens of English salads grown in the month of March, and consisting of corn-salad, lettuce, and blanched chicory, were sent from the Marquis of Salisbury's gardens at Hatfield. Among the other exhibits was a quaint orchid (*Cœlogyne pandurata*), a native of Borneo, sent from Kew Gardens. The flower is bright green, like the colour of forced lilac-leaves, with a dull jet-black blotch and lines on the lip.

AT the meeting of the Royal Botanic Society on Saturday, it was announced that the donations received included an interesting collection of seeds from the gardens of Mr. Thomas Hanbury, at Mortola, on the coast near Ventimiglia, Italy, with printed catalogues of the great variety of plants and trees from all climes growing in the garden—more than 4000 named species.

BARON DE LISSA, the pioneer planter of British North Borneo, arrived at Sandakan in January last. The official *Gazette* of British North Borneo says that the Royal Geographical

Society of Australia have forwarded to the Baron a draft for £100 towards the expenses of obtaining some information regarding the fauna and flora of Kina Balu and its neighbourhood. Baron de Lissa has placed himself in communication with the Governor on the subject, and is endeavouring to secure the services of a well-known geologist and naturalist who is residing at Sandakan.

THE following science lectures will be delivered at the Royal Victoria Hall:—April 1, an hour with the telescope, by J. D. McClure; April 15, the colours of a soap bubble, by John Cox.

IT is pleasant to turn over the pages of the handsome new edition of Darwin's famous "Voyage of a Naturalist" (Murray). The text is well printed, and no one can fail to enjoy the admirable illustrations contributed by Mr. R. T. Pritchett. In a prefatory note Mr. Murray explains that most of the views given in the work are from sketches made on the spot by Mr. Pritchett, with Mr. Darwin's book by his hand.

IN a few days the first part of a new work on the theory of determinants, by Dr. Muir, of Glasgow, will be published by Messrs. Macmillan and Co. It presents the subject in the historical order of its development, beginning with the brilliant but unfruitful conceptions of Leibnitz in 1693, and carrying the record forward to 1841, the year of the appearance of Cayley's first paper.

MR. H. A. MIERS, of the Natural History Museum, is engaged upon a text-book of mineralogy, which will be published by Messrs. Macmillan and Co.

LAST week (p. 478) we noted that at the meeting of the Royal Society of Edinburgh, on February 28, Dr. John Berry Haycraft had communicated the results of some recent investigations on voluntary muscular contraction. Dr. Haycraft's observations are interesting both to physiologists and to physicists. Where a muscle is stimulated by an electrical shock, all the fibres of the nerve receive the same stimulus, and all the fibres of the muscle to which the nerve passes contract together, and in the same way. This is not the case when a muscle contracts on receiving a natural nerve stimulation, starting either as a result of volition or of reflex action. The central nervous system seems unable to affect all the fibres of a muscle, through the numerous nerve fibres passing to it, in such a manner that they all shall contract exactly in the same way. The reason for supposing this to be the case is the fact, observed by the author, that fascicular movements are always present within a muscle during a voluntary or a reflex contraction, so that tracings taken from different parts of the same muscle invariably differ from each other. The experiments were conducted both upon the human masseter and the gastrocnemius muscle of the frog. These fascicular movements occurring within it will prevent any muscle from pulling with perfect steadiness on any lever or other registering apparatus, and the tracings taken by means of such apparatus will show oscillatory waves, often very rhythmical in their appearance. Many observers have concluded from an examination of these tracings that they indicate that the central nervous system discharges impulses into the muscle at a rate corresponding with that of the oscillations observed. Thus some observers find 20, others 10 oscillations per second in the muscle curve, and they consider that the nervous system discharges into the muscle at these rates. The author finds that the fascicular movements just described as occurring within the muscle itself account fully for the oscillations seen, the irregular aperiodic movements of the muscle compounding themselves with the period of oscillation proper to the registering apparatus itself, for by varying the instruments used, the resultant curves may be varied at will; slow oscillations appearing when using instruments of slow period, quick oscillations when using instruments of quick period. The author suggests that these fascicular movements probably account for the production of the muscle sound, which Helmholtz long ago pointed out was chiefly an ear-resonance sound. This, of course, could readily be evoked by any slow aperiodic movement, and the fascicular movements within the muscle must at any rate assist in producing it. These fascicular movements may, perhaps, account for the results obtained by Lovén, with the capillary electrometer, for it is more probable that he was registering the period of his own instrument than that the muscles were twitching at the slow rate of 8 times per second. If these conclusions are correct, there remains little to be said in support of the theory generally accepted that the nervous system normally discharges nerve impulses into the muscles like shots quickly fired from a revolver. It may be that this is the case, but the subject requires more extended investigation before any definite conclusions can be arrived at.

THE St. Petersburg Academy of Sciences has issued the Report for 1889, which was read at the annual meeting on January 12. The Report contains a valuable analysis of the scientific work done by the members during the year. In mathematics, Prof. Tchebysheff's applications of simple fractions to the investigation of the approximate value of the square root, and M. Ishmenetsky's work on the integration of symmetrical differential equations, are especially worthy of note. In astronomy, we notice O. A. Backlund's researches on the influence of temperature upon refraction. In physics, M. Khwolson made an attempt at a mathematical investigation of the extremely complicated laws of dispersion of light in milk-coloured glasses. The exploration of earth magnetism has made marked progress, both as regards the theory of diurnal variations and the measurement of magnetical elements in Caucasia and Siberia. Besides theoretical work in meteorology, the Central Physical Observatory has extended its system of weather-forecasts. Much interesting work has been accomplished in geology, Baron Toll having brought out the first volume of the geological part of the work of the expedition to the New Siberia Islands. In the botanical department the chief event was the publication of two parts of Prof. Maximowicz's description of the plants brought from Central Asia by Przewalsky, as well as the flora of Western China, as represented in the valuable collections brought by M. Potanin. Highly interesting work was done in zoology by Prof. Famintzyn.

WHEN the sun sets in the sea, a curious appearance, as of a bluish-green flame, is sometimes observed. This has been thought to be due to the light passing through the crests of waves. But Prof. Sohncke (*Met. Zeits.*) considers this view disproved by such an observation as that recently made by Prof. Lange at a watering-place on the Baltic. Shortly before sunset, the disk was divided in two by a thin strip of cloud; and just as the upper part disappeared under the cloud, the blue flame was observed. Thus the cause appears to be in the air, not in the sea. It is a case of atmospheric refraction. And as a planet, seen near the horizon with a good telescope, appears drawn out into a spectrum, with the more refracted blue-violet end higher than the red, so the last visible part of the sun furnishes the blue-violet end of a spectrum. But it would be interesting, Herr Sohncke remarks, to determine more precisely the conditions of this not very frequent phenomenon. Perhaps it requires merely great transparency of air, as only in this case would the last ray be able to give a spectrum sufficiently intense in its blue region.

THE Report of the Meteorological Council for the year ending March 31, 1889, has been published, and describes the work of the Office under three heads. (1) Ocean Meteorology. The

number of logs received from ships was 189; of these 80 per cent. were classed as "excellent," being a greater percentage of excellence than has been reported for some years. The discussion of the meteorology of the Red Sea is still in progress, and the work is well advanced. Charts of barometrical pressure for four representative months for the various oceans have been issued, together with charts showing the mean barometrical pressure for the year, and the extent of range of irregular fluctuations, and considerable progress has been made in the construction of the current charts for the various oceans. As these works are cleared off, it is intended to undertake a discussion of the meteorology of the region from the Cape of Good Hope to New Zealand. (2) Weather Telegraphy. The work of this branch continues to increase, and the Daily and Weekly Weather Reports, in particular, have been extended and improved. Forecasts continue to be prepared three times daily, and special forecasts were issued during the hay-making season; the highest percentage of success of the latter was in the southern part of England, and the lowest in the north-east district. Storm warnings are issued to those places on the coast that desire to receive them. (3) Land Meteorology of the British Isles. The records from the Observatories and Stations of the Second Order are discussed and published. The Council have continued the annual grant of £100 towards the expenses of the Ben Nevis Observatory, and have received copies of the observations made there. They have also agreed to allow £250 a year to the proposed Observatory at Fort William, for five years, and to supply an outfit of an Observatory of the First Order, to be equipped with self-recording instruments. The Report also contains interesting notes on some results of an examination of the Atlantic charts published by the Office, and on the measurement of squalls shown on the traces of Robinson's anemometers.

