THURSDAY, MARCH 8, 1888.

PHYSICAL SCIENCE AND THE WOOLWICH EXAMINATIONS.

WE are interested to learn that the views we have expressed on this subject are probably shared by representatives of military opinion; for we are informed that the treatment of scientific candidates for Line cadetships, under the similar regulations for admission to Sandhurst that were introduced in 1884, met with a very unfavourable reception from at least one of the service journals. At the time of their introduction, the *Army and Navy Gazette* pointed out, as we have done, the serious objections that exist to giving modern languages so great an ascendency as is allotted to them in the present Sandhurst competitions. All that was said on this subject in 1884 applies with much greater force to the proposed mode of selecting officers for the scientific branches of the Army. We do not underrate the value of modern languages to soldiers, or to any other class, but an education in which mathematics and modern languages occupy so dominant a position as they are likely to possess in the education of many of the successful Woolwich cadets of the future [1] is scarcely more defensible than would be the adoption now of the purely classical training of former years. We trust, therefore, that no pains will be spared by those who are interested in this question to further the efforts that are being made to bring about the adoption of a more liberal scheme, which shall encourage early specializing on the part of the candidates to a less degree, and be more just to the particular class whose claims we have urged.

These regulations seem calculated to perpetuate the system of education of which it has been repeatedly complained that "it has too much to do with books and too little to do with things"; and, apart from their unfairness, they will tie the hands of those head masters who are willing, or even anxious, to adapt the work of their schools to the needs of the times, by forcing upon them a narrow curriculum of which they do not approve. This is not only unfortunate but unnecessary, for there is no real obstacle in the way of formulating a scheme of examination that shall both give fair play to all the candidates, and leave the hands of the teachers comparatively unshackled.

Much as the claims of science are still underrated by the unthinking among us, it was hardly to be expected that the representatives of a scientific profession would sanction regulations which will tend to prevent the admission to that profession of youths of scientific power, and which are also calculated to discourage any element of science teaching in the previous education of those who may wish to join it. Complaints of the absence of such training are familiar enough, and regulations intended to encourage such preliminary work are not uncommon. This adds not a little to our surprise at the proposals of the War Office Committee. We regret to perceive in them a fresh illustration of the tendency of Examining Boards to sacrifice the interests of the examined to a desire for simplicity in their schemes of examination, a tendency that constitutes a source of serious danger to proper freedom of education in these days, when admission to all the higher avocations is so jealously guarded by competitive or qualifying examinations.

In the discussion of this subject that has occurred in our columns a statement has been made, and repeated, by one of our correspondents, that requires notice. We allude to the contention that chemistry, physics, and geology are not good educational subjects for boys under sixteen years of age. This is a statement with which very few who have given these sciences a fair trial will agree; moreover, it is not pertinent to the question under discussion. Successful candidates for the Woolwich cadetships are, we believe, on an average, not much less than seventeen and a half years of age, and in future the average of age is more likely to rise than to fall in consequence of the increased severity of the examination in obligatory mathematics. No liberal-minded man will deny that the above-named sciences are exceedingly good educational subjects, between the ages of fifteen and seventeen and a half years, in the case of those who have ability and liking for them, by whom alone they will as a rule be studied among the candidates for Woolwich. Of course there are some for whom such studies are unfitted, but we very much doubt whether the military authorities will greatly regret the rejection of such as these. Their powers are likely to be more profitably employed in other directions.

If we may judge from the memorandum lately issued with the Army Estimates by Mr. Stanhope, we may conclude that the present time affords a good opportunity for urging upon his notice the thoroughly unpractical character of the proposed changes. The frankness with which Mr. Stanhope admits other deficiencies in the system of our military administration encourages the expectation that in this matter also he will act with an equal degree of practical sense, and that it will not be long before we shall hear that the efforts of those who have taken up this matter are bearing fruit.

[1] Since mathematical and modern languages will count for 12,000 marks out of a maximum of 16,500, and as about 5000 will be sufficient for success in future, it is not unlikely that many candidates may deem it safest or easiest to almost confine their studies to these two branches.

PROFESSOR FLEEMING JENKIN.

Papers, Literary, Scientific, &c., by the late Fleeming Jenkin, F.R.S., LL.D. Edited by Sidney Colvin, M.A., and J. A. Ewing, F.R.S. With a Memoir by Robert Louis Stevenson. 2 vols. (London: Longmans, Green, and Co., 1887.)

THIS is a work of great interest to many classes of scientific men, as well as to the public at large. Its contents are of an extremely varied character. Readers of NATURE, as such, are not deeply concerned with discussions of Female Dress in ancient Greece, with Rhythm in English verse, or with the characteristics of Mrs. Siddons as an actress. Nor will they, as a body, care much for the merits and demerits of Trade Unions, the relations of Supply and Demand, or other branches of the would-be science called Political Economy. The literary and economic Journals, on the other hand, will probably regard these as among the more valuable contents of these volumes.

But the Biographical Sketch of Prof. Jenkin is of high interest to all:—first, because it traces the successive advances made by the indomitable perseverance of a brave man in his protracted struggles against difficulties of no common order:—secondly, because it is the work of one of the most remarkable writers of our time, who has thus given fresh proof of the versatility of his genius. The result, however, cannot we think be looked on as wholly satisfactory by those who really knew Prof. Jenkin. The power displayed in the narrative is unquestionable, the various characters stand forward in clear-cut outline, and we seem to see them act out their lives before us as we read. But the weird imagination of the writer has proved too much for him, and some of his "situations" are altogether overcharged.

The late Prof. Jenkin was essentially a frank, straightforward, hard-working, clear-headed, practical scientific man:—and it is in this capacity that he will be held in honourable remembrance by the scientific world. What was the character of his grandmother, or what forms of relaxation he himself sought from study or business, are matters of infinitely less importance. Scientific men would have been glad to learn many things not mentioned here:—*e.g.* the secret of his singularly methodical management of complicated correspondence:—for it is in such matters that they are, as a rule, most sorely tried as well as most miserably inefficient. But his Biographer is a true Artist, for whom business, method, and even science itself have no attractions; except in so far as they may serve occasionally to heighten the lights or to darken the shadows of an ideal picture. And it must be acknowledged that Mr. Stevenson has, in a very remarkable degree, succeeded in the work *as he understood it;* viz. in tracing the behaviour of that wholly unscientific (and therefore imaginary) structureless germ which renders "the biography of the man . . . . only an episode in the "epic of the family."

We are introduced at starting to a powerful but repulsive sketch of a family of country bumpkins, sots and sorners:—culminating in a weak but handsome and well-meaning midshipman of "a simplicity that came near to "vacancy." He married, in the West Indies, the daughter of a somewhat lively lady who "would tie her house slaves "to the bed and lash them with her own hand." Of the daughter we are told that, on occasion, she exhibited "characteristic barbarity." The domestic fate of the poor midshipman can of course be foreseen. "His wife, "impatient of his incapacity and surrounded by brilliant "friends, used him with a certain contempt. She was the "managing partner; the life was hers, not his; after his "retirement they lived much abroad, where the poor "Captain, who could never learn any language but his "own, sat in the corner mumchance; and even his son, "carried away by his bright mother, did not recognize "for long the treasures of simple chivalry that lay buried "in the heart of his father."

Such, we are told, were the parents of Professor Jenkin. Now we would ask in all earnestness *cui bono?* What class of readers is likely to be the better of such information as this? Surely such things, if such there were, ought to have been passed over in silence, or at least reserved to adorn, incognito, a new sensational narrative of the Jekyll and Hyde, or Dynamiter, type!

This powerful but cold-blooded description of monsters, and their atrocities, is succeeded by another quite as realistic whose *motif* is the struggle for existence on the part of the impecunious parents. Here, however, we find some relief in the frank boyish letters from young Jenkin, describing to an old school-fellow what he saw in Paris in the memorable days of 1848. For a few pages the merciless scalpel is allowed to remain inactive:—only to be applied again with fresh vigour, but now to Prof. Jenkin himself. All who knew him were aware that in the course of his singularly errant career he had lived much and happily with rough working men, and that he had made no great efforts to acquire that artificial veneer of "manners" (as it is called) which often serves the vilest of our race as a passport into "Society." But surely a single sentence on the subject would have sufficed any reasonable biographer! Why this Pre-Raphaëlite minuteness and copiousness of detail, except to add to the miserable heap of "Things one would rather not have said"? We gladly leave this aspect of the book with the remark that it affords fresh proof that literary men, even of the highest rank, are not necessarily qualified to be writers of biography, specially of scientific biography.

But there are statements of a darker stamp, such as in fact tend to impeach the sterling honesty which was one of the prominent features of Jenkin's character. The Biographer's story of his Class Certificate in Engineering will, we are certain, find no credence with any one who knew Prof. Jenkin. Under the conditions stated, nothing worthy the name of certificate could have been given by him. The story is susceptible, however, of an easy explanation. The Biographer has already told a similar tale of himself regarding his relations to another of the Edinburgh Professors. We have therefore only a recurrence of one of those half sportive, half serious, fits of introspection which form part of his literary art. Still, we do not like to meet with such things in such a connexion.

An exceedingly interesting and graphic chapter gives, in Jenkin's own words, a sketch of the busy times he had in laying and lifting submarine cables in the Mediterranean and in the Atlantic. His capacity for hard work, and his readiness of resource, appear at once from this singularly modest narrative. Appended to the Biography we have a brief but comprehensive summary of Jenkin's electrical work, drawn up by Sir William Thomson. From this we cannot make extracts. It must be read as a whole. Col. Fergusson has added an excellent sketch of Jenkin's services to general sanitation. Had Jenkin done nothing but this, his name would still be well worthy of remembrance as that of a signal benefactor of humanity.

The other contents of these volumes, so far as they can be discussed here, consist of reprints of some of Jenkin's published papers. Particularly interesting and valuable are two from the *North British Review:*—the first on *Lucretius, and the Atomic Theory*, the second on *Darwin, and the Origin of Species*. Both have important bearings on questions at present prominently before the public, so that it is specially convenient to have them in this easily accessible form. From the second we quote but a single sentence, of itself quite sufficient to confirm the above statements:—

"Any one of the main pleas of our argument, if "established, is fatal to Darwin's theory."

This is not, as some might hastily suppose, the self-laudation of a flippant "paper-scientist"; it is the deliberate statement of a clear-headed man who took nothing for granted, and who never wrote on anything till he felt convinced that he understood it.

We next come to a thoroughly practical Essay on *Scientific and Technical Education*, a subject on which Jenkin was peculiarly qualified to speak. The following extract may be taken as a specimen. Jenkin has been alluding to the willing and valuable assistance which a Teacher often receives from his higher practical students in conducting some new research; and proceeds to say:—

"The rank and file—the ordinary well-meaning student "who will never become a leading light in science—is "worthy of our attention. If he is well educated he may "become a successful manufacturer, contractor, engineer, "or farmer, and sensibly increase the power and wealth "of our country. It seems to me that this student is not "so well provided for in our scientific teaching as is "desirable. And the main question I propose for dis- "cussion is, how we are to improve the education of this "second-best young man. My own answer put briefly, "is that we can teach him systematically the art of "measurement. We cannot give him the hunger for "knowledge, the acute logical discrimination, nor the "imaginative faculty required for research; but we can "teach him how to ascertain and record facts accurately; "we can bring home to him the truth that no scientific "knowledge is definite except that based on the numeri- "cal comparison which we call measurement; we can "teach him the best modes of making that comparison "in respect of a vast number of magnitudes, and in teach- "ing this we shall teach him to use his hands and eyes. "This practical teaching gives clear conceptions to the "minds of many who receive a verbal definition as a "mere string of dead words. I should be glad if it were "generally proclaimed that the elementary training in all "our science laboratories should be a training in the art "of measurement. I wish that the classes were called "measurement classes. Then a student of ordinary in- "telligence would know that by entering a given class he "would learn how to measure those magnitudes with "which he will have to deal in after life. The attempt to "measure them will lead him to consider their nature, "and he will approach scientific study in the class room "with a faith in the reality of science which no verbal "exhortation will ever give him. You may define the "absolute unit of electrical resistance as accurately as "you will, and your definition shall affect the average "brain to no perceptible extent; but a young man of "very ordinary education and intelligence can learn to "measure resistances in ohms, and having learnt this, an "ohm becomes a reality to him. Not only does the "knowledge he has acquired make him a more valuable "assistant to the engineer and contractor, but having "acquired a working faith in the existence of ohms, he "is prepared to take some trouble to understand the "scientific definition."

Prof. Ewing reprints in full, in the last division of the work, three characteristic papers selected from Prof. Jenkin's writings on *Applied Science*:—and he gives in brief but clear abstract, and with full references, the contents of all. This part of the work seems to be very well done, and it forms a sort of commentary on, as well as complement of, the short article of Sir W. Thomson's to which we have already alluded. These handsome volumes will be specially welcomed by practical scientific men, but as we said at starting, there is much in them of interest and value to all. P. G. T.

OIL ON TROUBLED WATERS.

Le Filage de l'Huile. Par le Vice-Amiral G. Cloué. (Paris: Gauthier-Villars, 1887.)

THAT the great effect produced by oil in smoothing troubled waters should have been so well known in times past as to have passed into a proverb, and yet that no general practical use of this effect should have been made until the last few years, is a remarkable instance of the tardiness of mankind to apply the benefits that natural phenomena provide. To the Hydrographic Office of the United States is mainly due the credit of bringing into prominence, and forcing on the notice of seamen, in various publications, the great importance of this property of oil under circumstances when life and property are endangered by breaking seas, and the extreme facility and trifling expense of its employment. Thanks to the efforts of the Americans, the facts are now well known to all English-speaking mariners, and many are the instances of the successful use of oil; but, nevertheless, the prejudices of many are still against it.

The Admiralty, in 1886, issued a memorandum on the subject to the fleet, largely founded on the American publications. Admiral Cloué has done a like service for his countrymen, and has written the best and most complete essay on the subject, in the little *brochure* before us. Drawing on the mass of experiences collected by the American Office, and giving them due credit for their action, he reports additional striking cases which have occurred during the last year or two, and suggests many practical means of employing oil under circumstances other than those yet tried, or where it has to some extent failed.

The facts are briefly these. In the heaviest gales at sea, when breaking seas are a source of danger to small or heavily laden vessels, or an inconvenience and discomfort to larger or more seaworthy ones, a very small quantity of oil, skilfully applied to suit the circumstances, spreads upon the surface of the water with marvellous rapidity, and forms a perfect breakwater, the raging waves being instantaneously transformed into a harmless swell, which quietly lifts the ship without any of the violent shocks and blows caused by the impact of an almost wall-like mass of water about to break. Spray alone comes on board in place of the sheets of water and green seas which often do so much damage. Admiral Cloué calculates, from a number of instances where the quantity of oil used and the speed of the vessel are given, that the film of oil which causes this marvellous and beneficent effect can be little more than 1/100,000 of a millimetre in thickness!

Experience already goes to show that a small quantity of oil is more efficacious than a free application of it, the film apparently spreading more quickly. Less than half a gallon an hour seems to secure the largest ship from being boarded by the waves.

The ordinary method of its application is to hang small canvas bags, containing about a couple of gallons of oil, so as to dangle or float on the water, the bags being pierced with small holes by a sail needle, through which the oil slowly exudes. These bags are placed in different positions, according to whether the ship is flying before the tempest, or lying-to comparatively motionless. This simple appliance is therefore within the means of every ship, and there can be little doubt that already many vessels owe their immunity from damage, and in some cases even their safety, to its employment.

Among remarkable instances of saving life, is one, cited by Admiral Cloué, of the boats of a ship burnt in 1885, 800 miles from the Seychelles Islands, in which the crew were making their way to land. A cyclone was encountered, which raised a terrific sea, but the boats, provided with oil by the prescience of the captain, weathered it out in perfect safety for sixty hours, riding to a floating anchor of their masts and oars, to which was attached a bag of oil.

Our author points out that from the time of Pliny oil has been thus used, but only by small communities, or by individuals, whose efforts to bring it into general use have always failed. Benjamin Franklin presented a paper on the subject to the Royal Society of London, which is printed in the Philosophical Transactions, 1774, but it remained without fruit.

Experiments were carried out in this country in 1883 by Mr. Shields, at Peterhead and Folkestone, with a view of diminishing the heavy sea at the entrance of these harbours. These experiments were successful, but at the expense of a great quantity of oil; the fact being that the conditions of breaking seas in shallow water are totally different from those in the open ocean.

Admiral Cloué remarks on the great utility of oil when wrecks have to be boarded; and suggests that the builders of rock lighthouses, when their work is delayed by the difficulty of landing material, might find it to be of much service.

The general application of oil is in fact yet in its infancy, and everyone must welcome any such good collection of facts, and of suggestions tending to extend its sphere of usefulness, as that given in "Le Filage de l'Huile."

W. J. L. WHARTON.

OUR BOOK SHELF.

Comparative Morphology and Biology of the Fungi, Mycetozoa, and Bacteria. By A. De Bary. Translated by Henry E. F. Garnsey, M.A. Revised by Isaac Bayley Balfour, M.A., M.D., F.R.S. (Oxford: Clarendon Press, 1887.)

ANYONE acquainted with the numerous researches of De Bary, published in German, will readily indorse Prof. Balfour's remark in the preface to this English translation, viz. "it brings within reach of all English-speaking students the most thorough and comprehensive treatise upon these groups which has appeared in any language," and after perusing this volume we should add that "a finer volume, and a more handsomely and exhaustively illustrated one," is not known in the literature of this subject.

The book seems to us more like a well and comprehensively arranged collection of classical monographs on Fungi and allied organisms, written by a master mind, translated by a scholar, and revised and edited by a practical worker and teacher of these subjects.

It is difficult to pick out any one chapter in which this is not conspicuous. The array of facts, and of phenomena as to form, growth, and development of Fungi, and minute details bearing important relations to one another and to the whole, are told with singular lucidity and in comprehensive sequence; and numerous suggestions that at once engage and invite the reader's and student's inquisitive mind are everywhere, almost on every page, to be met with. As the title of the book indicates, the subjects of Fungi, Mycetozoa, and Bacteria are each separately treated in the first, second, and third parts of the volume respectively.

As was to be expected from De Bary's researches, the first part forms the bulk of the volume. As far as our present knowledge of the ever-enlarging subject of the thallus, spores, and development of Fungi goes, hardly anything could be added to make the book complete both for students and workers; but we venture to think that in Chapter V., besides the important bibliography added to the description of the different groups of Fungi, an appendix setting forth briefly the various species hitherto recognized, not only in name but also in distinguishing characters, would be a valuable addition.

This is still more the case in the third part—Bacteria. We doubt whether this will advance the knowledge of the student beyond a general insight into the nature and mode of life of Bacteria, though he will find here a most valuable and suggestive account of the different modes of spore-formation.

The illustrations are very numerous and well rendered. The bibliography in the first part (Fungi) is carefully and judiciously arranged.

As to the translation little need be said. It is excellent, and the book reads more like an original than a translation, if it were not that one is repeatedly reminded of the contrary by the presence, after an exact rendering in English, of the original German. There seems to be really no necessity to put (p. 1) after filamentous Fungi (*Fadenpilze*); (p. 2) after compound Fungus body (*Zusammengesetzter Pilzkörper*); (p. 4) after sprouting Fungi (*Sprosspilze*); (p. 73) endogenous spore-formation (*Endogene Sporenbildung*); (p. 84) solution or gelatinous swelling (*Auflösung, gallertige Verquellung*).

Why should (on p. 110) to "tube germination" be added (*Schlauchkeimung*); to "sprout germination" (*Sprosskeimung*); to "germ tube" (*Keimschlauch*)?

It is different with "abjunction" and "abscission" explained on p. 61 in a footnote, for here confusion might arise as to the exact meaning of the German "*Abgliederung*" and "*Abschnürung*."

The "Explanation of Terms" at the end of the volume is in this respect most welcome.

E. KLEIN.

Emin Pasha in Central Africa. A Collection of his Letters and Journals. Edited and Annotated by G. Schweinfurth, F. Ratzel, R. W. Felkin, and G. Hartlaub. Translated by Mrs. R. W. Felkin. (London: George Philip and Son, 1888.)

THE personal interest connected with this volume is even greater than its scientific interest. Emin Pasha already ranks as one of the heroes of the modern world, and the record of the bare facts of his career has all the fascination of a good romance. Appointed in 1878 to be Governor of the Equatorial Province, he ruled his territories with astonishing vigour and discretion, so that in 1882 he was able to report that slave-dealers had been wholly banished from his borders, and that the people subject to him were prosperous and contented. The troubles in the Soudan created for Emin many most formidable difficulties, but his courage never failed him, and we may hope that long before this time he has been stimulated to fresh hope and activity by aid received from Mr. Stanley. The letters translated in this volume begin with one dated Dufilé, July 16, 1877, and include several received by friends in the course of last year. They bring out indirectly all the qualities of Emin's character, and no one can read them without being filled with admiration for his sustained enthusiasm, his inexhaustible energy, and his unaffected simplicity and modesty. He has been too much occupied with official duty to devote as much time as he would have liked to scientific investigation; but he is an ardent student of zoology, botany, and ethnography, and he says enough to show that we may expect from him hereafter very important contributions to our knowledge of all these subjects. So far as the present volume is concerned, the most valuable of the letters, from a scientific point of view, are those relating to the various tribes whose habits and customs he depicts. His descriptions are remarkably vivid, and are evidently the result of much careful observation. His description of the Wanyoro, for instance, is a model of what such a piece of work ought to be. The writer omits no characteristic that is likely to be suggestive to anthropologists, while he has taken care not to spoil the general effect of his sketch by the intrusion of unnecessary details. Dr. Felkin's introduction is written with perfect tact and judgment, and Mrs. Felkin has done her work as a translator admirably. An excellent map has been prepared by Mr. Ravenstein, who has also done good service by marking the latitude and longitude of every place mentioned in the index and glossary.

Colour. By A. H. Church, M.A. (London: Cassell and Co., 1887.)

IN a work which has been limited to somewhat less than 200 pages, there has of necessity been a good deal omitted which would have been found in a larger work. In the part devoted to the production of the spectrum, the details are almost absent in some particulars and perhaps are rather too full in others. The subject of polarized light is also dismissed too briefly. There are one or two statements to which exception can be taken. The first is where the author states (p. 44) that "calorescence may be regarded as a variety of fluorescence." The introduction of the term calorescence at all is a mistake; but it is a greater mistake to mix it up with what is a really distinctive phenomenon.

Another is at p. 78, where the author says, when speaking of a person who is "red" colour-blind, that "the nerve fibrils which in the normal retina receive the sensation of red are not, indeed, wanting, but transmit to the brain the same sensation as that transmitted by the second set of fibrils, the green." This doctrine is rather against facts: the fibrils are either wanting or else are paralyzed, as the total amount of light perceived by the red colour-blind person in white light is less than that perceived by the normal-eyed person. The sensations of the green and blue primary colours are on the average equal in both, but the normal-eyed person has in addition the red sensation. If the fibrils which in the normal-eyed person respond to the red respond to the green in the red colour-blind person, this would not be the case.

With these and one or two minor exceptions the work is to be recommended for accuracy; and the author may claim to have accomplished what he states in his preface he has endeavoured to do, viz. "to present and to explain in a concise yet popular form many of the chief facts connected with the origin, the phenomena, and the employment of colour."

Astronomy for Amateurs. By J. A. Westwood Oliver. (London: Longmans, Green, and Co., 1888.)

THIS volume, to quote the preface, "is intended to afford the amateur astronomer, possessed of limited instrumental means, but yet anxious to devote his labours to the furtherance of astronomical science, such hints and suggestions as will help him to direct his efforts into the channels which experience has indicated as best fitted to his qualifications and equipment." Its pages are accordingly entirely devoted to practical astronomy, theories of every description being disregarded. The different branches of the subject are dealt with by well-known specialists, Mr. Oliver's share in the work being chiefly editorial. The fundamental chapter on the telescope and observatory, which is full of practical information, is appropriately contributed by Sir Howard Grubb. Mr. Maunder contributes an instructive chapter on the sun; Mr. Gore deals with variable stars, of which an admirable list is given; and Mr. Denning gives directions to those who are anxious to distinguish themselves as comet-discoverers. The chapter on the moon is very detailed, and, with the index map, will be of great service to observers of our satellite. Special stress is in all cases laid upon the importance of adapting the ends to the means. The book is thoroughly practical throughout, and Mr. Oliver deserves the thanks of all who are interested in the progress of astronomy, for bringing together such an excellent series of papers. Celestial spectroscopy and photography are reserved for a forthcoming volume, which we sincerely hope will not be behind the one already issued.

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 Micromillimetre.

PROF. RÜCKER's note in NATURE, of February 23 (p. 388) induces me to ventilate a suggestion in nomenclature which, among other advantages, might reconcile the practice of botanists and biologists with the C.G.S. system by leading to the disuse of the prefixes *mega-* and *micro-* in favour of *self-significant* prefixes.

It is not improbable that, in spite of Prof. Rücker's protest, the arbitrary definition of the prefixes *mega-* and *micro-*, laid down in the C.G.S. system may come, or continue, to be disregarded in different departments of science, until the ambiguity thence arising necessitates their disuse, as the disuse of the words *billion*, *trillion*, &c., is necessitated by their different senses in English and French. Be this as it may, it is certainly desirable that those who are not in the daily habit of speaking of *megohms*, *megadynes*, *micromètres*, &c., should be saved the necessity of recalling, or hesitation in realizing, the precise meaning of the prefixes.

Instead of denoting *decimal multiples* by Greek, and *decimal parts* by Latin, prefixes to the name of the unit, let the multiples be denoted by the addition of a termination *-n* (say), with a suitable vowel, and the parts by that of a termination *-t* (say), and let the *order* of multiples and parts alike be denoted by numeral prefixes indicating the *power* of ten by which the unit is multiplied or divided, or, what is the same thing, the distance of the digit denoting it from the units digit.

Thus, starting from the *metre*, instead of the scale—

metre { decametre, hectometre, kilometre, &c,
decimetre, centimetre, millimetre, &c.,

we might adopt the following:—

metre { metron (or monometron), dimetron, trimetron, tetrametron, &c.,
metret (or monometret), dimetret, trimetret, tetrametret, &c.

Then the *micromètre* (the botanists' *micromillimetre*), would become the *hexametret*; the *megohm*, the *hexohmen*; the *megadyne*, the *hexadynen*, &c.

As an aid to the memory, such a system would be valuable, reinforcing the *visual* memory, which has (I think) in many cases to be relied on, by a corresponding *oral* reading. Thus, the unit of attraction of gravitation in the C.G.S. system is about $6\frac{1}{2} \times 10^{-8}$ dynes, that is, in the proposed language, $6\frac{1}{2}$

octodynets. So, too, Joule's equivalent J, which is about "$4 \cdot 2 \times 10^7$ ergs per gramme-degree Centigrade" (Everett's "Units and Physical Constants"), would be more easily remembered as 4·2 *heptergons.* Again, the velocity of light would be (approximately) expressed as 3 *octometrons* per second, or 3 *decavelons*, if the word *vel* were adopted for the unit speed in the C.G.S. system—namely, that of 1 centimetre (or *dimetret*) per second. I have chosen these instances, as cases where the prefixes mega- and micro- would be of little use as aids to expression or memory.

The system I am advocating coincides exactly with the method, which I believe most intelligent teachers of arithmetic are adopting, of reckoning the place of any digit of a number by its distance, not from the decimal point, but from the unit's digit. This distance it has been proposed to call the *order* of the digit, so that the order of the unit's digit is 0; those of the tens, hundreds, &c., 1, 2, &c.; and those of tenths, hundredths, &c., − 1, − 2, &c. Then, if the *order* of a number be regarded as that of its highest digit, its *order* is the *characteristic* of its logarithm. I forbear to dilate on the advantages of this reform in arithmetical language, but it is obvious that the proposed system naturally arises out of it. If the British Association or the Physical Society should, after discussion, accept the principle of the proposed nomenclature, and give it the stamp of their authority, I believe they would add to the benefits they have already conferred on science by the introduction of the C.G.S. system of units. My proposal would not extend to attempting to replace the words in ordinary use—kilometre, millimetre, kilogramme, &c.—unless they, in the course of time, died out, replaced by the synonyms here proposed on the principle of the "survival of the fittest."

Harrow, February 27. ROBT. B. HAYWARD.

IN NATURE of February 23 (p. 388) there appears an interesting letter from Prof. A. W. Rücker with reference to the equivalent value of the "micromillimetre." It is therein mentioned that the micromillimetre is commonly employed by biologists as equivalent to one-thousandth of a millimetre; but that the proper name for the thousandth of a millimetre (μ) is "micromĕtre," and not "micromillimetre."