A NEW alkaloid, to which the name taxine is applied, has been extracted and isolated by Drs. Hilger and Brande, of Erlangen, from the leaves, seeds, and young shoots of the yew tree (*Taxus baccata*). Lucas some time ago pointed out the existence of a narcotic partaking of the nature of an alkaloid in the yew tree, and Marmé has since described a mode of extracting it. Drs. Hilger and Brande have lately prepared large quantities of this alkaloid, and have at length satisfactorily determined its composition and its more important chemical properties. The leaves and seeds were first repeatedly treated with ether in order to extract as much of the alkaloid as possible. The extract was then subjected to distillation to remove the ether, and the residue agitated with water acidified by a little sulphuric acid. The acid washings were noticed to be strongly coloured, and this was found to be due to the high tinctorial power of a compound of taxine with sulphuric acid. The acid solution was then rendered alkaline by ammonia, and the precipitated alkaloid dried over sulphuric acid. After dissolving in ether, re-washing with acid and precipitating with ammonia several times, the alkaloid was obtained as a perfectly white powder of extremely bitter taste, and melting at 82° C. On heating in a glass tube the melted taxine partly sublimes as a white cloud which condenses in the colder part of the tube in the form of drops of oil which solidify on cooling. At the same time it evolves a most characteristic odour. It is very difficultly soluble in water, chloroform, or benzene, but readily in alcohol and ether. Concentrated sulphuric acid produces an intense purple coloration. Dilute acid solutions give precipitates with gold chloride, platinum chloride, and picric acid, and also even in very dilute solutions yield precipitates on the addition of caustic alkalies or ammonia insoluble in excess. Analyses show that the formula of taxine is most probably $C_{37}H_{52}O_{10}N$. It forms with acids salts readily soluble in water. The hydrochloride, sulphate, acetate, oxalate, and tartrate, have been prepared, likewise the double salts with the chlorides of platinum and gold. The hydrochloride is best obtained by passing hydrochloric acid gas through a solution of taxine in anhydrous ether, when the salt is at once deposited in good crystals. Analysis indicates the formula $C_{37}H_{52}O_{10}N.HCl$. The sulphate possesses the composition $(C_{37}H_{52}O_{10}N)_2H_2SO_4$, the platinochloride $(C_{37}H_{52}O_{10}N.HCl)_2PtCl_4$, and the aurochloride $(C_{37}H_{52}O_{10}N.HCl)AuCl_3$. A compound of taxine with ethyl iodide, of the composition $C_{37}H_{52}O_{10}N.C_2H_5I$, was also obtained by heating equal molecules of the alkaloid and ethyl iodide to 100° C. under pressure. This compound is also a crystalline solid soluble in water. As regards the constitution of the alkaloid, which from its high molecular weight must of necessity be extremely complex, it has only yet been ascertained that it belongs to the class of nitrile bases. The leaves of the yew tree were found to contain the largest quantity of taxine, the seeds containing a smaller but still by no means inconsiderable quantity of the alkaloid.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus* ♀) from India, presented by Mr. McDowall Currie; a Ring-necked Parrakeet (*Palæornis torquatus* ♂) from India, presented by Miss Thornton Smith; two West African Love Birds (*Agapornis pullaria* ♂ ♀) from West Africa, presented by Mrs. Cyril Tatham; a Black-necked Stork (*Xenorhynchus australis*) from Malacca, two Peacock Pheasants (*Polyplectron chinquis* ♂ ♀) from Burmah, purchased.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on March 27 = 10h. 21m. 7s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G.C. 2102	—	Blue.	10 19 29	−18 5
(2) 37 Leonis	5·7	Yellowish-red.	10 10 47	+14 17
(3) γ Leonis...	2	Yellowish-white.	10 13 54	+20 24
(4) α Leonis...	1	White.	10 2 30	+12 30
(5) 136 Schj.	6	Very red.	10 46 17	−20 46
(6) X Boötis...	Var.	Dull orange.	14 18 59	+16 49

Remarks.

(1) This is a very bright planetary nebula in the constellation Hydra. From its size and equable light, Smyth compared it to Jupiter. It is about 32″ in diameter, and its spectrum consists of bright lines. In 1868, Dr. Huggins recorded the presence of the three characteristic nebula lines, but Lieutenant Herschel only saw two of them. The spectra of planetary nebulæ are by no means difficult to observe, notwithstanding their generally small diameters. If no cylindrical lens be employed, the lines in some cases are considerably bright, and their shortness is no great drawback. Now that we know that there are a good number of lines in the nebula of Orion, it seems reasonable to expect that a careful search will reveal a greater number in other nebulæ. D_3 and a line about λ 447 are the next in order of brightness to the three chief lines and G in the visible part of the spectrum of the nebula in Orion, and these should therefore be first looked for. It should also be particularly noted whether the brightest line is perfectly sharp on both edges, or otherwise.

(2) This star has a spectrum of the Group II. type. Dunér states that the spectrum is rather feebly developed, all the bands being narrow. The bands 2 and 3 in the red are the strongest. The character of the spectrum indicates that the temperature of the star is probably higher than that of most of the members of the group, the spectrum approaching that of Aldebaran. In that case, a considerable number of lines may be expected. It will be remembered that in Aldebaran there is mainly a line spectrum, together with the remnants of the bands in the red.

(3) A star of the solar type (Gothard). The usual observations are required.

(4) This is a star of Group IV., showing several fine metallic lines in addition to those of hydrogen. The usual observations are required.

(5) The spectrum of this star is a fine one of Group VI. The usual carbon bands are wide and dark, and the subsidiary bands 4 and 5 are perfectly well seen (Dunér). It seems probable that favourable conditions of observation, which, unfortunately, are not common for low stars in our latitude, may reveal other secondary bands.

(6) This is another variable star of which the spectrum has apparently not been recorded. The period as determined by Baxendell is 121·4 days, and the magnitudes at maximum and minimum are 9·2 and 10·2 respectively. The maximum will be reached about April 5. (This is Baxendell's V Boötis.)

A. FOWLER.

CHARLES MARIE VALENTIN MONTIGNY.—It is with regret that we have to announce the death of Prof. Montigny, at Schaerbeek, on the 16th inst. Prof. Montigny was born on January 8, 1819, and was a member of the Royal Academy of Belgium, Astronomical Correspondent of Brussels Observatory, an officer of the Order of Leopold, and decorated with the civil cross of the first class. He is best known for his interesting researches on the scintillation of stars, which form the subject-matter of a series of papers communicated to the Brussels Academy. In the January number of *Himmel und Erde* a long description is given of the results of Montigny's observations, and the instrument he devised and used for the determination of the amount of scintillation on different nights, and for the same stars at different altitudes. It is well known that if a scintillating star is observed by means of an opera-glass or small telescope, and the instrument tapped, the star appears to move and not the instrument; if the instrument is kept vibrating, the star will appear to move in a closed curve, along which different colours repeat themselves. The scintillometer devised by the late Prof. Montigny for investigating these appearances consisted of a small disk which could be whirled round in front of the eye-piece so that the star appeared to describe a circle in the field of the telescope. The circumference of this circle was made up of a regular sequence of colours, of which blue, yellow, and red were predominant. If the rate of motion of the disk be known, then by counting the number of times the colours were repeated the number of changes of colour a second may be found. All the causes affecting the scintillation of stars were investigated, and the relation of the amount to the character of the spectrum, the state of the atmosphere, and the colour of the star, made the subject of inquiry. The results obtained by means of this ingenious instrument are important, and the whole work on scintillation done by the deceased astronomer stands as a fitting monument to his memory.

AN OBSERVATORY AT MADAGASCAR.—A new Observatory has been established at Tananarivo under the direction of the Jesuit fathers, and with the concurrence of the French Government. The site chosen is a hill a short distance to the east of the town, and about 4400 feet above sea-level, making the Observatory one of the highest in the world. It already possesses an equatorial, a meridian instrument, and all necessary apparatus for meteorological observations; and a photographic telescope will shortly be provided for solar observations.

THE ADMINISTRATION OF FOREIGN FISHERIES.

THE following notes[1] were drawn up at the request of the late Lord Dalhousie just before he became seriously ill. The failure of his health and his absence from home—before the sad bereavement and shock which terminated in his death—prevented him perusing them, though the substance of much that appears in the subsequent pages formed the theme of several conversations with him. His familiarity with the sea, his wide knowledge of the fisheries, his upright and generous bearing, and his sound judgment, would undoubtedly, if he had been spared, have been of infinite service to the Department (which, probably, sooner or later, he would have reorganized very thoroughly). No greater loss, indeed, has happened to the fisheries in recent times.

[1] For information on various points relating to the subject, I have to thank Profs. Alex. Agassiz, Hubrecht, Möbius, Lovén, and G. O. Sars, Herr von Behr, Drs. Anton Dohrn, Lindeman, Nansen, and Sauvage; while Mr. Hoyle kindly aided me with the Norwegian statistics.

The United States Fish Commission is managed by a Director, who is more or less autocratic and irresponsible; though in the case of the late Prof. Baird the Americans were extremely fortunate in having a Director possessed of great administrative power and tact, and who never utilized the resources at his disposal for personal display or advancement. However able this Director may be, the system has its disadvantages, and is less suitable than a mixed Commission of men of position, who would have an opportunity of expressing their views as to the work to be carried out. Moreover, the American plan is less safe than a responsible head—that is, a chief under the control of a Board or Commission of those who are not necessarily specially skilled. It is possible, indeed, that, as the fisheries are at present administered in the United States, a considerable expenditure of money and of time annually takes place, which under other methods might be curtailed. The practical advances made by the Americans have in the main been confined to the fresh-water fisheries—that is, the propagation of the salmon-tribe, carp, and other fluviatile and lacustrine forms. The Marine Department has not yet succeeded in making any noteworthy improvement in sea-fisheries, though much money has been spent, and a large Annual Report is regularly issued. This Report contains not only the work accomplished by the staff of the Department, but reprints and translations of papers relating to the fisheries of other countries. There is, therefore, a wide difference between the condition in this country (where the observations connected with the fisheries have often to be published by Societies or independent journals) and the lavish expenditure on the other side of the Atlantic.

In France, again, the management of the fisheries is exclusively vested in the Minister of Marine at the Bureau des Pêches. At the head is a Director charged by the State with the inspection of the fisheries. For the scientific study of the questions pertaining to the marine fisheries the chief station is at Boulogne—though the Minister of Agriculture, under whom the station was constructed, also gave a small subsidy to the Zoological Laboratory at Villefranche (Alpes Maritimes) for the study of diverse questions concerning fishes and oysters—and this was founded by a subsidy from the town and the Chamber of Commerce. The advances made by M. Coste and others in the fresh-water fisheries of France are too well known to need further attention. France is fortunate in having a series of excellent marine laboratories, at which considerable advances have already been made in regard to the food-fishes, and in collateral scientific subjects. The names of MM. Lacaze Duthiers, Giard, Marion, Barrois, Pouchet, Sauvage, and others, are sufficient guarantees that the work of the fisheries and cognate subjects will be worthily carried out.

In Norway there is no special Fishery Board, but the Governmental Department of the Interior manages both the marine and fresh-water fisheries. As yet only a general inspector for the latter has been appointed at a fixed salary. For each of the more important marine fisheries, however, a so-called *opsynschef* is engaged by the Government, to see to the administration of justice during the time the fishery is going on. Moreover, an annual grant of 16,000 kr. is granted to the Society for the Advancement of Norwegian Fisheries in Bergen. The aims of this Society, which has various branches in towns along the coast, are chiefly practical, such as the improvement of fishing implements, the most suitable and successful preparation of the fishery products, and other features. It also has a special department for the artificial hatching of the food-fishes, in connection with the laboratory at Arendal, on the southern coast. The expenses of this establishment are partly borne by the Society just mentioned, and partly by private subscription. It is at this laboratory that M. Dannevig has done so much good work in the artificial rearing of cod, oysters, and lobsters, in the former case having succeeded in keeping the fishes till the end of the second year, and when of considerable size (14–16 inches).

For strictly scientific investigations in connection with the marine fisheries the Storthing grants an annual sum of 4800 kr. These investigations have for many years been chiefly carried out by Prof. G. O. Sars, whose observations on the Lofoten cod-fisheries, and the development of the cod, are well known and justly esteemed, while, as a worthy son of a distinguished father, he has in other departments of zoology contributed largely to our knowledge. Other naturalists have also been engaged in the work, chiefly in regard to the herring-fisheries. Prof. Sars, moreover, with a view of protecting the marine fisheries, has to report on every contrivance proposed,

and in regard to restriction in the use of certain fishing implements, besides giving his advice concerning the regulation of close seasons and similar subjects. He has to present to the Department his opinions on these matters before the proposals are brought in for the Storthing. In 1886 much discussion took place in the latter assembly concerning a more central management of the Fishery Department, and the establishment of a special office for a chief director for all the fisheries, together with a staff of subordinate inspectors. This arrangement is considered in Norway to be of considerable importance, but unfortunately no individual is known who unites in himself all the many qualifications for this important office. The following are the grants sanctioned for the financial year from July 1, 1886, to June 30, 1887, for the Fishery Institutions:—

(1) For practical scientific investigation regarding the sea fisheries, the last Parliament voted 4800 kr.[1]

It is proposed to increase this by 2400 kr., to be given to Hr. Lumholtz.

(2) As a contribution to the Society for the Encouragement of the Norwegian Fisheries, the last Parliament voted 16,000 kr., of which 4000 kr. were to be given to the affiliated Societies of Tromsö, Stift, and 2000 kr. to the Institution for Pisciculture in Arendal.

It is desired to increase this sum to 32,000 kr. for the coming year; the work of the Society depends upon this grant, because the fishermen cannot be expected to contribute much, and the needs of the Society are always increasing. The expenses for the coming year are estimated at 34,910 kr., of which 12,000 kr. will be needed for the regular expenses of the Society. It is proposed that the fisheries should be under a central direction with subordinate officials, and thus the Society would be relieved of a large part of its expenses.

The Department decided, however, that the grant should be retained at its original amount, 16,000 kr.

(3) For inspection and administration of the law at Lofoten cod-fishery, 31,950 kr. were voted.

(4) For increased police inspection of the mackerel-fishery at Uleholmene 200 kr. were voted.

(5) For increased police inspection of the spring cod-fishery in Namdal 1000 kr. were voted.

(6) For increased police inspection of the spring cod-fishery in Finmark 7200 kr. were voted.

(7) For increased police inspection of the spring cod-fishery in Söndmöre 3600 kr. were voted.

(8) For inspection and administration of the law at the herring-fishery 12,000 kr, were voted.

(9) For the encouragement of fresh-water fisheries 24,040 kr. were voted.

This sum it is desired to increase to 31,000 kr.

A. *Expenditure.*

	Kronas.	Kronas.
I. For practical scientific investigations into the sea fisheries, of which 2400 kr. form an honorarium for Hr. Lumholtz		7,200
II. Contribution to the Society for the Encouragement of Norwegian Fisheries		16,000
III. For inspection, &c., of cod-fisheries at Lofoten (1200 kr. only in the event of there being a congregation of fishermen at Raftsund) ...		31,950
IV. For increased police inspection at:—		
(1) Mackerel-fishery at Uleholmene	200	
(2) Spring cod-fishery at Namdal ...	1,000	
(3) ,, ,, Finmark ...	7,600	
(4) ,, ,, Söndmöre	3,200	
	12,000	
V. For inspection, &c., at the herring-fishery in 1887		12,000
VI. For the encouragement of fresh-water fisheries:		
(1) To salary and office help for the inspector (400 kr. for personal expenses of present inspector)..	3,640	
(2) To two permanent assistants ...	3,400	
(3) To travelling expenses of the above officials in the fishing districts, and for travelling expenses of temporary assistants.	5,000	
(4) Inspection of salmon-fishery ...	7,600	
(5) For experimental transport of Wener salmon	200	
(6) For experimental marking of salmon and sea-trout	400	
(7) For encouragement of artificial spawning	1,000	
(8) Contribution:—		
a. For erection of salmon ladders at water-falls in accordance with plans given by the inspector in 1884 ...	1,667	
b. For erection of a salmon ladder at Haaelven in accordance, &c.	300	
	1,967	
		23,207
		102,357

[1] About 18 kronas = £1 sterling.

B. *Income.*

Salvage of nets and apparatus at Lofoten	600

In Sweden there is, strictly speaking, no Central Government Office for the fisheries. The fishery laws, and other special measures relating to the fisheries, are decreed by the Governors of the provinces or by the Department of the Interior. Previously, however, to the promulgation of any new law, the Governor must, pursuant to the Royal Ordinance of November 7, 1867, consult the Intendant of the Fisheries, who, conjointly with two assistants and one Instructor in Fish breeding, are the public functionaries in connection with the fisheries in this country. Before the appointment of these officials, in 1864, there was (from the year 1855) a special Fishery Overseer (*Fiskeritillsyningsman*), or Inspector of the Sea Fisheries, in the province of Gothenburg and Bohus. He receives a salary from the Agricultural Society of that province, with subvention from the Crown, and is subordinate to the Governor of the province. The Intendant of the Fisheries and his assistants are under the control of the Royal Academy of Agriculture in Stockholm.[1]

The duties of the Intendant of the Fisheries are:—

(1) To investigate, with the aid of his assistants, the fisheries of the country.

(2) To propose or examine drafts of fishery laws or other measures for the improvement of the fisheries.

(3) To assist proprietors of fisheries with advice for hatching fishes, or with other measures for a rational management of the fisheries.

(4) To prepare and elaborate the fishery statistics.

(5) To control and direct the labours of the assistants and the fishery overseers.

Persons desiring the assistance of the fishery officials have to lodge intimation with the Royal Academy of Agriculture, and then the Intendant submits to the Academy a plan for the labours and the journeys of the fishery officials for the ensuing year. A fixed sum of 3500 kr. (about £198, or £83 for the Intendant and £55 for each assistant) is assigned for the travelling expenses of the fishery officials. Those requesting assistance have to pay 6*s.* per day.

The Intendant has to present annually a brief report on the labours of the fishery officials, and from time to time more detailed notices of the fisheries of the country. The Inspector of the Sea Fisheries of Gothenburg and Bohus submits an annual report on those fisheries to the Agricultural Society of the province.

The legal proceedings relating to the fisheries are briefly as follow:—If one or more proprietors of fisheries desire new or modified laws for the fisheries in their waters, or the Intendant of the Fisheries proposes such, the matter is submitted to the Governor of the province. The Governor then convokes all persons interested to meet and discuss the question. If the Governor, after having consulted the Intendant of the Fisheries, judges the proposals of the majority of the fishery proprietors suitable for the improvement of the fishery, those proposals are sanctioned, either as they stand, or with the necessary modifications. Anyone who dissents from the judgment may appeal to the Department of the Interior.