Permit me, however, to suggest that even the denomination "micromĕtre," may be hardly acceptable to scientific workers. The denomination for the measure of the one-thousandth of a millimetre (μ), or 0·000001 metre, is "micron," and not "micromĕtre."

For the "micron" we have the authority of the "Comité International des Poids et Mesures." One shudders at the thought of the confusion likely to arise when computers are required to deal with both micromĕtre-units and micromēter-divisions.

The Comité International have also recommended the use of the following metric denominations for minute measurements:—

Denomination.	Symbol.	Equivalent.
Micron	μ ...	0·001 millimetre.
Microgramme ...	γ ...	0·001 milligrame.
Millilitre	ml ...	0·001 litre.
Microlitre	λ ...	0·000001 litre.

For the millionth of a millimetre we have at present the (C.G.S.) denomination "micromillimetre" ($\mu\mu$), as pointed out by Prof. Rücker. H. J. CHANEY.

7 Old Palace Yard, Westminster, February 27.

ALLOW me to add a few remarks to Prof. A. W. Rücker's letter, published in your issue of February 23 (p. 388).

Mr. O. J. Broch, Correspondent of our Institute in its Section of Mechanics, and Director of the International Board of Weights and Measures, having kindly undertaken to ascertain by actual measurement my pendulum's coefficient of expansion by heat, began by asking how old it was. On my expressing surprise at such a question, he told me that, having carefully measured the length of a brass rod recently made and 1 metre long, he found that it became shorter by 8 *microns* in the first year, and 3 more in the second one. *Micron* is currently used here to express 1/1000 of a millimetre. French botanists call it μ, and seldom use its first decimal because they cannot see such a small space.

The only objection against *micron* is that, unlike other subdivisions of the metre, it does not define its length by its name. But the word *metre* has itself the same fault. It is the ten-millionth part of a quarter meridian, and is, according to Clarke's computations, too short by 0·2 millimetre, or, more exactly, 187·7 microns. Improvements in geodesy will probably alter in either sense that fraction which is too small to disturb terrestrial requirements.

The quarter meridian being the true basis of our metrical system, it ought to have a name of its own, and might be called *megist*, as being the greatest space accurately measured. It should be the *metre* used in astronomy. Thus the velocity of light would be 30 megists, the motion of the star Aldebaran in the line of sight would be 18 megists per hour, and the sun's distance 15,000 megists ± 50. To give the latter in kilometres or miles is tantamount to describing the height of St. Paul's in London as being 1,100,000,000 microns. It is useless to express a distance in units so small that one of them may be added or subtracted without altering our useful notion of the whole sum. Moreover, those who can grasp at once a practical idea of such huge numbers are few and far between.

February 29. ANTOINE D'ABBADIE.

Coral Formations.

MR. G. C. BOURNE's observations, as far as described in last week's NATURE (p. 414), appear to corroborate fully the view that corals grow more rapidly and luxuriantly on those parts of a reef or bank where there is an abundant supply of food, and only in scattered patches where the food supply is limited or where there is a quantity of sand or other inorganic materials in the currents. He states his belief that "the favourable conditions are due to the action of currents on coral growth." If it be not the food in these great oceanic currents, then Mr. Bourne should tell us what it is in "the action of currents" bathing the outer slopes of a reef that renders them favourable to growth; does he hold to the old view of more oxygen in the water?

It is to be hoped that Mr. Bourne has observed some of the corals feeding on the outer slope or in the lagoon, and can tell us of what their food consists. It will be interesting to know if he has worked his tow-nets in the outer currents, in the "strong currents," and in the still water, and has made a comparison of the results. If he has done so, his paper will doubtless be one of great interest and value.

There would appear to be a slip of the pen in the passage where Mr. Bourne refers to a current impinging directly on a slope. JOHN MURRAY.

An Incorrect Footnote and its Consequences.

THANKS to the wide circulation of NATURE, my original note with the above heading has attracted attention in quite a number of the proper quarters. Several letters have reached me on the subject, and more than one of the writers, after reporting that the *Demonstratio eliminationis Cramerianæ* had been found properly catalogued under De Prasse, proceed in consequence to express their surprise at Baltzer's mistake. Mr. Copeland's letter in yesterday's NATURE (p. 343) adds another instance of this correctness of cataloguing. The additional fact, which he mentions, that there are two copies of the *original edition* of the *Demonstratio* in the Dun Echt library is very interesting, and is a fresh proof of the existence there of valuable rarities.

When, however, Mr. Copeland diverges into the fruitless path of "the might have been" he is much less pleasantly instructive. Having read my letter on the search for a work by Mollweide, and on the discovery that the work meant was not by Mollweide at all but by De Prasse, Mr. Copeland turns to his catalogue under Mollweide, finds a cross-reference to De Prasse, looks up De Prasse, picks out the desired plum, and is pleased accordingly. In all this there is nothing singularly lucky or otherwise: it is exactly what ought to have happened. Mr. Copeland apparently thinks that the cross-reference in the Dun Echt catalogue was the missing link; but if he had had occasion to look up other catalogues besides his own he would have found the same cross-reference or a more complete one, and might then have given my helpers in the search a little more credit. The fact is that the booklet of mathematical tables which was the cause of the cross-reference (and whose title Mr. Copeland carefully transcribes) is a comparatively common book, having gone in its time through several editions. Its name is thus of not infrequent occurrence in catalogues, being placed under De Prasse with a reference to Mollweide, or *vice versâ*; and, so catalogued, it was repeatedly met with by us. There were, however, two points of difference between Mr. Copeland's position and ours. We unfortunately knew from the first what the cross-reference was for, and Mr. Copeland did not: we did not know that Mollweide was not the author, and Mr. Copeland, having read NATURE, did.

The hint is further let slip that something in Poggendorf "might have given a clue to the authorship." All I can answer is that at least two librarians looked up Mollweide in Poggendorf, and were not erratic enough to think of the clue. Indeed, the main part of my original letter has been written in vain if I have failed to make clear that at first we did not seek for "a clue to the authorship," Baltzer having so cruelly misled everybody by asserting in the usual matter-of-fact way that the author was Mollweide. And what I wanted to insist upon was the following simple canon—*Never, so long as books are catalogued as at present, insert without comment an author's name in a title where no author's name exists.* THOMAS MUIR.

Bothwell, Glasgow, February 11.

Cause of September Typhoons in Hong Kong.

AN investigation of the average distribution of atmospheric pressure in South-Eastern China and neighbouring regions has proved the existence of a trough of relatively low pressure in the channel between Formosa and Luzon, and in the northern part of the China Sea during September. This appears to be the reason why typhoons so frequently enter the China Sea during that month of the year, and cause north-east veering to south-east gales to be felt in Hong Kong. Like storms that visit the British Isles, they move along between two areas with higher pressures, and are sometimes developed under the influence of those areas. This remark would be of considerable value in forecasting typhoons in Hong Kong if the district round the China Sea were better furnished with telegraphic reporting stations than it is at the present time. W. DOBERCK.

Hong Kong Observatory, January 11.

The Composition of Water by Volume.

IN my paper "On the Composition of Water by Volume" (Proc. R.S. 1887, 398) the ratio 1·994 volumes of hydrogen to 1 volume of oxygen was given as the most probable value, as I assumed that both gases were of an equal degree of purity. The ratio 1·9967 : 1 was given from the best six experiments if the impurity be supposed to be altogether in the oxygen. At the last meeting of the British Association (B.A. Trans., 1887, 668) I pointed out that this was the most probable ratio, as I had found the impurity to be chiefly oxides of carbon arising from the combustion of traces of the vaseline used in lubricating the stop-cocks finding their way into the eudiometer. Dr. Sydney Young's interesting and ingenious letter (p. 390) is a most valuable corroboration of the hypothesis that the impurity is almost entirely due to the oxygen. A new and larger apparatus, enabling me to use twice the volume of gas, and to measure with much greater accuracy the residue, as well as make a complete analysis of it, still gives a ratio of less than 2 : 1, as the four last experiments made with it show.

	Measured volumes.		Residue.				Combining volumes.		Ratio.
	H	O	H	CO_2	CO	N	H	O	
I.	6969·4	3451·2 ...	38·9	7·2	7·9	0·7 ...	6870·5	3440·1 ...	1·9972 : 1
II.	6882·2	3114·2 ...	74·9	2·6	5·3	3·6 ...	6807·3	3409·0 ...	1·9968 : 1
III.	7657·2	3798·7 ...	63·3	—	—	0·8 ...	7593·9	3798·7 ...	1·9980 : 1
IV.	7561·4	3777·9 ...	19·9	—	—	0·7 ...	7541·5	3777·9 ...	1·9962 : 1

In Experiments I. and II. vaseline was used as the lubricant, and in III. and IV. syrupy phosphoric acid, by using which all traces of the oxides of carbon are eliminated, and the gases shown to be of a high degree of purity. If we allow that half the amount of oxygen which was used to burn the carbon would be required in addition to burn the hydrogen combined with it in the vaseline, then the ratio becomes 2 : 1.

To use phosphoric acid as a lubricant with security, I find it is necessary to use safety-taps, and am having them in place of the ordinary ones now on my apparatus, and hope very shortly to settle beyond all doubt the true ratio in which hydrogen and oxygen combine to form water.

The ratios of the CO and CO_2 in Experiments I. and II. recall Bunsen's experiments. ALEXANDER SCOTT.

Durham, February 27.

Water Supplies and Reservoirs.

HAVING observed in NATURE (p. 375) an article on the drought of past years, and the probability of one this year also, from deficient rainfall, I take the occasion of suggesting that the old reservoirs might still be made more available for an additional storage of water to counteract its effects. As there is always abundance of rainfall, 40 inches, in Lancashire, and on its surrounding hills, from the cities of which district come complaints of want of water supplies, no fear need be entertained of lack of water if the rain could be all impounded without loss.

It has appeared to me surprising that our hill reservoirs have not been excavated deeper into the valleys and ravines they are made out of, after the manner of the water tanks in India.

In this country a reservoir seems to be simply formed by making a rampart across a ravine, and letting the upper part fill itself, as it stands naturally, with rain in course of time.

The ravine still lies encumbered with sodden grass, stumps of trees, rotting herbage, old walls, and fences, with organic remains, and submerged under the impounded lake, so that an emptied reservoir looks like a long mud ditch, through which a flood or a sea tide had lately passed.

Now if the sides were cut down perpendicularly, and the bottoms levelled horizontally, such valley reservoirs would be able to contain twice as much water as they now do, on the principle that the area of a rectangle is twice as great as that of a triangle between the same parallels.

The whole area of the reservoir might possibly be excavated cleanly out, so as to have its sides and bottom as good as any wet dock in a seaport, and our water supplies would then be considered quite sufficient, and of better quality, for the great towns. If this were done, say, for Liverpool and Manchester, there might be found less need for constructing new and distant waterworks, as the present reservoirs when thus enlarged would hold nearly double the amount they now do.

Besides the lessened rainfall, all reservoirs must suffer serious loss by evaporation, especially in dry seasons, and this is not occasioned so much by the sun's heat as by the action of drying winds, which may carry off as much as 0·20 inch per diem, or 6 inches in a month, or more than an average monthly rainfall. To counteract this tendency, belts of trees planted round the margins of reservoirs are found very useful in sheltering the surface of the waters from the winds, and they act beneficially besides in attracting rain itself to the pools. Further, on the same idea it might be found advisable to cover over entirely the head tanks for city supply, with sheds or roofs, so as to keep off the sun's rays from the water; or else to erect a high screen on the windward side to keep the prevailing winds off the surface, and counteract unnecessary evaporation.

Edinburgh. W. G. BLACK.

A Photographic Objective.

MY attention was called some time since to a letter from Prof. Pickering in your issue of October 13, 1887 (vol. xxxvi. p. 562), describing a form of objective adaptable either to photographic or visual work, by reversion of crown lens and alteration of its distance from the flint.

The form described is exactly similar to that which had been suggested to me by the President of the Royal Society, and which I reported on at the June meeting, 1887, of the Royal Astronomical Society, as having been actually constructed and found to give good results (see *Observatory*, No. 125, pp. 253 and 254).

I should perhaps have mentioned this matter before, but thought that Prof. Pickering would certainly have seen the published account of my previous communication. I have, however, lately seen a newspaper report that a patent has actually been granted for this form of objective.

It therefore appears necessary to point out that this form had been previously suggested by Prof. Stokes, and put in actual practice here.

I may mention that long previous to Prof. Pickering's communication, I had arranged with the Astronomer-Royal to construct the new 28-inch objective for Greenwich Observatory on this principle on certain conditions, and also that this particular form of photographic objective has a distinct place in the last edition of my catalogue. HOWARD GRUBB.

Rathmines, Dublin, February 27.

A Green Sun.

I WAS looking, a few days ago, at three o'clock in the afternoon, towards the sun, which was shining in a clear sky. Exhaust-steam from an engine employed in the new Thames Tunnel works, and situated just below my window, was passing intermittently over his face. Many puffs had already crossed it, some partially, others completely obscuring the luminous disk, when presently, three puffs, following each other quickly, successively covered the sun, which then shone brightly through the steam with a vivid light-green colour. The effect was strikingly noticeable, and the green colour intense. I watched for twenty minutes, but in vain, for another "green sun," and at 3.30 clouds came up.

I have since tried to reproduce the same effect by observing the arc lights in Cannon Street Station through steam rushing upwards from the safety-valve of a locomotive. Seen through the thickest part of such a column of vapour, the electric light exhibits a deep red colour, and I *think* there is a green transmission near the edge of the column; but the latter was unsteady, while the point is evidently critical, and it is impossible to say positively that it was so. D. PIDGEON.

Holmwood, Putney Hill, February 11.

RABIES AMONG DEER.

THAT all domesticated or semi-domesticated mammals succumb to inoculation with the virus of rabies has long been asserted, and examples of its occurrence have been duly recorded. The possibility, however, of the disease affecting half-wild animals seems to have been lost sight of, and it was therefore with much surprise on the part of the public that the announcement was received last year of the deer in Richmond Park being attacked by the malady.

Apart from the general interest attaching to the welfare of the public using the parks in which these animals are kept, and beyond the special interest felt by the veterinary profession in the clearing up of the diagnosis of this strange and novel condition, the outbreak was of importance as affording a fresh opportunity of investigating the character of the malady under, as it were, new circumstances, and hence we find in the reports of this epizooty recently furnished to the Privy Council by Mr. Cope and Prof. Horsley, many points which fill up certain blanks in our scientific information on the subject.