[1] The allowances of these officials from the Treasury are as follow:—Intendant, £250; two assistants, respectively, £111 and £83.

Germany, likewise, has no special central or chief authority for the management of the fisheries. The Empire has no right of control or even of cognizance of the fisheries. The State, however, gives annually a small sum to the German Fisheries Union (Fresh-water Fisheries). The control and management of the fisheries is therefore a matter for the different States which form the Empire. All these (Prussia included) have Inspectors of Fisheries (*Oberfischmeister*) and master-fishers (*Fischmeister*), but their duty only relates to the fiscal interests of the States and the rigorous observance of the fishery laws. They also give directions to the fishermen concerning the use of new and suitable fishing apparatus.

The control of the fresh-water fisheries of Prussia is vested in the Minister for Agriculture, Woods, and Forests, but there is no special Board for Fisheries. The various questions are worked up by clerks as they arise, as also is the preparation of Bills for the Prussian Chambers. In like manner the provincial control, the district (*Regierung*) control, and the Kreiss or county control, are carried out respectively by the Oberpräsident, the Regierungs Präsident, and the Landrath.

The Deutsche Fisherei Verein, of which Herr von Behr is chairman, is an independent association. It receives occasionally money grants from the Prussian Minister from a fund voted by the Prussian Chambers, and a regular grant, amounting at present to £1500 a year, from the German Parliament, towards the encouragement of fish-breeding throughout Germany.

Prussia for a series of years has had at Kiel a Commission for scientific researches in the German seas. It consists of four members, viz. a zoologist, a botanist, a physiologist, and a physicist. The present members are Professors in the University of Kiel, and Prof. Möbius (zoologist) is chairman. This Commission is placed under the control of the Ministry of Agriculture, and from that body it receives annually a sum of 9600 marks (£480) for general and personal expenses. The Commission publishes meteorological observations, statistics of the fisheries on the Baltic stations, and reports on scientific researches.

Much valuable work has been accomplished by this Commission in regard to the life-histories and development of fishes and the pelagic animals of the Baltic. Amongst other recent suggestions is one regulating the saleable size of certain fishes in special localities, *e.g.* the salmon and salmon-trout being fixed at 19½ and 11 inches respectively, the flounder at 6 inches, and the plaice at 7.

The Fishery Board of the Netherlands (Collegie voor de Zeevisscherijen) is composed of fifteen members, one of whom is president, and a secretary, who is not actually a member. All are nominated by the Crown, and the president out of a leet of two drawn up by the Board itself. The president and secretary form a kind of standing Committee by whom the every-day business is managed. All important affairs, however, have to come before the meetings of the Board, of which there are at least two yearly, viz. one in summer and one in winter. Very often the meetings are more numerous.

The majority of the members must be free from any direct interest in the fishing trade or the fisheries industries. The minority may, on the contrary, represent such interests. Actually the minority is composed (1) of a specialist for the herring-fishery—a great shareholder and head of a large fishing firm; (2) a member for the line-fishing; (3) one for the oyster industries; (4) one for the salmon and fresh-water fisheries; (5) one for the herring and cod fisheries; and (6) one for the fisheries of the Zuyder Zee.

Further, there are on the Board one shipowner and shipbuilder; one naval officer; several lawyers, several local authorities; and two zoologists.[1]

The members receive no salary—only their travelling expenses. Whenever a question is laid before the Board either by Government or at its own invitation, the President selects a special committee of three or five members to study, discuss it, and to draw up a report, which is then circulated, and afterwards, if necessary, discussed and voted about. All questions concerning fishery legislation are thus brought before the Board, and generally settled according to its advice.

There is a yearly grant (dating back, however, only a few years) of about £250 for experiments on the fishing industries, fish-culture, &c. Another £1000 are yearly devoted to salmon-culture, this sum being disbursed to the most successful fish-culturists at the rate of 5*d.* for a salmon a year and a half old (smolt), and two-fifths of a penny for one a few months old (parr). If the number of parr offered exceeds the sum which is available after the full value has been paid for the smolts, the culturists must either acquiesce in a reduction of price or keep their fishes. One or more members of the Board are always present when the fishes are set free into the rivers.

Since 1881 certain legal restrictions have been made with regard to the fisheries of the Zuyder Zee, and a staff of police organized on the inland sea, the chief officer being directly under the orders of the President of the Board. The same is the case with the police on part of the oyster territories. Those in Zealand have been, since the fresh start in 1870, under a special local Board.

In Italy the affairs relating to the fisheries are managed by the Minister of Agriculture, &c. The Minister nominates a Central Committee of twenty-four members. These consist of scientific men, magistrates, persons industrially interested in the fisheries, and some members of the Legislature (M.P.'s). Twelve members are elected or reappointed every year. The meetings of this Committee do not take place at certain fixed periods, but only by invitation of the Minister, who submits to the Committee the material to be discussed.

Besides the Central Committee there are a series of local Committees throughout the kingdom. These consist of the Captain of the Port, a zoologist, and technically experienced men. Their term of office lasts for three years from the date of appointment. The Regulation is published in the *Annali dell' Industria*, 1882, by the Ministry of Agriculture, Direzione dell' Industria e Commercio.

The duties of these local Committees are as follow:—

(1) To study and to propose all new regulations rendered necessary by experience.

(2) To collect the material for annual statistics.

(3) To give, on the demand of the Government, the Provinces, and the Communes, their opinion on matters directly or indirectly connected with the fisheries.

(4) To further the diffusion of the best methods of fishing and the advancement of the industries connected with them.

(5) To "render popular" the knowledge regarding the production, food, and diffusion of fishes and other useful marine animals.

From a consideration of the foregoing remarks on the Commissions, Boards, or Departments of foreign countries, it would appear that a central authority composed of a single individual, as in America, has certain disadvantages which can only be overcome by a rare combination of scientific eminence, administrative skill, and unbiassed judgment. It has, moreover, been a costly experiment; and it cannot be said that the Americans—even in the case of the cod—have succeeded so well as Dannevig at Arendal, in Norway, with the moderate resources at his disposal. It cannot be questioned, however, that the liberality of the Government of the United States has greatly aided scientific inquiry into marine life in general. Moreover, their efforts to increase the fresh-water fishes are most praiseworthy, and indeed in this they give us a good example, for there are still many fresh-water streams and lochs that would be of great value to the country if scientific fish-culture were put on a proper footing. The instance of the Outer Hebrides, *e.g.* North Uist, is sufficient in our own country. From the top of the Lee Hills the eye rests on a multitude of lochs—fresh-water and salt—which seem to be almost as extensive in superficial area as the shreds of land between them. In many of these, trout, salmon-trout, and salmon are found, so that one familiar with the agricultural poverty of these regions would not hesitate to place the culture of the water far before that of the land in regard to remuneration. A well-organized system of pisciculture in connection with these lochs would effect a revolution in the financial affairs of the people, and greatly supplement the food-supply for the community.

The French system does not seem to offer any suggestion of note in regard to the administration of the marine fisheries. The early labours of M. Coste and others in the culture of trout and salmon have, however, been of great service both to the adjoining Continental States, to us, and to America. It must not be forgotten also that M. Coste was one of those who took much interest in the Stormontfield experimental station on the Tay,

[1] This account does not quite correspond with the view published by the Fishery Board in their Sixth Annual Report, Part III., p. 305, for it is there stated that in Holland "There is a State Commission for Sea Fisheries, chiefly composed of naturalists and scientific men."

and personally, along with Mr. R. Buist, aided its establishment under the Committee of Proprietors.

Much that is useful for the purposes of administration may be learned from Norway, especially in connection with the Society for the Advancement of Norwegian Fisheries in Bergen, a place so classic to marine zoologists, from the days of Michael Sars to those of Fridtjof Nansen. Nowhere in Scotland can we point to a series of open-air reservoirs of pure sea-water, such as at Arendal, in which larval fishes can be raised to post-larval and subsequent stages; though at Stonehaven an enclosure of this kind formerly existed, and was used about thirty years ago in experimenting with young salmon (smolts). Yet no place is better fitted—both scientifically and economically—for such an arrangement than St. Andrews, as has indeed been often pointed out. The Norwegians are also fortunate in having the services of an able and original naturalist—trained from boyhood in marine zoology, besides others of European reputation. Sweden, though rich in names well known wherever zoology is studied, *e.g.* Lovén, places the direction of the fisheries under the Academy of Agriculture, the Governors of the provinces, and the Intendant; while the Inspector of the Sea-fisheries of Gothenburg and Bohus submits a special report to the Academy. The arrangements seem to work fairly, but it is doubtful if any feature of the system would be of advantage to this country.

No central authority for the whole of Germany yet exists, each of the States having Inspectors of Fisheries. Prussia, however, has the Special Commission at Kiel, the scientific work of this body being very much in its own hands. It has done good service in regard to the scientific aspects of the marine fisheries. The encouragement held out by the Deutsche Fisherei Verein to fresh-water fisheries is noteworthy and commendable.