The prevention of rabies in all animals we have shown before to be the simplest task imaginable for the health authorities of this country to undertake, and nothing illustrates this more clearly than the history of the recent epidemic, which attracted so much notice on account of its excessive mortality, and which terminated by causing the local mischief which forms the ground of this article.

It will be remembered that in 1884 rabies began to increase in the London and home counties districts. No notice being taken of its spread, it soon produced a severe effect, when in 1885 the numerous deaths (twenty-seven) among human beings caused a popular panic, and led the authorities to institute measures for its repression. The authorities in the London district having provided for the merciful extirpation of stray dogs, the familiar vehicle of the disease, secured the non-transmission of the virus by enforcing the use of muzzles. The result of their work during 1886 has been seen during 1887, in the practically total immunity of the population of this great city from this the most justly dreaded of all diseases. Let us not forget to add in passing that as was pointed out at the time of the expiration of the local regulations by those acquainted with the malady, that the measures being but local could only produce a temporary relief from the evil, since the metropolis was continually being infected from districts beyond the reach of the regulations, and that though it could be kept free for a time, yet reintroduction of the virus would certainly occur, and the work would have to be done all over again. This is actually now happening, though not yet officially declared. The disease has reappeared (as it has usually done) in the southern suburbs, and is gradually making its way into the metropolis.

But to return. The epidemic of 1885 terminated in the London district with the infection of the roe deer in Richmond Park, resulting in the extermination of several hundreds of these valuable and pretty animals. From Mr. Cope's interesting report it appears that the first to be seized was a doe which had a suckling fawn, and as we learn from the very valuable evidence of Mr. Sawyer, the head-keeper of the Park, it seems that under these circumstances a doe will attack a dog attempting to worry the herd, as a rabid dog passing through the Park would do. Fortunately in the Richmond case no instance occurred of the transmission of the disease from the deer to man through the dog as in an outbreak recorded in 1856 at Stainborough. Had this happened, the deaths of the deer would not have been attributed to various causes, poisoning, &c., as they now were until the remarkable aggressiveness of the affected animals led to a thorough investigation by the veterinary advisers of the Government. Rabid deer were sent for observation to the Veterinary College, and the symptoms noted. The exact determination yet remained to be made, and, thanks to the recent researches of M. Pasteur, this was now possible. Portions of the central nervous system from these animals were sent to the Brown Institution, and there inoculated by Prof. Horsley into rabbits by the subdural method. These animals died after exhibiting the characteristic symptoms of rabies, and after death the usual *post-mortem* appearances were duly discovered. More infected deer were sent also to the Brown Institution, and the extraordinary changes effected by the disease more closely studied. This kind of deer, naturally gentle and timid, was transformed into a fierce and savage animal, rivalling the rabid horse almost in its attempts to do mischief. The early symptoms, as in all animals, appear to have been indicative of mental hallucination, for the animals would stop feeding, hold up their heads, sniff the air, and then, without the slightest reason, burst into a gallop. When placed in confinement the least noise attracted their attention, and later—*i.e.* on the second and third day—caused them to charge in the direction of the sound. The mental perversion which leads a rabid dog one moment to lick with almost frantic energy a healthy dog placed with it, and then the next moment to violently bite it, finds its parallel in the deer similarly affected, for these animals in a like manner licked their companions, and then ferociously attacked them, seizing them with their jaws (usually about the shoulders) and tearing off hair and pieces of skin. The points thus inoculated with the virus after cicatrization became, as is almost invariably the case, the seat of intense irritation when the disease actively showed itself; hence one of the most prominent signs presented by the animals was that of their rubbing themselves with such force as to make these parts raw. In connection with the differences which are now known to be characteristic of the same disease in different classes of animals, it is interesting to note that in all large animals, whatever be the previous temperament, the course of the malady is closely identical; thus in the horse, the ox, the sheep, the pig, the deer, &c., the illness is rapid, there is great aggressiveness, and yet early paralysis. It is of common knowledge that in the dog these two latter features are sometimes widely separated. The paralysis may set in so soon as to obliterate aggressiveness, and thus a distinct form (dumb) of rabies be produced, though of course the aggressive form of the disease always ends in paralysis if not suddenly arrested by syncope. In the deer the combination of the two symptoms seems to have been very equal. For even when the animal had fallen down from paresis (of the hind-limbs more especially) it would nevertheless spring up and attempt to seize and worry with its teeth every person or object coming within its reach. The complete metamorphosis of the usual temper of the animal is of course only to be explained by profound mental disturbance, exactly as seen in the human being. We have alluded to the mode of transmission of the disease—viz. through the saliva. This mode was put to direct experiment by an infected animal being placed with a healthy one which had been isolated for some time, and the incubation period was determined in this instance to be nineteen days, the comparative shortness of the period being no doubt due to the very numerous points of inoculation. An interesting and confirmatory circumstance of the reality of this method of transmission was afforded by the fact that so long as the bucks retained their horns they were able to literally stave off infection, but as soon as these natural means of defence fell off at the usual periods, both sexes suffered alike.

The mode of death seems in all cases to have been ultimately cardiac failure, which supervened frequently before the customary coma, the final stage of paralysis, was developed. Relatively, syncope occurred much more frequently than it does in the human subject, and *a fortiori* than it does in the dog, a circumstance explicable by the necessarily extremely fatiguing nature of the fits of excitement to which deer are evidently specially liable in the early development of the disease. According to Prof. Horsley's pathological report, both macroscopic and microscopic appearances of the affected tissues revealed the usual lesions which are symptomatic of rabies. This last fact is a healthy sign of scientific progress, for any layman who has sought to obtain from books or verbal statements made by those justly recognized as being qualified to speak with authority on this subject must have been disappointed with the uncertainty of knowledge which has prevailed respecting the morbid anatomy of rabies up to the present time. The obscurity which existed on this point was aggravated no doubt by the absurd popular superstitions connected with the disease, and by the failure to recognize that it was simply a very severe kind of one of the acute specific maladies. From the latter cause especially has confusion arisen, since it will be found that previous records of the *post-mortem* appearances fallaciously comprehend the examination of animals dying at all possible stages of the malady. But now we know these points accurately; and as in this particular case the subject has been so thoroughly worked up, there will be scarcely any excuse for the disease escaping immediate recognition and adequate treatment.

Here we cannot help pointing out what a very grave injury is inflicted on the public by the vexatious operation of the so-called Vivisection Act, which prevents the veterinary inspector from at once resorting to M. Pasteur's admirably simple and conclusive method of testing the real condition of any animal killed under the suspicion of rabies. Under the present *régime* valuable time is lost, and risk incurred of the inoculative material becoming useless from decomposition, &c., by reason of his being compelled to forward it to some such institution as the Brown for examination. The very valuable observation recently published by M. Pasteur's assistant Dr. Roux, that the immersion of the tissue in a mixture of glycerine and water prevents septic change, but does not mitigate the influence of the virus, to a slight extent obviates part of the difficulties and inconvenience just noted, but the anomaly still remains that, while the immense value of the experimental test has received the full recognition of the recent Committee of the House of Lords, the law does not permit it to be used except in one, or at the outside two places in Great Britain, which have with the usual difficulties and obstruction succeeded in obtaining the necessary permission. No one perhaps supposes that the benefits which science offers to the public will ever be received with anything like adequate acknowledgment of the difficulties, and it may be dangers, which have attended this or that particular discovery. But we think that it cannot be recognized by the mass of the people who actually or theoretically direct the Legislature by their votes, that, while they eagerly reap the benefits of the harvest of science, at the same time they permit that harvest to be choked by the tares of legislative obstruction, and thus very greatly diminish the profits which would otherwise be theirs.

Just as we are much behind other nations in the foundation of technical instruction, so we are being fast outstripped in the provision for means for the scientific investigation of matters which, like the one we are now considering, greatly concern the public welfare. We believe it to be a fact that at the present moment neither of the two great Government Departments which are concerned in the scientific arrest of national disease, viz. the Privy Council and the Local Government Board, have any laboratory whatever at their disposal, and consequently are obliged to seek the necessary accommodation in private institutions; or, to put it in plain language, the Government is not ashamed to get its public work done by the favour of private means. The Berlin Laboratory and the Pasteur Institute should serve as the kind of example which a statesman whose desire for the improvement of the country and the people is not a question of votes but of genuine interest might study with advantage.

Those gentlemen, unfortunately few in number, who represent science at the present moment in Parliament, would have a large field of good work open to them if they attempted to reform this state of affairs by adjusting the advantages and assistance offered by science to the real needs of the nation. At present the actual opinion of the scientific world on any subject of special interest is usually only extracted with difficulty by evidence before a Select Committee. It would be very easy for the scientific members of the House to concentrate their force by previous meeting and organization, and so to give weight to that side in a debate which was truly working for the best solution of any national problem involving health and disease. In former years, the opinion of unscientific persons has been sought on the subject of rabies as being of equal weight with the assured observations of scientific experts. This lamentable state of things has led to the present condition of our legislation against this disease, under which the malady is but temporarily, if readily, stamped out in one district alone; this same district becoming infected again from neighbouring parts of the country as soon as the regulations are withdrawn. There is no doubt from the minutes of the Lords Committee on Rabies, that the Report of that Committee was drafted in this unfortunate manner owing to the influence of Lords Mount-Temple and Onslow, who, in their speeches and writings, have afforded numerous evidences of their complete want of scientific knowledge of the nature of the disease, and who, consequently, have failed to grasp the most obvious way in which it can be extirpated—namely, the universal application of preventive legislation. Mistakes of this kind, it seems to us, would be utterly prevented by combined action of the scientific members of either House, and if, as is sometimes our unfortunate duty, we have to chronicle ill-advised measures of suppositiously scientific officialism, let us hope they will not have passed out into law without a strenuous protest from the *united* voice of "our representatives."

THE COMING OF AGE OF THE "JOURNAL OF ANATOMY AND PHYSIOLOGY."

DURING the past summer there was established (as our readers have been informed), under the title of the "Anatomical Society of Great Britain and Ireland," a new brotherhood of anatomists; and the adoption by it of the above-named journal as a medium for publication, taken in conjunction with the fact that the same has entered on its twenty-second year, affords a fitting opportunity for briefly reviewing its progress and prospects.

Of the work of the Society to which we have alluded it would be premature to judge. It has been founded in the cause of "those interested in the science of anatomy," and on glancing through its roll of members we see that the comparative and human anatomist are, at last, at work in a common cause. All modern experience shows it to be a truism that the study of human anatomy, if it is to bear good fruit, must be based upon the comparative method. It is well known that essays have long since been made, by certain leaders at home, and by Coues more especially in America, towards the realization of this dream: we will not pause to comment upon the somewhat tardy manner in which these have been received by human anatomists at large. The new Anatomical Society, as its constitution shows, is alive to the truth we have asserted, and, this being so, we shall follow with extreme interest the progress of the new brotherhood, which, if properly ordered, cannot fail to exercise a most beneficial influence upon the healing art.

The journal which the founders of the new Society have selected as their mouth-piece has had, thus far, a successful run. To its pages most of our leading anatomists and physiologists have contributed, and within its covers lie papers which have revolutionized the particular departments of knowledge with which they deal. Fifteen months ago it entered, under a change of publishers, upon a "new series"; and more recently it has, under its extended auspices, as might be expected, shown signs of increase in bulk. Its editors have been ever indefatigable, and most willing to oblige all who have applied to them; but the limit of their generosity has most certainly been reached, and, unless we are sadly mistaken, they will before long find it necessary to reconsider their scheme. In anticipation of this, and in the interests of workers in general, we would advise a more judicious selection and revision of matter tendered for publication than is at present adopted. In the current number we find thirteen papers presented in all—some of great merit, others of a more questionable character. In one of them we read at the outset the remarkable statement that "the minute anatomy of the skin of the horse has never before been described," and at the conclusion the erroneous assertion that "having got perfectly free from the old hair the (hair-) papilla now commences secreting again." On reading this and certain other papers which have been published of late, we cannot close the volumes without being struck with the general looseness and absence of all regard for authority which pervade them. This should not be. To papers such as these the worker turns for originality, or, failing that, for at least a *résumé* of work done up to the time of writing: their multiplication, in the unsatisfactory form to which we now reluctantly call attention, is regrettable, and, in the interests of a literature already overburdened, greatly to be deplored.

By way of further insuring the restriction of the publication within reasonable limits, we would urge the exclusion from the body of each issue of pure compilations and papers wholly controversial—such, for example, as one a short time ago devoted to a consideration of the relations of the Mammalia to the lower Vertebrata, and others which could be named. Productions such as these, containing nothing original, and occasionally but a portion of that which is known on the subjects under review, should be dealt with as supplementary matter. We hear a great deal nowadays, on all hands, about the scant recognition of work done by our countrymen. The retention of papers such as those to which we have alluded, in an authoritative journal like the one before us, cannot fail to call forth the unwelcome "*enthält nichts neues*"; and if it be persisted in, is it not likely that we may yet have to thank ourselves, in a measure, for the supposed want of respect?

Far be it from us to discourage the efforts of individual workers. In calling attention to these defects we merely desire to guard against reproach. If the journal whose interests we are seeking is to continue its useful work done in the past, and to do justice to the best interests of its new supporters in the future, some such deliberate modifications as those to which we have pointed are called for. Far-reaching interests will not excuse inauthoritativeness, and, if the new leaven is to work its best, the rising generation of anatomists will not tolerate inefficiency.

NOTES.

BARON VON SCHWERIN, the Swedish explorer, has presented his whole collection of ethnographical objects, gathered during the last two years' journeys in Africa, to the National Ethnographical Museum at Stockholm. The collection is the largest and most valuable ever presented to this institution by any private person.

ADMIRAL SIR ASTLEY COOPER KEY died suddenly last Saturday. He was in his sixty-seventh year. He had seen much active service, and had held some high appointments, including that of Principal Naval Lord of the Admiralty, and Director of the Royal Naval College, which owed much to his endeavours to apply science to the wants of the Navy.

THE Swedish Government has decided to expend £3000 on a new botanical museum at the Lund University.

THE eighth German Geographentag will be held at Berlin on April 4, 5, and 6.

FROM July 25 to 31 there will be held in Paris, in the rooms of the Medical School, a meeting of the Society for the study of Human and Animal Tuberculosis, under the presidency of Profs. Chauveau and Villemin. Interesting communications and papers are expected.