One of the most satisfactory arrangements is seen in the Fishery Board of the Netherlands, in the composition of which all interests have been consulted. Moreover, the recent appointment of a scientific Superintendent of the Fisheries (viz. Dr. P. Hoek, an able zoologist) is important. The names of Hubrecht and Hoffman, who represent scientific zoology on the Board, are a sufficient guarantee that both tact and talent are at the service of the State. The solid scientific work done in the department by Profs. Hubrecht and Hoffman would alone give the Dutch Board a reputation, and when we add the names of other workers who have aided it, the position is considerably enhanced. Further, the mode by which scientific questions are referred to special committees—say of zoologists or physicists—and their reports thereon dispassionately discussed at meetings of the whole Board, obviates the possibility of the mistakes caused by a committee having perhaps only a single head to direct it in a particular inquiry.

The Italian system is satisfactory so far as the composition of the Board goes, though it seems to be a large one for efficiency, and the somewhat irregular nature of the meetings would hardly suit the methodical system generally followed in this country. The short period of office (three years), is perhaps not of much moment if re-election of the right men takes place. The fine Zoological Station at Naples under Dr. Dohrn (who, however, is too closely occupied to serve on the Central Committee of the Fisheries), gives the Italian Government a source of independent and reliable information, and of a different kind from that derived from the servants of a Board. The establishment of hatching stations, and the series of local committees throughout the country are features worthy of note, especially if due care be taken in the composition of the latter, so as to avoid the entrance of those who trade, it may be, on the credulity or ignorance of the fishing population.

W. C. McINTOSH.

SCIENTIFIC SERIALS.

L'Anthropologie, paraissant tous les deux mois, tome i. No. 1, 1890 (Paris).—The first number of the new French review of anthropology, formed by the amalgamation of the older *Revue d'Anthropologie* and the *Revue d'Ethnographie*, begins with an article by Dr. Topinard, one of its joint editors, on the skull of Charlotte Corday, which ranked among the most interesting of the curious contents of the anthropological section of the Paris Exhibition, to which it was presented by Prince Roland Bonaparte. The author explains that, in making choice of this special skull, his object is not to compare its craniological characteristics with the moral disposition historically attributed to the individual to whom it had belonged, but simply to make it the text for an exposition, which might serve our own and future students as a lesson for the examination and description of an isolated skull after the precise methods taught by Broca, and having regard to the present condition of our science. In accordance with this object, Dr. Topinard, confining himself almost entirely to craniometrical determinations, of which he gives a most comprehensive series, together with several well-drawn illustrations, only occasionally enters into the comparative relations presented by this cranium to other isolated crania. From this exhaustive lesson in craniometry it would appear that the skull of Charlotte Corday closely accords with the typical form of the female skull, established by Broca as characteristic of Parisian women, deviating only from the normally perfect feminine cranial type in presenting a certain flatness of the frontal region, and some traces of jugular apophysis.—The Bronze Age in Egypt, by M. Montélius. The author, in opposition to the opinions of Lepsius and Maspéro, believes that the use of iron was not known in the valley of the Nile as early as bronze, which was probably fabricated 6000 B.C., and that the use of the former metal was not sufficiently common to justify us in speaking of an Iron Age in Egypt before 2000 B.C. He, moreover, believes that we must consider the era of Egyptian civilization as belonging mainly to the Bronze Age.—A short notice of the works of Alexander Brunias, by Dr. E. T. Hamy.—On the rock-sepulchre of Vaphio, in the Morea, by M. S. Reinach. The exploration of this tumulus was undertaken last year at the cost of the Archæological Society of Athens under the direction of M. Tsountas, and although the contents have not yet been fully examined, there can be no doubt of their extreme importance to archæology, as it has been proved beyond question that this rock-sepulchre had remained intact till the present time. It appears from the report of M. Tsountas that the poniards and other implements, together with many of the numerous funereal objects brought to light by the explorations at Vaphio, are similar to the remains obtained at Mycenæ. Among these finds special interest attaches to two golden goblets carved in strong relief, representing both clothed, and almost nude, figures, engaged in the hunting and taming of wild bulls. M. Reinach proposes in a future number of this journal to discuss the Vaphio tumulus more fully, but in the meanwhile he appeals to English archæologists to test the accuracy of a statement published in 1813 by the German traveller Baron von Stackelberg, that the so-called Treasury of Atreus at Mycenæ had a few years earlier been ransacked by Veli Pasha, who was said to have disposed of part of its treasures to Lord North. Dr. Schliemann questions the truth of this report, but M. Reinach is of opinion that it bears evidence of authenticity, deserving the notice of Englishmen, and he hopes, in the interests of archæological science, that some of these precious objects may yet be found in one or other of the great English collections.—We may remark, in conclusion, that the present review surpasses its predecessors in the excellence of its printing and its illustrations, while it has the great advantage of being edited by MM. Cartailhac, Hamy, and Topinard. In the space allotted to the consideration of the scientific literature of various countries, to which more than half the entire volume is devoted, there are various notices of Russian, Hungarian, and other works, not generally accessible to the ordinary reader; but we trust that in future numbers the reports of English works and memoirs will not, as in the present number, be drawn exclusively from the Quarterly Journal of the Royal Geographical Society of London.

American Journal of Science, March 1890.—Sedgwick and Murchison: Cambrian and Silurian, by Prof. James D. Dana. The relations of these two geologists to one another, and to Cambrian and Silurian geology is given. The full paper appeared in NATURE of March 6 (p. 421).—Notes on the Cretaceous of the British Columbian regions; the Nanaimo group, by George M. Dawson.—Celestite from Mineral County, West Virginia, by George H. Williams. A large number of celestite crystals, from an extensive railroad cutting into a bluff of lower Helderberg limestone, has been investigated.—A method for the determination of iodine in haloid salts, by F. A. Gooch and P. E. Browning.—On the mineral locality at Branchville, Connecticut, fifth paper, by George J. Brush and Edward S. Dana; with analyses of several manganesian phosphates, by Horace L. Wells. A new member of the triphylite group—a sodium-manganese phosphate, which has been called natrophilite—has been found, and the rare mineral hureaulite identified in the Branchville minerals.—A simple interference experiment, by Albert A. Michelson. Two pieces of plane glass, silvered on

the front surfaces, are fixed against a block of wood, so that the angle between the two surfaces is slightly less than 90°. This simple apparatus will give the interference phenomena produced by means of Fresnel's mirror or bi-prism.—An improved wave apparatus, by John T. Stoddard. This is a method of demonstrating to a class the formation of the compound curves representing the combination of two simple sound waves.—On a recent rock-flexure, by Frank Cramer.—On the origin of the rock-pressure of the natural gas of the Trenton limestone of Ohio and Indiana, by Edward Orton. By the rock-pressure of gas is meant the pressure in a well which is locked in so that no gas can escape; and the author concludes that the rock-pressure of the gas of the Trenton limestone is due to the pressure of a water column under which it is held in the arches of the rocks. This explanation seems applicable to all gas fields.

THE *American Meteorological Journal* for January contains a continuation of Faye's theory of storms, and of Ferrel's convectional theory of tornadoes, both of which have been already referred to; the latter paper is concluded in the number for February. Of the other articles in these two months the principal are:—The mathematical elements in the estimation of the Signal Service Reports, by W. S. Nichols. He points out that attempts to measure the accuracy of the daily weather forecasts are liable to give rise to a confusion of ideas, and, confining his attention to rainfall, he lays down certain rules for testing the value of the predictions to the community when judged from the stand-points of quantity and quality, as well as the accuracy of the information.—On the use of the "sling" thermometer in the prediction of frosts, by Prof. H. A. Hazen. With the view of protecting delicate plants from destruction by frost, the author advocates the determination of the dew-point in the evening, and if it is found to be as low as 25°, and the air-temperature at 45° or lower, with a clear sky, frost may be expected, and the plants should be protected by smoke from burning straw, before the early morning.—On globular lightning, by Dr. T. C. Mendenhall. The author quotes many interesting instances of this rare phenomenon, the earliest case recorded being at Stralsund in June 1670; and he describes several instances in which it has been observed at sea. Photographs of the phenomenon are much wanted.—Diminution of temperature with height, by Prof. H. A. Hazen. He has recently spent several weeks on the summit of Mount Washington (6300 feet above sea-level), and finds that the diurnal range of temperature, which is very small, is not due to the heating of the air by the sun, but only to the convection currents caused by the warm rocks. The object of the paper is to endeavour to throw light on the true explanation of storm phenomena.—An interesting summary, by A. L. Rotch, of the Meteorological Conference held at Paris in September last, in connection with the International Exhibition. This is the first general account which has appeared in English.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 6.—"On the Development of the Ciliary or Motor Oculi Ganglion." By J. C. Ewart, M.D. Communicated by Prof. M. Foster, Sec. R.S.