THE Chair of Psychology to which M. Ribot has been appointed has long existed in the Collège de France, and was not, as has been stated, established by the Paris Municipal Council. This Chair must not be confounded with that of *Philosophie Biologique*, which the Council is creating for Prof. Giard.

A SHORT course of lectures on "The Protection of Buildings from Lightning," by Prof. Oliver J. Lodge, F.R.S., to be delivered under the title of the "Dr. Mann Lectures," as a memorial of the late Dr. Mann, will be begun on Saturday afternoon next, March 10, at the Society of Arts. The course will consist of two lectures, the first of which will take the form of a slight historical sketch, and will call attention to the outstanding questions, difficulties, and points of controversy in connection with lightning-conductors. At the second lecture experimental answers will be given to some of the questions raised, and an endeavour will be made to supply a more complete account of the liability of conductors to side-flash than has yet been attempted. The chair will be taken at 3 o'clock.

LAST Saturday, Sir James Paget delivered an interesting address to the students attending University Extension Lectures in London. His subject was "Scientific Study," and he showed in a remarkably clear and striking way how the study of science develops the power of observation, fosters accuracy of thought, gives men a vivid conception of the difficulty of attaining to a real knowledge of the truth, and makes them familiar with the methods by which they may pass from that which is proved to the thinking of what is probable. He also offered illustrations of the power of science to minister to the needs of ordinary life, and to satisfy man's "insatiable appetite for the knowledge of wonders." Such addresses as this, delivered by acknowledged masters in their own departments of study, do excellent service to science by bringing prominently before the public the solid advantages which are to be gained by scientific training. They are also made the occasion of some good writing in the daily newspapers. The *Daily News*, for example, had an excellent article on Sir James Paget's address, enforcing the principle that "the study of science goes further than other studies to teach us the simple love of truth for truth's sake."

THE *Japan Weekly Mail* states in connection with the recent publication of the "Life and Letters of Charles Darwin" that the *Beagle*, in which Darwin made his memorable voyage, is now used as a Japanese training-ship. It is stationed at Yokosuka, a naval station in the Bay of Yedo, not far from Yokohama.

THE Directors of the Crystal Palace have arranged that the Photographic Exhibition shall remain open until March 17, a fortnight later than was at first intended. The public interest in this Exhibition is said to have exceeded the most sanguine expectations.

THE Council has reported to the Senate of the University of Cambridge against the admission of women to degrees.

AT the University of Zürich there are at present forty-five female students, twenty-nine of whom study medicine, fourteen philosophy, and two political economy. In 1887 there were 108 female medical students in Paris.

A NEW and most valuable method of determining the molecular weights of non-volatile as well as volatile substances has just been brought into prominence by Prof. Victor Meyer (*Berichte*, 1888, No. 3). The method itself was discovered by M. Raoult, and finally perfected by him in 1886, but up to the present has been but little utilized by chemists. It will be remembered that Prof. Meyer has recently discovered two isomeric series of derivatives of benzil, differing only in the position of the various groups in space. If each couple of isomers possess the same molecular weight, a certain modification of the new Van't Hoff-Wislicenus theory as to the position of atoms in space is rendered necessary; but if the two are polymers, one having a molecular weight *n* times that of the other, then the theory in its present form will still hold. Hence it was imperative to determine without doubt the molecular weight of some two typical isomers. But the compounds in question are not volatile, so that vapour density determinations were out of the question. In this difficulty Prof. Meyer has tested the discovery of M. Raoult upon a number of compounds of known molecular weights, and found it perfectly reliable and easy of application. The method depends upon the lowering of the solidifying point of a solvent, such as water, benzene, or glacial acetic acid, by the introduction of a given weight of the substance whose molecular weight is to be determined. The amount by which the solidifying point is lowered is connected with the molecular weight M by the following extremely simple formula: $M = T \times \frac{P}{C}$; where C represents the amount by which the point of congelation is lowered, P the weight of anhydrous substance dissolved in 100 grammes of the solvent, and T a constant for the same solvent readily determined from volatile substances whose molecular weights are well known. On applying this law to the case of two isomeric benzil derivatives the molecular weights were found, as expected, to be identical, and not multiples; hence Prof. Meyer is perfectly justified in introducing the necessary modification in the "position in space" theory. Now that this generalization of Raoult is placed upon a secure basis, it takes its well-merited rank along with that of Dulong and Petit as a most valuable means of checking molecular weights, especially in determining which of two or more possible values expresses the truth.

A REPORT on Indian fibres and fibrous substances exhibited at the Colonial Exhibition, 1886, has been published by authority of the Secretary of State for India. It contains the results of a laboratory investigation conducted by C. F. Cross, E. J. Bevan, and C. M. King, in association with E. Joynson; and Dr. George Watt contributes notes of methods of treatment and uses prevalent in India. In issuing the volume, the authors say that perhaps the utmost they can hope to do is to indicate the scope of a more adequate treatment of the subject. They are convinced that when the vegetable fibres come to be recognized as constituting a special field for research, and worthy the attention of those who have command of the necessary resources, there will be a considerable gain to science in the results of the systematic and sustained investigations which will follow.

MESSRS. LONGMANS AND CO. are preparing for publication "The Testing of Materials of Construction," embracing the description of testing machinery and apparatus auxiliary to mechanical testing, and an account of the most important researches on the strength of materials, by William Cawthorne Unwin, F.R.S.; "A Text-book of Elementary Biology," by R. J. Harvey Gibson, Lecturer on Botany in University College, Liverpool; "Dissolution and Evolution and the Science of Medicine," by C. Pitfield Mitchell; and "The Fundamental Principles of Chemistry practically taught, by a New Method," by Robert Galloway, Honorary Member of the Chemical Society of the Lehigh University, U.S.

MESSRS. SWAN SONNENSCHEIN, LOWREY, AND CO. are issuing, in parts, what promises to be a most useful publication—"The Cyclopædia of Education."

A FIFTH edition of Munro and Jamieson's "Pocket-book of Electrical Rules and Tables" has been issued. The first part of this excellent little volume deals with the fundamental principles and measurements of the science; the second part with their applications, including telegraphy, telephony, electric lighting, and the transmission of power by means of electricity. In the new edition many important additions have been made.

WE have received Part I. of "The Characeæ of America," by Dr. T. F. Allen. The author has postponed the publication of the work from time to time in order to accumulate material for a more complete account of the species growing in America. The demand in America for information concerning these plants is, however, so pressing that Dr. Allen has thought it best to issue the first part, which contains introduction, morphology, and classification. The second part will appear in a year or two, and will give descriptions of the species now known to inhabit American waters. The work is illustrated.

THE new number of the Proceedings of the American Philosophical Society (July to December, 1887), contains, among other important papers, a valuable "Contribution to the History of the Vertebrata of the Trias of North America," by E. D. Cope. There are also interesting papers on the question, "Were the Toltecs an Historic Nationality?", and on the ethnology of British Columbia, the former by D. G. Brinton, the latter by F. Boas.

MM. BEAUREGARD AND GALIPPE, of Paris, have issued a second edition of their practical guide to micrographical work. It has been much enlarged.

M. REINWALD, of Paris, has just brought out the first volume of MM. C. Vogt and Yung's "Anatomie comparé pratique."

THE Report on the Administration of the Meteorological Department of the Government of India for the financial year 1886–87 gives interesting details of the work carried on in the various provinces, and of the inspection of the stations. The observatories now number 135; three have been established in the new territory of Upper Burmah, where scarcely anything is yet known about the meteorology. Rainfall is registered at 486 stations, and bright sunshine at six observatories. Ground temperature is recorded at five selected stations, and some of the results are of great interest, showing that the average temperature of the ground in India is about 5° above that of the air; and also that there is a small oscillation of many years' duration, amounting to about 4°, affecting the air temperature and the intensity of solar radiation. Considerable attention is paid to the laws of drought, and the hope is expressed that by degrees they may be established on a sound physical basis. The influence of forests on rainfall has been fully discussed, and the evidence afforded is favourable to the assumption that forests increase the rainfall. The work of marine meteorology also is actively prosecuted; the weather charts of the Bay of Bengal have been lately mentioned (NATURE, December 8, 1887, p. 137). A work on the storms of that district is in course of preparation, and it is proposed to draw up a hand-book on the subject, for the use of seamen.

UNDER the title of "Deutsche ueberseeische meteorologische Beobachtungen," the Hamburg Meteorological Office has commenced a new publication containing observations made under its auspices abroad. The first part contains observations made at six stations in Labrador from September 1883 to December 1884. These stations were equipped in August 1882 as supplementary to the International Polar Expeditions, and, as the missionary observers were willing to continue the observations, and the stations are important owing to the passage of many barometric depressions over Labrador, it has been decided to retain them. The other stations for which observations are published are Hatzfeldhafen (New Guinea) and Walfish Bay (West Coast of Africa). Future parts are to be published as soon as another year's observations are received from Labrador, and will include observations received from other stations in the meantime.

THE Pilot Chart for the North Atlantic Ocean for the month of February draws attention to the great danger to Transatlantic navigation from icebergs and field ice, from the present time and until the end of August. The ice is liable to be encountered off the Grand Banks as far south as 42° N., and between the 42nd and 52nd meridians. It is pointed out that too much reliance should not be placed on the use of the thermometer, and that warning may often be obtained by means of the echo thrown back from the surface of an iceberg when a whistle is sounded, or any sharp noise is made.

THE Chief Signal Officer of the United States has issued a new edition of "Instructions to Observers of the Signal Service" (Washington, 1887, 142 pp. large 8vo). The "Instructions" are most complete, and contain information which will be very useful to observers in all countries, and many points that will be novel to English readers. On the establishment of a station, a local committee of management is formed, the chairman of which corresponds directly with the Signal Office, and a detailed report on the working of the station is furnished each year. All barometrical observations are to be reduced for gravity at lat. 45°, and complete directions are given for removing air from both barometers and thermometers. Instead of the usual drawings of the instruments, detailed plans of all their separate parts are given; by this means observers obtain an accurate knowledge of their construction. The observation of clouds is referred to seven types only. Full directions are given for drawing weather maps from telegraphic reports, and, finally, a good list of works recommended for study, and the necessary tables for reduction, complete the volume.

A REMARKABLE achievement in transportation of live fish a great distance is described by M. Jousset de Bellesme in a recent number of the *Revue Scientifique*. The aquatic fauna of Chili being very poor, a selection of fish, comprising 100 Californian salmon, 40 carp, 20 tench, 20 gudgeon, with a number of eels, barbs, minnows, lotes, &c., were despatched from Paris in September last to stock the waters. The voyage, of about a month, was, of course, a very trying one in this relation, especially as regards variation of temperature. In treatment of the fish care was taken to lessen the activity of their functions by refrigeration and starvation (a carp will live fifty days without food), and a continuous air circulation was kept up in the water (which was not renewed). There was some loss among the salmon, but thirty-nine were successfully installed at Santiago; and the other groups were mostly intact. Only the gudgeons, lotes, and barbs, suffered serious loss. The experiment seems to prove the possibility of carrying alive the most delicate fish from any point of the globe to any other point. It was also ascertained that a temperature of 23° C. is not hurtful to the health of alevins of *Salmo quinat*, as might have been feared. The expense of the transport was considerable, but was willingly borne by the Chilian Government, in view of future advantage to the country.

THE *Zoologist* for March reprints an extraordinary pamphlet, entitled, "An Account of Wolves nurturing Children in their Dens." This pamphlet was printed at Plymouth in 1852, and has long been out of print. On the wrapper of a copy in the Zoological Library of the Natural History Museum at South Kensington there is the following memorandum in the handwriting of the late Colonel Hamilton Smith:—"This account, I am informed by friends, is written by Colonel Sleeman, of the Indian army, the well-known officer who had charge of the Thugg inquiries, and who resided long in the forests of India." The writer records a number of cases of children who are said to have been nurtured by wolves in India. In one instance a large female wolf was seen to leave her den followed by three whelps and a little boy. This happened near Chandour, ten miles from Sultanpoor, in the year 1847. The boy went on all fours, and ran as fast as the whelps could. He was caught with difficulty, and had to be tied, as he was very restive, and struggled hard to rush into holes and dens. When a grown-up person came near him he became alarmed, and tried to steal away. But when a child came near him he rushed at it with a fierce snarl, like that of a dog, and tried to bite it. When cooked meat was put near him he rejected it with disgust; but when raw meat was offered he seized it with avidity, put it on the ground under his hands, like a dog, and ate it with evident pleasure. He would not let anyone come near him while he was eating, but he made no objection to a dog coming and sharing his food with him. The trooper who captured the boy left him in charge of the Rajah of Hasunpoor, who sent him to Captain Nichollets, commanding the first regiment of the Oude Local Infantry at Sultanpoor; and some interesting notes as to the boy's habits are given on this officer's authority. He died in August 1850; and after his death it was remembered that he had never been known to laugh or smile. He used signs when he wanted anything, and very few of them except when hungry, and he then pointed to his mouth. When his food was placed at some distance from him, he would run to it on all fours, like any four-footed animal, but at other times he would walk uprightly occasionally. He shunned human beings, and seemed to care for nothing but eating. If the pamphlet can be proved to be perfectly trustworthy, it certainly deserves to be carefully studied by anthropologists.

THE last issue (Heft 37) of the German Asiatic Society of Japan contains a lengthy paper, with numerous tables of analyses, on the food of the Japanese, the authors being Dr. Kellner and M. Mori. They refer at the outset to the extraordinary differences of opinion amongst various writers as to the exact nature of the staple diet of the Japanese people. One writer says it is almost wholly boiled rice flavoured with small quantities of fish or pickled vegetables; another says that, as far as means allow, it is a mixed, and not a purely vegetable diet, and therefore physiologically ample; a third that it is almost wholly vegetarian; a fourth, that as much animal food is consumed in Japan as in Germany, Austria, France, and the Danubian Principalities; and so on. All the writers here quoted are modern men of science who have resided in Japan, and have therefore had ample opportunities for forming an accurate opinion. As to beef, however (there is no mutton in Japan), there can be no question that its consumption is very small. In 1882 only 36,288 beasts were slaughtered, or about 1 kilogramme of meat per head of the population, and it must be borne in mind that a large consumption takes place at the open ports amongst Europeans, and in the proximity of vessels. The conclusions to which the present writers—one of them, it will be noticed, being a native investigator—come is that the food of the Japanese people varies so considerably that, from a physiological point of view, no single proposition can be laid down respecting it. There are two main groups to be distinguished: in one, the people from poverty are compelled to be vegetarians, and use a diet which leaves much to be desired in its effect in strengthening the body; those in the second group are able to obtain animal food from the sea with some ease, and therefore use a mixed diet, which in kind and quantity appears ample. Between these two extremes we find all kinds of diet. The authors have not only made analyses of the various food-stuffs of Japan, but have investigated in various public institutions, from prisons to schools for army officers, the effect of various classes of food on the labour and weight of different persons.

ON February 10, at 12.40 a.m., a brilliant meteor was seen at Venersborg, in Sweden. It went in a direction from south to north, and was surrounded by an intense blue light. It was seen to fall to the earth some considerable distance off, but no sound could be heard.

DR. ROBERT FRIES, a Swedish botanist, has completed a memoir on the fungus-flora of the south-west coast of Sweden on which he has been engaged for a number of years. It embraces 865 varieties.

PROF. SVEN LOVÉN, the "Nestor of Swedish science," recently completed his seventy-ninth year, when he received numerous congratulations from friends at home and abroad. He is at present engaged in publishing a catalogue by Linnæus of the Lovisa Ulrika Museum in Sweden, which will be accompanied by numerous illustrations and explanatory notes from a modern scientific point of view by Prof. Lovén.

THE report of the Norwegian Association for the Preservation of Archæological Remains for last year shows that thirty-one barrows were opened in 1887 by the Association at Tvetene, in the parish of Brunlanæs, all of which were found to date from the early Iron Age. Some 146 objects of various kinds were found. These objects were added to the Museum of the Christiania University.

THE well-known Norwegian naturalists, M. Michelet and Dr. Bahrt, have introduced a Bill into the Storthing, prohibiting the killing of any birds (except birds of prey, ravens, rooks, and magpies) in the whole of Norway during the period April 1 to August 15, also the taking of eggs or young birds. The chief object of this Bill is to put a stop to the present wanton destruction of birds by foreign "sportsmen."

MR. F. S. WELLS, of Southgate, has sent us four photographs of the lunar eclipse of January 21 last. Considering the small size of the photographs, they are very interesting, and Mr. Wells tells us that they were taken without costly apparatus. In the original negatives the images were merely seven-sixteenths of an inch. Mr. Wells enlarged them five diameters.

MR. R. COPELAND writes to us:—"I have just learnt from Leipzig that Prof. Krehl is the University Librarian at that place, and not Virchl as printed in Dr. Muir's letter on p. 246, and repeated by me on p. 344 of NATURE." Mr. Copeland also mentions that the "Demonstratio eliminationis Cramerianæ" was duly entered under De Prasse by Mr. R. Tucker, Hon. Sec. Mathematical Society, when drawing up the catalogue of the "Mathematical and Scientific Library of the late Charles Babbage" in 1872. This library forms the nucleus of Lord Crawford's collection of scientific books.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus* ♀) from India, presented by Captain R. F. Hibbert; a Common Raccoon (*Procyon lotor*) from North America, presented by Mr. C. J. Urquhart; a —— Civet (*Viverricula* ——) from China, presented by Mr. Percy Montgomery; two Laughing Kingfishers (*Dacelo gigantea*) from Australia, presented by Mrs. Mars Buckley; twelve Black-headed Gulls (*Larus ridibundus*), a Common Gull (*Larus canus*), British, presented by Mr. J. G. Barker; five Prince of Wales's Pheasants (*Phasianus principalis* ♂ ♂ ♀ ♀ ♀) from Afghan Turkistan, presented by Major Peacock, R.E.; a Cape Eagle-Owl (*Bubo capensis*), five Angulated Tortoises (*Chersina angulata*), three Areolated Tortoises (*Homopus areolatus*), a Natal Sternothere (*Sternothærus castaneus*), a Smooth Snake (*Homolosoma lutrix*), an Infernal Snake (*Boodon infernalis*), a Rufescent Snake (*Leptodira rufescens*), a Spotted Slowworn (*Acontias meleagris*), five Round-throated Frogs (*Rana fuscigula*), a Narrow-headed Toad (*Bufo angusticeps*) from South Africa, presented by the Rev. G. H. R. Fisk, C.M.Z.S.; a Natal Sternothere (*Sternothærus castaneus*) from South Africa, presented by Colonel J. H. Bowker, F.Z.S.; two Cirl Buntings (*Emberiza cirlus*), British, purchased; a Hog Deer (*Cervus porcinus*), an Eland (*Oreas canna*), a Yellow-footed Rock Kangaroo (*Petrogale xanthopus*) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

TEMPEL'S COMET, 1867 II.—M. Raoul Gautier has published in the Memoirs of the Société de Physique et d'Histoire Naturelle de Genève, vol. xxix. No. 12, a discussion of the orbit of the comet discovered by Herr W. Tempel, at Marseilles, on April 3, 1867, with especial reference to its appearances in 1873 and 1879. There are several points of especial interest about this comet: not only was it an addition to the number of known comets of short period, but it possesses the peculiarity of an elliptic orbit of but slight inclination, and of less eccentricity than that of any other member of the same class. Its spectrum, too, would seem to be unusual, for the imperfect view of it obtained by Dr. Huggins, May 4 and 8, 1867, led him to conclude that the bright bands, which it gave together with a continuous spectrum, were not those of carbon. Its orbit, and especially its period, is also subject to great perturbations from the action of Jupiter, and its perihelion distance was considerably increased between 1873 and 1867 without its aphelion distance being much altered. It had also been identified by M. Winnecke with the comet observed by Goldschmidt at Paris, May 16, 1855, in a search for De Vico's comet, but von Asten's inquiries have shown that the identification was an erroneous one.

M. Gautier—though the perturbations due to Jupiter during the period 1873–79, with which he was principally engaged, have been but small, the two bodies being always distant from each other—has calculated the perturbations after the method of variation of the elements, since this method was most suitable for the periods 1867–73 and 1879–85, and he wished to connect his calculation with those for the two other periods, which it is his intention to compute, and which he hopes to carry forward so as to furnish positions for the comet for its next return in 1892.

The following are the final results obtained by M. Gautier for the two appearances :—

	Second appearance, 1873. Mean equinox 1873·0.		Third appearance, 1879. Mean equinox 1879·0.		Mean errors common to both systems.
M_0 1873 April 15·0 =	−4° 5′ 24″·177	M 1879 April 24·0 =	−2° 10′ 2″·454	±	29″·35
μ =	592″·9765465	=	593″·1200165	±	0·000140
ϕ =	27° 33′ 22″·79	=	27° 33′ 6″·69	±	5·24
	° ′ ″		° ′ ″		′ ″
π' =	240 2 52·71	=	240 15 31·77	±	1 31·75
☊′ =	21 29 0·30	=	21 29 34·33	±	6·14
ι' =	27 0 58·62	=	27 0 39·50	±	2·00
π =	238 2 52·98	=	238 15 30·65	±	1 31·75
☊ =	78 43 48·42	=	78 45 55·66	±	13·18
ι =	9 45 58·59	=	9 46 2·64	±	2·61
T =	1873 May 9·83096	=	1879 May 7·15493	±	0d·0495
$\log a$ =	0·5179794	=	0·5179093		
$\log q$ =	0·2482605	=	0·2482463		
e =	0·4626205	=	0·4625512		

The time of perihelion passage is given in Berlin mean time.

The comet was not seen in 1885, and there seems distinct evidence, from the greater difficulty of observation in 1873 and more especially in 1879, that it has diminished in brightness at each succeeding return.

COMET 1888 *a* (SAWERTHAL).—The following elements have been computed for this comet by Mr. W. H. Finlay, Royal Observatory, Cape of Good Hope :—

T = 1888 March 17·18 G.M.T.

$$\left.\begin{array}{l} \pi - ☊ = 4^\circ\ 29' \\ ☊ = 244\ \ 6 \\ \iota = 43\ \ 57 \end{array}\right\} \text{Mean equinox 1888·0.}$$

$$\log q = 9·8354$$

Error of middle observation—

$$\Delta\lambda \cos\beta = -5'' \quad \ldots \quad \Delta\beta = -2''.$$

$$x = [9·8927]\, r \sin (330^\circ\ 30' + v)$$
$$y = [0·0000]\, r \sin (240\ \ 7 + v)$$
$$z = [9·7954]\, r \sin (329\ \ 30 + v).$$

The following ephemeris for Greenwich midnight has been computed by Dr. L. Becker, the perihelion passage having been increased by one day, as suggested by Prof. Krueger :

1888.	R.A. h. m.	Decl. ° ′	Log *r*.	Log Δ.	Brightness.
March 5	20 33·9	33 9 S.	9·865	9·956	1·5
13	21 3·4	20 29 S.	9·840	9·975	1·6
21	21 30·8	8 31 S.	9·838	0·008	1·4
29	21 57·5	1 58 N.	9·859	0·047	1·0
April 6	22 23·5	10 43 N.	9·898	0·088	0·7

The brightness on February 18 has been taken as unity.

THE TOTAL ECLIPSE OF THE MOON, JANUARY 28.—The following list has been received from the Pulkowa Observatory of the number of occultations observed at those observatories from which reports had been received up to February 17, in addition to those given in NATURE for February 2 (p. 333) :

Pulkowa	50	Padua	4
Tashkent	21	San Fernando	10
Turin	32	Strasburg	10
Belgrade	3	Bordeaux	21
Bothkamp	30	Kiel	36
Geneva	23	Collegio Romano	5
Neuchâtel	6	Wilhelmshaven	2
Kis Kartal	2	Marseilles	39
Paris	12	Liverpool	11
St. Petersburg	2	Bilk	8

At Helsingfors and Algiers they had also been successful.

The weather was cloudy at the following stations : Besançon, Breslau, Charkow, Dorpat, Dresden, Gotha, Gottingen, Hamburg, Jena, Kalocsa, Kasan, Kremzmunster, Leipzig, Munich, Nikolajen, Pola, Prague, Riga, and Upsala. Seventy-five observatories had not reported at the above-mentioned date.

VARIATIONS OF LUNAR HEAT DURING THE ECLIPSE OF THE MOON.—Dr. Boedicker succeeded in making a series of interesting experiments under favourable circumstances of the variations in the amount of heat radiated to us from the moon during the progress of the total eclipse of January 28. The observations were made with a Thompson's galvanometer used in connection with Lord Rosse's 3-foot reflector at Parsonstown, and commenced at 7h. 19m., or 1h. 10m. before the first contact with the earth's penumbra, and continued until 15h. 45m., or 1h. 34m. after the last contact. 638 readings were made in all. The principal deductions drawn from the observations were :—

(1) The heat radiated by the moon commenced to decrease long before the first contact with the penumbra.

(2) Twenty-two minutes before the commencement of totality the heat was reduced to less than 5 per cent. of that which it had been twenty minutes before the first contact with the penumbra.

(3) In spite of this rapid cooling at the approach of totality, the heat after the last contact with the penumbra did not remount immediately to the point where it had been before the first contact.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 *MARCH* 11–17.

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

At Greenwich on March 11

Sun rises, 6h. 24m. ; souths, 12h. 10m. 1·3s. ; sets, 17h. 57m. : right asc. on meridian, 23h. 28·4m. ; decl. 3° 25′ S. Sidereal Time at Sunset, 5h. 16m.

Moon (New on March 12, 16h.) rises, 6h. 16m. ; souths, 11h. 23m. ; sets, 16h. 39m. : right asc. on meridian, 22h. 41·3m. ; decl. 10° 59′ S.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Right asc. and declination on meridian. h. m.	° ′
Mercury	5 43	11 13	16 43	22 30·9	6 42 S.
Venus	5 29	10 12	14 55	21 30·1	15 24 S.
Mars	21 20*	2 38	7 56	13 55·2	8 56 S.
Jupiter	0 48	5 1	9 14	16 17·9	20 24 S.
Saturn	12 51	20 49	4 47*	8 8·9	20 44 N.
Uranus	20 10*	1 44	7 18	13 0·9	5 45 S.
Neptune	8 44	16 24	0 4*	3 42·9	18 1 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

March.	h.	
11	6	Mercury in conjunction with and 5° 8′ north of the Moon.
16	4	Mercury stationary.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
R Ceti	2 20·3	0 41 S.	Mar. 13,		*M*
λ Tauri	3 54·5	12 10 N.	,, 14,	22 5	*m*
ζ Geminorum	6 57·5	20 44 N.	,, 15,	2 0	*M*
R Canis Majoris	7 14·5	16 12 S.	,, 11,	0 41	*m*
			,, 17,	20 17	*m*
U Monocerotis	7 25·5	9 33 S.	,, 16,		*M*
δ Libræ	14 55·0	8 4 S.	,, 14,	0 40	*m*
U Coronæ	15 13·6	32 3 N.	,, 17,	1 50	*m*
S Libræ	15 15·0	19 59 S.	,, 13,		*M*
R Herculis	16 1·2	18 40 N.	,, 14,		*M*
R Ursæ Minoris	16 31·5	72 30 N.	,, 12,		*M*
U Ophiuchi	17 10·9	1 20 N.	,, 16,	3 0	*m*
X Sagittarii	17 40·5	27 47 S.	,, 11,	3 0	*M*
U Sagittarii	18 25·3	19 12 S.	,, 14,	3 0	*m*
			,, 17,	2 0	*M*
β Lyræ	18 46·0	33 14 N.	,, 11,	4 0	m_2
R Sagittæ	20 9·0	16 23 N.	,, 14,		*m*
T Vulpeculæ	20 46·7	27 50 N.	,, 13,	2 0	*M*
			,, 14,	4 0	*m*
δ Cephei	22 25·0	57 51 N.	,, 17,	22 0	*M*

M signifies maximum ; *m* minimum ; m_2 secondary minimum.

Meteor-Showers.

	R.A.	Decl.	
Near Capella	50°	48° N.	March 4–12.
,, ξ Virginis	175	10 N.	Bright ; slow.
,, κ Cephei	300	80 N.	Bright ; slow.

GEOGRAPHICAL NOTES.