The most conflicting views have for some time been held as to the origin, relations, and homology of the ciliary (motor oculi, ophthalmic, or lenticular) ganglion. By Remak, Schwalbe, Marshall, and others, the ganglion of the ophthalmicus profundus has been described as the ciliary ganglion, and this ganglion has frequently been regarded as the ganglion of the motor oculi nerve, and hence as homologous with the Gasserian and other cranial ganglia. The ciliary ganglion having been shown by van Wijhe to be quite distinct from the ganglion of the ophthalmicus profundus, the old view of Arnold has been recently revived, and already van Wijhe, Hoffmann, Onodi, Dohrn, and Beard have indicated that they regard the ciliary as a sympathetic ganglion. Hoffmann bases his belief on certain observations on the development of the ciliary ganglion in reptiles, while Onodi has adopted this view chiefly because in the higher vertebrates the ciliary ganglion receives a communicating branch from the sympathetic. But Beard, while considering the ciliary a sympathetic ganglion, states that in sharks he has seen nothing in support of "the mode of origin for the ciliary ganglion described by Hoffmann," in reptiles.

In studying the ciliary ganglion in Elasmobranchs I have been specially struck with its tendency to vary not only in the same genus or species, but in the same individual. Of the numerous specimens examined, I have only once found the ganglion entirely absent (in an adult *Raia radiata*), while I have occasionally (in *Acanthias*) found two well-developed ganglia on each side. Usually in sharks I found the ganglion lying in connection with the inferior branch of the motor oculi, while in skates it was generally in contact with the ophthalmicus profundus, or lying midway between the motor oculi and the ganglion of the profundus. In form the ganglion varies extremely, rounded or conical in some cases, in others it was represented by two or three groups of cells lying parallel to or in contact with the motor oculi.

In some cases ganglionic cells had wandered from the ganglion a considerable distance along the ciliary nerves towards the eyeball.

Although in sharks the ciliary ganglion often lay in close contact with the motor oculi nerve, no ganglionic cells were ever found either in the trunk of that nerve or on any of its branches. In skates the ganglion was usually more intimately related with the ophthalmicus profundus than the oculo-motor. In all cases the ciliary ganglion had at least two roots, one from the motor oculi, and one or two from the ophthalmicus profundus. In skates the profundus root always proceeded directly from the profundus ganglion, and the profundus ganglion was frequently found to be connected by a communicating branch with the Gasserian ganglion.

Both in sharks and skates, in addition to the ciliary nerves from the ciliary ganglion there were ciliary nerves proceeding from the ganglion and from the trunk of the profundus, and in some cases large ganglionic cells had wandered from the profundus ganglion along the ciliary nerves; occasionally a few large cells had migrated some distance along the main trunk of the profundus. In all cases the majority of the cells of the ciliary ganglion were only about half the size of the cells of the profundus ganglion.

In skate embryos under two inches in length no indication of the ciliary ganglion was discovered, and in shark embryos about ten inches in length the ganglion was frequently represented by small groups of cells in the vicinity of the inferior branch of the oculo-motor nerve. In sharks the first steps in the development of the ganglion were not observed, but in skates it was possible to make out all the stages. The first indication of the ganglion was in the form of a slender outgrowth from the inferior border of the large ophthalmicus profundus ganglion, which met and blended with fibres from the descending branch of the motor oculi. The *outgrowth from the profundus ganglion* was crowded with cells; the *fibres from the motor oculi*, like its root and trunk, were absolutely destitute of cells. At a somewhat later stage the cells had accumulated at the junction of the outgrowth from the profundus ganglion with the fibres from the motor oculi. It looked as if the blending of the two sets of fibres had formed a network which resisted the further migration of the ganglionic cells. In typical cases, at a still later stage, all the ganglionic cells had left the outgrowth from the profundus ganglion to form a rounded mass from which the ciliary nerves took their origin. In some cases some of the fibres which connected the profundus ganglion with the Gasserian seemed to reach and end in the ciliary ganglion. It thus appears that the ciliary ganglion stands in the same relation to one of the cranial nerves (the ophthalmicus profundus) as the sympathetic ganglia of the trunk stand to the spinal nerves, and that the ciliary ganglion may henceforth be considered a sympathetic ganglion. Further investigations may show that the ganglia in connection with the branches of the trigeminus (fifth) nerve may also be considered as belonging to the sympathetic system. In conclusion, I may say that I have found the vestiges of the ophthalmicus profundus ganglion in a five-months human embryo lying under cover of the inner portion of the Gasserian ganglion, and satisfied myself that the ophthalmicus profundus of the Elasmobranch is represented in man, as suggested by several writers, by the so-called nasal branch of the ophthalmic division of the fifth. To as far as possible clear up the confusion that has arisen from mistaking the ophthalmicus profundus nerve for a branch of the oculo-motor or of the trigeminus nerve, and the ganglion of the ophthalmicus profundus for the ciliary ganglion, it might be well in future to speak of the profundus as the *oculo-nasal* nerve and its ganglion as the *oculo-nasal* ganglion.

Chemical Society, February 20.—Dr. W. J. Russell, F.R.S., in the chair.—The following papers were read:—The behaviour of the more stable oxides at high temperatures, by Dr. G. H. Bailey and Mr. W. B. Hopkins. Previous experimenters have found that cuprous oxide is obtained when cupric oxide is heated to redness. The authors find that at higher temperatures a further quantity of oxygen is given off, and an oxide having the composition Cu_3O is formed. This is insoluble in mineral acids and even in aqua-regia, but can be converted into a soluble form on fusion with caustic potash, from which it separates on treatment with water. The oxides of lead and tin seem to behave similarly at high temperatures.—The influence of different oxides on the decomposition of potassium chlorate, by Messrs. G. J. Fowler and J. Grant. The authors have systematically examined the influence of the chief metallic oxides and certain unstable salts on the decomposition of potassium chlorate by heat, and the chief results obtained may be summarized as follows:—(1) Acid oxides, such as V_2O_5, WO_3, and V_3O_8, cause the evolution of oxygen at a much reduced temperature with the formation of a metavanadate, tungstate, or uranate. Chlorine is evolved in large quantity in these cases, but the whole of the oxygen of the chlorate is not liberated, since the compound of K_2O with the oxide is not decomposed by heat or by chlorine—

$$4KClO_3 + 2V_2O_5 = 2K_2O,\ V_2O_5 + 2Cl_2 + 5O_2.$$

(2) Alumina acts similarly but less energetically. (3) Chromium sesquioxide causes the evolution of oxygen at a lower temperature, chlorine also being liberated—

$$8KClO_3 + 2Cr_2O_3 = 4KCrO_4 + 4Cl_2 + 7O_2.$$

(4) The sesquioxides of iron, cobalt and nickel, cupric oxide, and manganese dioxide cause the evolution of oxygen at a comparatively low temperature accompanied by only a small percentage of chlorine; the oxide is left but little altered at the end of the experiment. The authors find that their results are in harmony with the theory of the action of manganese dioxide advanced by McLeod (Chem. Soc. Trans., 1889, 184). (5) The monoxides of barium, calcium, and lead cause no evolution of oxygen when heated with potassium chlorate, but the latter breaks up below its normal temperature with the formation of potassium chloride and a peroxide. (6) In the presence of such oxides as silver oxide and the peroxides of barium and lead, potassium chlorate acts as a reducing agent. No oxygen is liberated, but a perchlorate is formed. (7) Oxides such as those of zinc and magnesium are completely inactive. The authors find that the physical condition of the oxide is of importance, thus copper oxide prepared in the dry way is almost inactive; and further, that certain substances, as powdered glass, sand, and kaolin, assist the decomposition, although apparently they undergo no chemical change.—The interaction of hypochlorites and ammonium salts; ammonium hypochlorite, by Messrs. C. F. Cross and E. J. Bevan. The authors bring forward evidence of the formation and existence of ammonium hypochlorite in solution, but have failed to isolate the compound when produced by the action of an ammonium salt on a dilute solution of bleaching powder, or by the electrolysis of ammonium chloride solutions. It exhibits curious anomalies in oxidizing properties in comparison with other hypochlorites. It is without action on many colouring matters—for example, those of the vegetable fibre; it does not decolorize a solution of indigo in sulphuric acid, although it at once liberates iodine from potassium iodide, and it does not peroxidize hydrated lead oxide. On the other hand, it oxidizes sulphites and arsenites, and its effect on aniline salts is identical with that of ordinary hypochlorites. In the discussion which followed the reading of the paper, Prof. Armstrong suggested that probably the authors were dealing with a chlorinated derivative of ammonia, *e.g.* NH_2Cl; such compounds, according to Gattermann's experiments, being more stable than is usually supposed.—The action of phosphoric anhydride on stearic acid, by Dr. F. S. Kipping. One of the products of the reaction is stearone, $(C_{17}H_{35})_2CO$, and the yield appears to be as good or better than that obtained when salts of stearic acid are submitted to dry distillation.—Semithiocarbazides, by Prof. A. E. Dixon.—Note on the production of ozone by flames, by Mr. J. T. Cundall. Ilosva (*Ber. der deut. chem. Gesellsch.*, Referate 1889, 791) states that when all the products of combustion of various kinds of flames are collected, they do not exhibit the smell or taste of ozone. This is confirmed by the results of some unpublished experiments made by the author in 1886, but recently he has found that the air aspirated through a tube, 3 mm. in bore, whose mouth is fixed about 5 mm. above the tube, and 5 mm. away from the flame of a Bunsen burner, both tastes and smells strongly of ozone. Similar results were obtained both with luminous and hydrogen flames. It was not found possible to confirm this fact by any other test for ozone, owing to the impossibility of finding any sufficiently sensitive reaction which was not common to dilute nitrogen oxides. The author agrees with Ilosva that the smell and taste of ozone are the only trustworthy tests for it when it is present in small quantities, and that Houzeau's papers (impregnated with red litmus and potassium iodide), which at first sight should give the necessary distinction, since an acid gas would not be expected to give an alkaline product, are useless, inasmuch as nitrogen oxides also turn them blue.