MOUNT RORAIMA, in British Guiana, was ascended for the third time on October 14 last, by Mr. F. Dressel, an English orchid collector. The first ascent, it will be remembered, was by Mr. Im Thurn, in December 1884. The second was in November 1886, by Mr. Cremer, also an orchid collector. Mr. Im Thurn's ascent took place in the beginning of the wet season, when everything was saturated with moisture. Mr. Dressel ascended after continuous dry weather, and found the upper surface comparatively dry, the elevated portions most markedly so; while large areas of the sward-like levels were perfectly desiccated. The water in the various channels was very shallow, and the deep basins or depressions contained but very small quantities, though in no case was any found to be quite dry. Frequently the surface of the water in these shallow basins was more or less covered with a green, apparently a Confervoid, layer. In the pools at the bottom of these wide basins, Mr. Dressel found a considerable quantity of quartz, in the form both of separate crystals, and of aggregated masses, of various and often of large sizes. The presence of such quartz in such positions and under such conditions, *Timehri* points out, is an extremely interesting fact, though our want of knowledge of the petrographic character of the formation of the top of Roraima, beyond the fact of its being sandstone, renders it barren, and one hardly justifying speculation. It will be remembered that on the first ascent no animal life was noticed during the short time spent on the top; and this necessarily denoted the likelihood of the absence or great rarity of birds and insects. During the two or three hours spent on the top by Mr. Dressel, no birds were seen; but a few specimens of butterflies, all of one kind, of a dark brown and nearly black colour, were observed, and two of them were caught, though one alone was sufficiently preserved to show much of its structure. In the shallow basins a few forms of a small black toad with a yellow spot on the throat was also seen, and one was caught, but was accidentally left on the top. A third animal form was found in the moist earth attached to some plants which had been pulled up; from Mr. Dressel's description it is conjectured by *Timehri* to be a Millipede, allied to *Julus*. It is probable enough that a stay of a day or two on the top would well repay the naturalist; and Mr. Dressel thinks it would not be difficult to arrange for such a stay. The fantastic shape into which the sandstone has been fashioned, and the weirdness of the scenes which have been so graphically described by Mr. Im Thurn, affected Mr. Dressel in a similar manner. He mentions that the surface of the rocks present very closely the appearance of granite, owing to weathering; and at first he thought some mistake had been made in describing the formation as sandstone, until he moved away a small rock from its setting, when its real nature was revealed.

Timehri for December last contains a very interesting account by Mr. E. A. Wallace of a visit he paid to the Guahivos, an isolated tribe of Indians, living near the head of the River Meta, a tributary of the Orinoco, in the Republic of Columbia.

AT the last meeting of the Royal Geographical Society Mr. Robert Gordon read a paper on the Ruby Mines near Mogok, Burma. These ruby mines lie about 100 miles N.N.E. of Mandalay. The ruby-bearing region, so far as known, lies within an area ten miles long by five wide, and consists of groups of small valleys nestling beneath the Toung-Meh range, and to the south of it. The Enjouk valley to the north is said to yield rubies and sapphires, but they have not been regularly worked. The valleys arrange themselves into three groups of nearly equal area by the distribution of the watercourses. To the east a few streams unite to form the Yay-Nee, or red water, so called from the washings of red earth from the mines. The most remarkable thing, Mr. Gordon stated, in the Mogok and neighbouring districts, is the distinctness and diversity of races among the peoples in the different communities, who evidently have kept themselves from intermarriage with their neighbours for centuries, and a brief notice of the tribes whose types are found here may not be out of place. In Kathey, as the name implies, the villagers are Katheys, whose ancestors were brought as prisoners from Munnipore very long ago, as they have lost both the Hindoo religion and their own language. In Mandalay, Prome, and Henzadah, where bodies of the same people have been long transplanted, they keep their race and religion pure still. The ethnologist would find matter of intense interest in the interactions of some of these races upon each other, and perhaps the history of these transplanted Katheys would yield the most curious results. When surveying for the railway in the district south of Mandalay, Mr. Gordon found them extensively distributed throughout the country, always living separately in their own villages, and retaining many of their peculiar characteristics, even when they had become thoroughly Burmanized in their speech, religion, and general habits. They are colonies of pure Aryan race, retaining the features and colour and physique of their Indian ancestors, although surrounded for centuries by Turanians of great assimilating power, whose cordial hospitality and tolerance tend to modify and absorb most of the races coming into close contact with them. None of the yellow races of Burma, or Siam, or China milk their cattle, and it is difficult when travelling in those regions to get a supply of this very useful article. Near Mandalay, and to the south of it, however, the Katheys have accustomed many of the Burmese to the use of milk, and it is perhaps the only part of Burma where it could be got in the country places. In Bama and other villages the people are Paloungs, who keep up intercourse with the tea-growing Paloungs on the hills to the east, and preserve their language, although, like the Katheys, they have become Buddhists. Less is known of the Paloungs than of most of the great tribes bordering on Burma. They differ in speech, and claim to differ in origin, from all their neighbours. They occupy a wedge-shaped territory of mountains and plateau between the Ruby Mines of Burma, the Shans, and China; their principal State being called Toung-baing, which has nominally been subject to Burma, but which, from its inaccessibility, has been practically independent. The region is known to the Burmese as the La-pet Toung, or Tea Mountains, as it is the part from which great supplies of tea in a dry or in a pickled state are brought. The Paloungs who cultivate it appear to be a quiet, unaggressive people; and they do not themselves bring their produce to the Burmese markets, but sell it to trading caravans of Shans and Panthays. In Kyatpyen the people claim to be of pure Burmese stock. They dress, however, in Shan costume of blue or white trousers and jackets, which is very unusual for the Burmese, whose ordinary costume resembles the Scotch kilt. In Mogok the permanent residents are Shans, but Burmanized. Separate communities of pure Chinese and of Mohammedan Chinese are found as permanent or as temporary residents. Beyond these principal peoples, we find in this small locality, attracted by its wealth and its markets, bodies of Mainthas and of Leesaws as temporary visitors. Although the Kachyens are near neighbours to the north, the powerful Shan State of Momeit prevents their irruption to the Ruby Mines. The Mainthas are either Chinese Shans of a different type from the main body, or are hill Chinese from the North-eastern Chinese Shan States. The Leesaws are hill-men of weaker physique, who occupy the mountain regions of Western Yunnan, and are found in isolated communities in the higher parts of the Northern Shan States. They are supposed to be of the same tribal origin as the Burmese; but to have been driven and kept in the more inhospitable hill tracts to the north.

ACCORDING to *Allen's Indian Mail*, Colonel Sartorius, of the 1st Beloochee Regiment, has made an interesting report on his recent journey through the Southern Shan and Red Karen country. At Saga iron ore is found in abundance. Tin is plentiful in Lower Kerennie, and coal at the Lowelon Mountain. Besides these, silver, sulphur, and saltpetre were also found. He describes Rosambhe Lake as being quite as beautiful as the lakes of Cashmere, and the Falls of Kazor, which are 130 feet in height, are perhaps the finest in the East.

OUR ELECTRICAL COLUMN.

LORDS CRAWFORD AND WANTAGE, Sir Coutts Lindsay, and others, have boldly thrown down the gauntlet to the gas people. They have taken ground at Deptford for a central station, and are going to supply electricity to London. They start with 200,000 lamps, and charge at the same rate as gas at 4*s.* 2*d.* per 1000 cubic feet.

THE Meteorological Society are promised a fine display of atmospheric electrical apparatus for exhibition at their meeting on March 20. Lightning protectors of all kinds will be shown.

THE introduction of the terms "magnetic resistance," and "magneto-motive force," as the analogues of electric resistance and electromotive force, with their ratios, magnetic flux and electric current, is exercising the minds of electricians just now. Mr. Bosanquet has put it very clearly that when there is any opposition to a physical change of such a nature that it is the greater the greater the measure of the cause, and the less the measure of the effect, it is clearly a resistance; and in this sense the quotient of magneto-motive force (ampere-turns among practical men) by magnetic flux per unit area (magnetic induction) is clearly resistance. It must, however, not be forgotten, that magnetic permeability is the analogue of electrostatic capacity, and if we regard iron as the analogue of a dielectric or an insulator, the use of the term is wrong.

THE following relative figures of the cost of the production of 1000 watt-hours, the unit of electrical energy introduced by the Board of Trade, are given by Peukert in the *Centralblatt fur Electrotechnic*.

	s.	d.
Thermo-electric battery (gas)	33	4
Bunsen battery	3	2
Daniell ,, ...	2	2½
Dynamo (gas)	0	6¼
,, (steam)	0	2½

MENGARINI is continuing the work originated by Blaserna, by which the maturing of wine is considerably expedited by the passage of powerful currents through it.

HEIM (Hanover) has recently made some interesting measurements of the intensity of light emitted by various artificial sources of light in daily use:—

Lamps.	Candle-power.	Consumption per Candle per Hour.
Ordinary petroleum	15	3·65 grammes
Argand (gas)	21·9	10·9 litres
Welsbach (gas)	14·4	6·6 ,,
Wenham (gas)	28·4	8·77 ,,
Flat burner (gas)	16·9	14·8 ,,
Pieper arc, 6 mm.	377	·405 watts
Pilsen arc, 10 mm.	1420	·291 ,,
Siemens arc, 14 mm.	3830	·236 ,,
Siemens glow	16	3·25 ,,

VON LANG has measured the counter-electromotive force of an arc lamp, using 5 mm. carbons, and finds it 37 volts, or for Edlund's formula—

$$E = a + blC,$$

where a and b are constants, l the length of the arc, and C the current—

$$a = 35·07,\ b = 1·32,\ l = 2·5 \text{ mm.},\ C = 5 \text{ amperes}.$$

He has found these constants for various other materials. Cross and Shepherd (Boston) had found this back electromotive force to be 39 volts. What is this so-called counter-electromotive force? Surely it is an abuse of terms.

MR. SHELFORD BIDWELL (Royal Society, March 1) is continuing his admirable researches on the changes produced by magnetism in the lineal dimensions of the different magnetic metals. He finds that iron, which first expands with the magnetizing force, soon reaches a maximum point, whence it retracts until it attains its original length; but, on still further increasing the magnetizing force, it contracts until it apparently reaches a minimum point, beyond which his means have not enabled him to proceed. Bismuth appears to continually expand; nickel to continually contract; whilst cobalt contracts, reaches a minimum point, and then expands, approaching its original length. Manganese steel was unaffected. His apparatus was so perfect and sensitive that he could read a variation of one hundred-thousandth of a millimetre.

PROFS. AYRTON AND PERRY have satisfactorily disposed of the question as to whether there is any difference in the light emitted by a glow-lamp when incandesced by alternate or direct currents. They find no difference. The same power (3·39 watts) applied gives the same light (one candle) in each case.

THE PRESIDENT'S ANNUAL ADDRESS TO THE ROYAL MICROSCOPICAL SOCIETY.[1]

RETROSPECT may involve regret, but can scarcely involve anxiety. To one who fully appreciates the actual, and above all the potential, importance of this Society in its bearing upon the general progress of scientific research in every field of physical inquiry, the responsibilities of President will not be lightly, whilst they may certainly be proudly, undertaken.

I think it may be now fairly taken for granted that, as this Society has, from the outset, promoted and pointed to the higher scientific perfection of the microscope, so now, more than ever, it is its special function to place this in the forefront as its *raison d'être*. The microscope has been long enough in the hands of amateur and expert alike to establish itself as an instrument having an application to every actual and conceivable department of human research: and whilst in the earlier days of this Society it was possible for a zealous Fellow to have seen, and been more or less familiar with, all the applications to which it then had been put, it is different to-day. Specialists in the most diverse areas of research are assiduously applying the instrument to their various subjects, and with results that, if we would estimate aright, we must survey with instructed vision the whole ground which advancing science covers.

From this it is manifest that this Society cannot hope to enfold, or at least to organically bind to itself, men whose objects of research are so diverse.

But these are all none the less linked by one inseverable bond; it is the microscope: and whilst, amidst the inconceivable diversity of its applications, it remains manifest that this Society has for its primary object the constant progress of the instrument—whether in its mechanical construction or its optical appliances; whether the improvements shall bear upon the use of high powers or low powers; whether it shall be improvement that shall apply to its commercial employment, its easier professional application, or its most exalted scientific use; so long as this shall be the undoubted aim of the Royal Microscopical Society, its existence may well be the pride of Englishmen, and will commend itself more and more to men of all countries.

This, and this only, can lift such a Society out of what I believe has ceased to be its danger, that of forgetting that in proportion as the optical principles of the microscope are understood, and the theory of microscopical vision is made plain, the value of the instrument over every region to which it can be applied, and in all the varied hands that use it, is increased without definable limit. It is therefore by such means that the true interests of science are promoted.

It is one of the most admirable features of this Society that it has become cosmopolitan in its character in relation to the instrument, and all the ever-improving methods of research employed with it. From meeting to meeting it is not one country, or one continent even, that is represented on our tables. Nay, more, not only are we made familiar with improvements brought from every civilized part of the world, referring alike to the microscope itself and every instrument devised by specialists for its employment in every department of research; but also, by the admirable persistence of Mr. Crisp and Mr. Jno. Mayall, Jun., we are familiarized with every discovery of the old forms of the instrument wherever found or originally employed.

The value all of this cannot be over-estimated, for it will, even where prejudices as to our judgment may exist, gradually make it more and more clear that this Society exists to promote and acknowledge improvements in every constituent of the microscope, come from whatever source they may; and, in connection with this, to promote by demonstrations, exhibitions, and monographs the finest applications of the finest instruments for their respective purposes.

To give all this its highest value, of course, the theoretical side of our instrument must occupy the attention of the most accomplished experts. We may not despair that our somewhat too practical past in this respect may right itself in our own country; but meantime the splendid work of German students and experts is placed by the wise editors of our Journal within the reach of all.

I know of no higher hope for this important Society than that it may continue in ever-increasing strength to promote, criticise, and welcome from every quarter of the world whatever will improve the microscope in itself and in any of its applications, from the most simple to the most complex and important in which its employment is possible.

There are two points of some practical interest to which I desire for a few moments to call your attention. The former has reference to the group of organisms to which I have for so many years directed your attention, viz. the "Monads," which throughout I have called "putrefactive organisms."

There can be no longer any doubt that the destructive process of putrefaction is essentially a process of fermentation.

[1] Delivered by the Rev. Dr. Dallinger, F.R.S., at the annual meeting of the Royal Microscopical Society, February 8, 1888.

The fermentative saprophyte is as absolutely essential to the setting up of destructive rotting or putrescence in a putrescible fluid as the torula is to the setting up of alcoholic fermentation in a saccharine fluid. Make the presence of torulæ impossible, and you exclude with certainty fermentive action.

In precisely the same way, provide a proteinaceous solution, capable of the highest putrescence, but absolutely sterilized, and placed in an optically pure, or absolutely calcined air; and while these conditions are maintained, no matter what length of time may be suffered to elapse, the putrescible fluid will remain absolutely without trace of decay.