Geological Society, February 26.—Mr. J. W. Hulke, F.R.S., Vice-President, in the chair.—The following communication was read:—On the relation of the Westleton Beds or "Pebbly Sands" of Suffolk to those of Norfolk, and on their extension inland, with some observations on the period of the final elevation and denudation of the Weald and of the Thames Valley; Part 3, on a Southern Drift in the valley of the Thames, with observations on the final elevation and initial sub-aërial denudation of the Weald, and on the genesis of the Thames, by Prof. Joseph Prestwich, F.R.S. In this third part of his paper the author gave a description of the characters of the Southern Drift, showing how it differs from the Westleton Beds in the nature of its included pebbles, which consist of flints from the Chalk with a large proportion of *chert* and *ragstone* from the Lower Greensand, while there is a total absence of the Triassic pebbles and Jurassic *débris* characterizing the Northern Drift. He traced the drift through Kent, Surrey, Berkshire, and Hampshire, and described its mode of occurrence. Another pre-glacial gravel was then discussed under the title of the Brentwood group, and its age was admitted to be doubtful. The author then entered into an inquiry as to the early physiographical conditions of the Wealden area, and gave reasons for supposing that a hill-range of some importance was formed in the Pliocene period after the deposition of the Diestian beds. From the denudation of this ridge, he supposes that the material was furnished for the formation of the Southern Drift, which may have been deposited partly as detrital fans at the northern base of the range. The relation of the Southern Drift to the Westleton Shingle and other pre-glacial gravels was considered, and the Westleton Beds were referred to a period subsequent to that of the formation of the Southern Drift. The influence of the meeting of the earlier Wealden axis with that of the folding which produced the escarpments of central England was discussed, and it was suggested that the result would be the genesis of the Thames valley and river. The following summary gives the results of the author's inquiry as developed in the other parts of the paper. He holds:—(1) That the Westleton Shingle ranges from Suffolk to Oxfordshire and Berkshire, rising gradually from sea-level to 600 feet. (2) That the lower Tertiary strata were co-extensive with this shingle. (3) That the upraising of the Westleton sea-floor, with its shingle, preceded the advance of the Glacial deposits, and that the latter become discordant to the former when traced westward, occupying valleys formed after the rise of the Westleton Beds. (4) That the Tertiary strata and Westleton Beds on the north border of the Chalk basin were continuous until the insetting of the Glacial period, when they were broken through by denuding agencies. (5) That none of the present valleys on the north of the Thames Tertiary basin date back beyond the Pre-glacial period. (6) That the same date may be assigned to the Chalk and probably to the Oolite escarpments. (7) That in the Thames basin, besides the Northern Drift, there is a Southern Drift derived from the Lower Greensand of the Wealden area, and from the Chalk and Tertiary strata formerly extending partly over it. (8) That during the Diestian period the Weald was probably partly or wholly submerged, and that between this and the insetting of the Glacial period, the Wealden area and the Boulonnais underwent upheaval resulting in the formation of an anticlinal range from 2000 to 3000 feet high. (9) That from the slopes of this range the materials of the Southern Drift were derived, and spread over what is now the south side of the Thames basin. (10) That this denudation commenced at the time of the Red Crag, and went on uninterruptedly through successive geological stages. (11) That consequently, though the Southern Drift preceded the Westleton Shingle, the two must at one time have proceeded synchronously. (12) That the valley-system of the Wealden area dates from Pliocene times—

the initial direction of the transverse valleys from pre-Glacial times—and of the longitudinal valleys from Glacial times. (13) That the Thames basin results from the elevation of the Weald and the flexures of the Chalk and Oolites of the Midland counties, and dates from a period subsequent to the Westleton Beds. (14) That the genesis of the Lower Thames similarly dates from early Pleistocene times, whilst its connection with its upper tributaries and the Isis, which possibly flowed previously north-eastward, took place at a rather later period. After the reading of the paper there was a discussion, in which the Chairman, Mr. Whitaker, Dr. Irving, Mr. Topley, Dr. Evans, and the author, took part. Dr. Evans congratulated the Society and Prof. Prestwich on his having been able to sum up the results of the observations of so many years in the series of papers which he had lately read.

Entomological Society, March 5.—Captain Henry J. Elwes, Vice-President, in the chair.—Mr. C. G. Barrett exhibited a number of specimens of *Dianthecia carpophaga*, Bork., bred by Mr. W. F. H. Blandford from larvæ collected near Tenby on flowers of *Silene maritima*. He remarked that the series included a number of forms intermediate between *D. carpophaga* and *D. capsophila*, and establish the fact that the latter is only a local variety of the former. Mr. W. H. B. Fletcher, Mr. Blandford, and Mr. McLachlan took part in a discussion as to the identity of the supposed species.—Mr. Barrett further exhibited a specimen of *Dianthecia luteago*, var. *Barrettii*, Db., also bred by Mr. Blandford from a larva found at Tenby, and he remarked that the species had not previously been taken in England ; also a long series of forms intermediate between *Catoptria scopoliana*, Hw., and its small variety *parvulana*, Wilk., collected by Mr. E. Bankes, Mr. Fletcher and Mr. Vine, in Sussex, the Isle of Wight, and Pembrokeshire ; also a specimen of *Botys mutualis*, Zell.,—a species widely distributed in Asia and Africa,—taken by Mr. C. S. Gregson near Bolton, Lancashire.—Mr. H. Goss exhibited several abnormal specimens of *Arctia caja*, bred last December. The object of the exhibition was to show the effect produced by forcing the larvæ, and subjecting them to unusual conditions. It was stated that the peculiarity of the colour of the hind wings of the female parent had not been transmitted to any of the offspring.—Mr. Blandford referred to two specimens of a species of *Cardiophorus*, from Tenby, which he had exhibited at the August meeting of the Society as *Cardiophorus cinereus*, and stated that subsequent investigation had led him to hand them to Mr. Champion for determination. Mr. Champion was of opinion that they did not belong to the same species ; that one of them was *C. asellus*, Er., and the other, probably, *C. equiseti*, Hbst., a species new to this country.—Mr. C. J. Gahan read a paper entitled "New Longicornia from Africa and Madagascar."—Captain Elwes read a paper entitled "On a new species of *Thymara* and other species allied to *Himantopterus fuscinervis*, Wesmael."—Dr. Sharp read a paper entitled "On some Water Beetles from Ceylon."—Mr. J. J. Walker communicated a paper entitled "Notes on Lepidoptera from the Region of the Straits of Gibraltar." Mr. F. Merrifield, Mr. B. G. Nevinson, Captain Elwes, and Mr. G. Lewis took part in the discussion which ensued.—It was announced that papers had also been received from Mr. E. Meyrick, Prof. Westwood, and Mynheer P. C. T. Snellen.

Royal Meteorological Society, March 19.—Mr. H. F. Blanford, F.R.S., Vice-President, in the chair.—The following papers were read :—A brief notice respecting photography in relation to meteorological work, by Mr. G. M. Whipple. The first person to use photography for obtaining meteorological records was Mr. T. B. Jordan, of Falmouth, in 1838. Some years later, Sir F. Ronalds and Mr. C. Brooke devised more complete and elaborate apparatus ; the arrangement of the former being now in use at the Observatories of the Meteorological Office, and that of the latter at the Royal Observatory, Greenwich. Reference was also made to Mr. J. B. Jordan's form of sunshine recorder, and to Captain Abney's photo-nephograph. The various photographic processes which have been employed in connection with these instruments were fully described.—Application of photography to meteorological phenomena, by Mr. W. Marriott. The author showed how photography could be most usefully employed for the advancement of meteorological knowledge. Much valuable information had been recently obtained from photographs of lightning and clouds. An interesting collection of such photographs was shown on the screen, together with others illustrating floods, whirlwinds, tornadoes, hailstorms, frost, snow, &c.—After the reading of these papers, the meeting was adjourned to allow the Fellows to inspect the Exhibition of Instruments, &c., an account of which we print elsewhere.

Mathematical Society, March 13.—J. J. Walker, F.R.S. President, in the chair.—The following communications were made :—Perfect numbers, by Major P. A. MacMahon, R.A.—The relation of distortion in prismatic images to dispersion, by Dr. J. Larmor.—On the satellite of a line relatively to a cubic, by the President (Prof. Greenhill, F.R.S., V.P., in the chair).—An approximate relation connecting successive terms of the expansion for tan x, by G. Heppel.

PARIS.

Academy of Sciences, March 17.—M. Hermite in the chair.—M. Maurice Lévy communicated a paper on the application of electro-dynamical laws to planetary motions. In a communication of February 17, M. Tisserand applied Gauss's formula of electro-dynamical attraction to the movement of celestial bodies without at all asserting it to be true. M. Lévy concludes that the formula is contrary to the doctrine of energy and to the facts, and shows that Riemann gave a law which, like that of Weber, is in accord with both.—On the photographic halo, and a method of making it disappear, by M. A. Cornu. The author has investigated the appearance and cause of the halos which surround intense points of light on a photographic plate, and the conditions necessary to remove them.—Under agricultural chemistry, M. Berthelot discusses the facts relating to observations on the reactions between the soil and atmospheric ammonia.—M. P. Schutzenberger, in researches on some phenomena produced during the condensation of gases containing carbon under the influence of the silent discharge, has investigated the composition of the brown solid formed together with carbonic acid from the condensation of carbonic oxide. The experimental results give a formula intermediate between $C_{12}H_2O_{10}$ and $C_{12}H_2O_{11}$.—Method of determining the pole of an ellipsoid of three unequal axes by the observation of its catoptric images, by M. D. E. Sulzer.—On a new system of electrical accumulators and some accessory apparatus, note by M. Charles Pollak.—On the double thiosulphates of lead and sodium, by M. J. Fogh.—The action of sulphuric acid on aluminium, by M. A. Ditte. The author finds aluminium to behave much like amalgamated zinc. With a smooth plate of this metal immersed in dilute cold sulphuric acid for some time but little hydrogen is liberated owing to the formation of a protecting film of the free gas, and that any circumstances tending to facilitate the removal of this film increase the rapidity of action of the acid ; for instance, a trace of a chloride of any metal reduced by aluminium causes the plate to be comparatively rapidly attacked owing to the roughening of the surface due to the deposition of a metallic film ; again a similar effect is obtained when the reaction is caused to occur in a vacuum, because of the freer disengagement of hydrogen. The product of the reaction is in the first place neutral sulphate of aluminium, but the reaction continues further, a basic sulphate being produced with further evolution of hydrogen. The conclusion is drawn that aluminium acts normally, in accordance with the heat of formation of its salts, when in contact with sulphuric acid or metallic sulphates, and that the slowness of the reaction is due to the mechanical interference of the liberated hydrogen.—On a new crystalline form of ammonium chloride, by MM. G. Geisenheimer and F. Leteur. M. Le Bel has shown the possibility of a second form of ammonium chloride (*Comptes rendus*, January 20, 1890) ; the authors give data leading them to conclude that they have probably obtained the second form, rendered stable by the presence of a slight impurity.—Note by M. J. Meunier, on the mono- and di-benz-acetals of sorbite.—On the α dextro- and lævo-rotatory borneol camphorates, by M. A. Haller. The author draws the conclusions—(1) that the total etherification of camphoric acid is only effected at a relatively high temperature and with the anhydride ; (2) that isomeric bodies are certainly produced under these conditions ; (3) that camphoric acid, in the acid ethers studied in this note, is analogous to phenol in its reactions.—On oxytetric acid, by M. Ch. Cloez.—On the value of the heat of hydration of malic acid, by M. Iw. Ossipoff.—Note by M. J. A. Muller, on the dissociation of the hydrochlorides of amines and dissolved salts of fatty acids. Using phenolphthalein as indicator, the author has been enabled to trace the dissociation of

these bodies on diluting or heating their solutions.—A botanical note, by M. Léon Guignard, on the formation and differentiation of the sexual elements which take part in fertilization.—Another botanical paper, by M. A. Prunet, on the comparative structure of the nodes and internodes in the trunk of the Dicotyledones.—Under geology, M. de Folin has a paper on the formation of nummulitic rocks. He concludes that these rocks are formed by the work of an organism of the same order as the Rhisopodes.—Also under geology, M. Stanislas Meunier contributes some chemical researches on the fossil shells of Foraminifera, Mollusks, and Crustacea. He has investigated the composition of the flocculent organic residue formed when these fossil shells are dissolved in acid.—On Pyrenean kersanton, its age and affinities with ophite, by M. J. Caralp.

BERLIN.

Physiological Society, February 28.—Dr. Rosenstein exhibited a patient with distension of the lymphatics in the leg, and fistulous openings which discharged an albuminous fluid sometimes amounting to 1100 c.c. in a day. Dr. J. Munk has made observations on this fluid. It is sometimes transparent, but is always milky after a meal containing fat. It thus resembles chyle rather than lymph, and probably really is chyle. At least two-thirds of the fat given at any one meal reappeared in the fluid from the fistula. On giving olive oil, fat appeared in the fluid in two hours, increased steadily till its maximum after five hours, then diminished, and in ten or twelve hours disappeared. With a harder fat, *e.g.* mutton fat, the phenomena were the same, but were longer in appearing. Erucic acid given to the patient appeared as a neutral fat, and not as free acid, synthesis having been effected in the body. No appreciable absorption of fat occurs from the rectum. Large doses of starch or sugar scarcely increased the percentage of sugar, nor did large meals of albumen increase that of proteids in the fluid. Thus the only food-stuff which leaves the intestine by the lacteals is fat.

Meteorological Society, March 4.—Dr. Vettin, President, in the chair.—Dr. Wagner spoke on fire-damp explosions in mines in their relationship to cosmic and meteorological conditions. He discussed the collection of the gas, the conditions necessary for its explosion, the part played by coal-dust, and the several chance circumstances which may lead to the non-discovery of the gas in the workings. He next discussed the various means available for avoiding and removing accumulations of fire-damp, and gave an account of researches on the relationship of its explosion to varying barometric pressures. His own work had consisted in working up the statistics of the Dortmund mining district in which explosions are more frequent than in any other state of Prussia. The reports cover a period of 21 years and give a record of 7000 explosions. He first compared the numerical relationship of the explosions with the phases of the moon, and concluded that there is no connection between the two. He then made a similar comparison of their frequency with the rotational period of the sun, taking the latter as 25·5 days: the result was again negative. He finally compared their frequency with periods of 27·9 days, this being, according to Buys-Ballot, the cycle of temperature variations resulting from the sun's rotation. In this case the curves he obtained were quite uniform and regular, showing a maximum on the third day and a second maximum on the twentieth. He refrained from drawing any definite conclusions from this last observation in view of the numberless chance circumstances which may lead to explosions.

Physical Society, March 7.—Prof. Kundt, President, in the chair.—Dr. Rubens spoke on the employment of the bolometer for observing the electrical radiations of Hertz as carried out by himself and Dr. Ritter. Up to the present it had not been found possible to measure the intensity of the radiation owing to the extraordinarily minute amplitude of the oscillations; but the speaker had been able to carry out the determination by means of a bolometer whose construction and working he fully described. It consists essentially of an accurately balanced primary Wheatstone bridge, two of whose arms are again converted into secondary Wheatstone bridges. If a current passes through one of them its resistance is altered by the rise of temperature, and the galvanometer gives a proportionate throw. A similar effect is produced by a wave of electrical radiation, and hence its amplitude can be measured by this bolometer when once it has been calibrated. When experimenting with the polarizing wire-grating it was found that there is a constant relationship between the intensity of the rays which pass the grating and the angle of inclination of the wires to the plane of oscillation of the rays. It was further observed that the energy which does not pass the grating is reflected, and to the extent of 98 per cent., when the wires are at right-angles to the plane of oscillation. Experiments in illustration of the above were shown at the end of the communication.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Report of the Meteorological Service of Canada, 1886: C. Carpmael (Ottawa).—The Mammalia of the Uinta Formation: W. B. Scott and H. F. Osborn (Philadelphia).—A Monograph of Oriental Cicadidæ, Part 2: W. L. Distant (West, Newman).—Il Monismo: E. dal Pozzo di Mombello (Castello, Lapi).—British Fossils and where to seek them; J. W. Williams (Sonnenschein).—Poems, complete edition: W. Leighton (Stock).—Classification of Birds: H. Seebohm (Porter).—Personal and Social Evolution (Unwin).—Proceedings of the Physical Society of London, Vol. x. Part 3 (Taylor and Francis).—The Asclepiad, vol. vii. No. 25 (Longmans).—Travaux de la Société des Naturalistes de St. Pétersbourg, Section de Zoologie et de Physiologie, Tome xx. Livr. 2.—Supplément aux Travaux de la Société des Naturalistes de St. Pétersbourg.—An International Idiom; A Manual of the Oregon Trade Language: H. Hale (Whittaker).—Second Melbourne General Catalogue of 1211 Stars for the Epoch 1880 (Melbourne, Brain).—Essays of an Americanist: Dr. D. G. Brinton (Philadelphia, Porter and Coates).—Days and Hours in a Garden, 7th edition: E. and B. (Stock).—Weather and Tidal Forecasts, 1890: D. Dewar (Glasgow, Brown).—Royal University of Ireland Calendar for 1890 (Dublin, Thom).—Report of the Rugby School Natural History Society, 1889 (Rugby, Lawrence).—The Signing of the Treaty of Waitangi: W. Colenso (Wellington, Didsbury).—Mekrolog auf Theodor Kirsch (Berlin, Friedländer).—Journal of the Chemical Society, March (Gurney and Jackson).—Journal of Physiology, vol. xi., No. 3 (Cambridge).

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