But suffer the slightest infection of the protected and pure air to take place, or, from some putrescent source, inoculate your sterilized fluid with the minutest atom, and shortly turbidity, offensive scent, and destructive putrescence ensue.

As in the alcoholic, lactic, or butyric ferments, the process set up is shown to be dependent upon and concurrent with the vegetative processes of the demonstrated organisms characterizing these ferments; so it can be shown with equal clearness and certainty that the entire process of what is known as putrescence is equally and as absolutely dependent on the vital processes of a given and discoverable series of organisms.

Now it is quite customary to treat the fermentive agency in putrefaction as if it were wholly Bacterial, and, indeed, the putrefactive group of Bacteria are now known as Saprophytes, or saprophytic Bacteria, as distinct from morphologically similar, but physiologically dissimilar, forms known as parasitic or pathogenic Bacteria.

It is indeed usually and justly admitted that *B. termo* is the exciting cause of fermentive putrefaction. Cohn has in fact contended that it is the distinctive ferment of all putrefactions, and that it is to decomposing proteinaceous solutions what *Torula cerevisiæ* is to the fermenting fluids containing sugar.

In a sense, this is no doubt strictly true: it is impossible to find a decomposing proteinaceous solution, at any stage, without finding this form in vast abundance.

But it is well to remember that in Nature putrefactive ferments must go on to an extent rarely imitated or followed in the laboratory. As a rule the pabulum in which the saprophytic organisms are provided and "cultured," is infusions, or extracts of meat carefully filtered, and, if vegetable matter is used, extracts of fruit, treated with equal care, and if needful neutralized, are used in a similar way. To these may be added all the forms of gelatine, employed in films, masses, and so forth.

But in following the process of destructive fermentation as it takes place in large masses of tissue, animal or vegetable, but far preferably the former, as they lie in water at a constant temperature of from 60° to 65° F., it will be seen that the fermentive process is the work, not of one organism, nor, judging by the standard of our present knowledge, of one specified class of vegetative forms, but by organisms, which, though related to each other, are in many respects greatly dissimilar, not only morphologically, but also embryologically, and even physiologically.

Moreover, although this is a matter that will want most thorough and efficient inquiry and research to understand properly its conditions, yet it is sufficiently manifest that these organisms succeed each other in a curious and even remarkable manner. Each does a part in the work of fermentive destruction; each aids in splitting up into lower and lower compounds; the elements of which the masses of degrading tissue are composed; while apparently, each set in turn, does by vital action, coupled with excretion, (1) take up the substances necessary for its own growth and multiplication; (2) carry on the fermentive process; and (3) so change the immediate pabulum as to give rise to conditions suitable for its immediate successor. Now the point of special interest is that there is an apparent adaptation in the form, functions, mode of multiplication, and order of succession in these fermentive organisms, deserving of study and fraught with instruction.

Let it be remembered that the aim of Nature in this fermentive action is not the partial splitting of certain organic compounds, and their reconstruction in simpler conditions, but the ultimate setting free, by saprophytic action, of the elements locked up in great masses of organic tissue: the sending back into Nature of the only material of which future organic structures are to be composed.

I have said that there can be no question whatever that *Bacterium termo* is the pioneer of Saprophytes. Exclude *B. termo* (and therefore with it all its congeners) and you can obtain no putrefaction. But wherever, in ordinary circumstances, a decomposable organic mass, say the body of a fish, or a considerable mass of the flesh of a terrestrial animal, is exposed in water at a temperature of 60° to 65° F., *B. termo* rapidly appears, and increases with a simply astounding rapidity. It clothes the tissues like a skin, and diffuses itself throughout the fluid.

The exact chemical changes it thus effects are not at present clearly known; but the fermentive action is manifestly concurrent with its multiplication. It finds its pabulum in the mass it ferments by its vegetative processes. But it also produces a visible change in the enveloping fluid, and noxious gases continuously are thrown off.

In the course of a week or more, dependent on the period of the year, there is, not inevitably, but as a rule, a rapid accession of spiral forms, such as *Spirillum volutans*, *S. undula*, and similar forms, often accompanied by *Bacterium lineola:* and the whole interspersed still with inconceivable multitudes of *B. termo*.

These invest the rotting tissues like an elastic garment, but are always in a state of movement. These, again, manifestly further the destructive ferment, and bring about a softness and flaccidity in the decomposing tissues, while they without doubt, at the same time, have, by their vital activity and possible secretions, affected the condition of the changing organic mass. There can be, so far as my observations go, no certainty as to when, after this, another form of organism will present itself; nor, when it does, which of a limited series it will be. But, in a majority of observed cases, a loosening of the living investment of Bacterial forms takes place, and simultaneously with this, the access of one or two forms of my putrefactive monads. They were amongst the first we worked at; and have been, by means of recent lenses, amongst the last revised. Mr. S. Kent named them *Cercomonas typica*, and *Monas dallingeri* respectively. They are both simple oval forms, but the former has a flagellum at both ends of the longer axis of the body, while the latter has a single flagellum in front.

The principal difference is in their mode of multiplication by fission. The former is in every way like a Bacterium in its mode of self-division. It divides, acquiring for each half a flagellum in division, and then, in its highest vigour, in about four minutes, each half divides again.

The second form does not divide into two, but into many, and thus, although the whole process is slower, develops with greater rapidity. But both ultimately multiply—that is, commence new generations—by the equivalent of a sexual process.

These would average about four times the size of *Bacterium termo:* and when once they gain a place on, and about, the putrefying tissues, their relatively powerful and incessant action, their enormous multitude, and the manner in which they glide over, under, and beside each other, as they invest the fermenting mass, is worthy of close study. It has been the life-history of these organisms, and not their relations as ferments, that has specially occupied my fullest attention; but it would be in a high degree interesting if we could discover, or determine, what beside the vegetative or organic processes of nutrition are being effected by one, or both, of these organisms on the fast-yielding mass. Still more would it be of interest to discover what, if any, changes were wrought in the pabulum, or fluid generally; for after some extended observations I have found that it is only after one or other, or both, of these organisms, have performed their part in the destructive ferment, that subsequent and extremely interesting changes arise.

It is true that in some three or four instances of this saprophytic destruction of organic tissues, I have observed that, after the strong Bacterial investment, there has arisen, not the two forms just named, nor either of them; but one or other of the striking forms now called *Tetramitus rostratus*, and *Polytoma uvella;* but this has been in relatively few instances. The rule is that *Cercomonas typica*, or its congener, precedes other forms, that not only succeed them in promoting, and carrying to a still further point the putrescence of the fermenting substance, but appear to be aided in the accomplishment of this by mechanical means.

By this time the mass of tissue has ceased to cohere. The mass has largely disintegrated, and there appears amongst the countless Bacterial and monad forms, some one, and sometimes even three forms, that whilst they at first swim and gyrate, and glide about the decomposing matter, which is now, much less closely invested by *Cercomonas typica*, or those organisms that may have acted in its place, they also resort to an entirely new mode of movement.

One of these forms is *Heteromita rostrata*, which it will be remembered, in addition to a front flagellum, has also a long fibre, or flagellum-like appendage that gracefully trails as it swims. At certain periods of its life they anchor themselves in countless billions all over the fermenting tissues, and as I have described in the life-history of this form, they coil their anchored fibre, as does a Vorticellan, bringing the body to the level of the point of anchorage, then shoot out the body with lightning-like rapidity, and bring it down like a hammer on some point of the decomposition. It rests here for a second or two, and repeats the process; and this is taking place, by what seems almost like rhythmic movement all over the rotting tissue. The results are scarcely visible in the mass; but if a group of these organisms be watched, attached to a small particle of the fermenting tissue, it will be seen to gradually diminish, and at length to disappear.

Now, there are at least two other similar forms, one of which, *Heteromita uncinata*, is similar in action, and the other of which, *Dallingeria drysdali*, is much more powerful, being possessed of a double anchor, and springing down upon the decadent mass with, relatively, far greater power.

Now, it is under the action of these last forms, that in a period, varying from one month to two or three, the entire substance of the organic tissues disappears, and the decomposition has been designated by me "exhausted"; nothing being left in the vessel but slightly noxious, and pale gray water, charged with carbonic acid; and a fine, buff-coloured impalpable sediment at the bottom.

My purpose is not, by this brief notice, to give an exhaustive, or even a sufficient account, of the progress of fermentive action, by means of saprophytic organisms, on great masses of tissue: my observations have been incidental, but they lead me to the conclusion that the fermentive process is not only not carried through by what are called saprophytic Bacteria, but that a *series* of fermentive organisms arise, which succeed each other, the earlier ones preparing the pabulum or altering the surrounding medium, so as to render it highly favourable to a succeeding form. On the other hand, the succeeding form has a special adaptation for carrying on the fermentive destruction more efficiently from the period at which it arises, and thus ultimately of setting free the chemical elements locked up in dead organic compounds.

That these later organisms are saprophytic, although not Bacterial, there can be no doubt. A set of experiments recorded by me in the Proceedings of this Society some years since would go far to establish this (*Monthly Microscopical Journal*, 1876, p. 288). But it may be readily shown, by extremely simple experiments, that these forms will set up fermentive decomposition rapidly, if introduced in either a desiccated or living condition, or in the spore state, into suitable but sterilized pabulum.

Thus while we have specific ferments which bring about definite and specific results; and while even infusions of proteid substances may be exhaustively fermented by saprophytic Becteria; the most important of all ferments, that by which Natura's dead organic masses are removed, is one which there is evidence to show is brought about by the successive vital activities of a series of adapted organisms, which are for ever at work in every region of the earth.

There is one other matter of some interest and moment, on which I would say a few words. To thoroughly instructed biologists, such words will be quite needless; but, in a Society of this kind, the possibilities that lie in the use of the instrument are associated with the contingency of large error, especially in the biology of the minuter forms of life, unless a well-grounded biological knowledge form the basis of all specific inference, to say nothing of deduction.

I am the more encouraged to speak of the difficulty to which I refer, because I have reason to know that it presents itself again and again in the provincial Societies of the country, and is often adhered to with a tenacity worthy of a better cause. I refer to the danger that always exists, that young or occasional observers are exposed to, amidst the complexities of minute animal and vegetable life, of concluding that they have come upon absolute evidences of the transformation of one minute form into another; that in fact they have demonstrated cases of heterogenesis.

This difficulty is not diminished by the fact that on the shelves of most Microscopical Societies there is to be found some sort of literature written in support of this strange doctrine.

You will pardon me for allusion again to the field of inquiry in which I have spent so many happy hours. It is, as you know, a region of life in which we touch, as it were, the very margin of living things. If Nature were capricious anywhere, we might expect to find her so here. If her methods were in a slovenly or only half-determined condition, we might expect to find it here. But it is not so. Know accurately what you are doing, use the precautions absolutely essential, and through years of the closest observation, it will be seen that the vegetative and vital processes generally, of the very simplest and lowliest life-forms, are as much directed and controlled by immutable laws, as the most complex and elevated.

The life-cycles, accurately known, of monads, repeat themselves as accurately as those of Rotifers or Planarians.

And of course, on the very surface of the matter the question presents itself to the biologist why it should not be so. The irrefragable philosophy of modern biology is that the most complex forms of living creatures have derived their splendid complexity and adaptations from the slow and majestically progressive variation and survival from the simpler and the simplest forms. If, then, the simplest forms of the present and the past were not governed by accurate and unchanging laws of life, how did the rigid certainties that manifestly and admittedly govern the more complex and the most complex come into play?

If our modern philosophy of biology be, as we know it is, true, then it must be very strong evidence indeed that would lead us to conclude that the laws seen to be universal break down and cease accurately to operate, where the objects become microscopic, and our knowledge of them is by no means full, exhaustive, and clear.

Moreover, looked at in the abstract, it is a little difficult to conceive why there should be more uncertainty about the life-processes of a group of lowly living things, than there should be about the behaviour, in reaction, of a given group of molecules.

The triumph of modern knowledge is the certainty which nothing can shake, that Nature's laws are immutable. The stability of her processes, the precision of her action, and the universality of her laws, is the basis of all science; to which biology forms no exception. Once establish, by clear and unmistakable demonstration, the life-history of an organism, and truly some change must have come over Nature as a whole, if that life-history be not the same to-morrow as to-day; and the same to one observer, in the same conditions, as to another.

No amount of paradox would induce us to believe that the combining proportions of hydrogen and oxygen had altered, in a specified experimenter's hands, in synthetically producing water.

We believe that the melting-point of platinum and the freezing-point of mercury are the same as they were a hundred years ago, and as they will be a hundred years hence.

Now, carefully remember that so far as we can see at all, it must be so with life. Life inheres in protoplasm; but just as you cannot get *abstract matter*—that is, matter with no properties or modes of motion—so you cannot get *abstract* protoplasm. Every piece of living protoplasm we see has a history: it is the inheritor of countless millions of years. Its properties have been determined by its history. It is the protoplasm of some definite form of life which has inherited its specific history. It can be no more false to that inheritance than an atom of oxygen can be false to its properties.

All this, of course, within the lines of the great secular processes of the Darwinian laws; which, by the way, could not operate at all if caprice formed any part of the activities of Nature.

But let me give a practical instance of how, what appears like fact, may over-ride philosophy, if an incident, or even a group of incidents, *per se* are to control our judgment.

Eighteen years ago I was paying much attention to Vorticellæ. I was observing with some pertinacity *Vorticella convallaria*; for one of the calices in a group under observation, was in a strange and semi-encysted state, while the remainder were in full normal activity.

I watched with great interest and care, and have in my folio still the drawings made at the time. The stalk carrying this individual calyx fell upon the branch of vegetable matter to which the Vorticellan was attached, and the calyx became perfectly globular; and at length there emerged from it a small form with which, in this condition, I was quite unfamiliar: it was small, tortoise-like in form, and crept over the branch on setae or hair-like pedicels; but, carefully followed, I found it soon swam, and at length got the long neck-like appendage of *Amphileptus anser!*

Here then was the cup or calyx of a definite Vorticellan form, changing into (?) an absolutely different Infusorian, viz. *Amphileptus anser!*

Now I simply reported the *fact* to the Liverpool Microscopical Society, with no attempt at inference; but two years after I was able to explain the mystery, for, finding in the same pond both *V. convallaria* and *A. anser*, I carefully watched their movements, and saw the *Amphileptus* seize and struggle with a calyx of *convallaria*, and absolutely become encysted upon it, with the results that I had reported two years before.

And there can be no doubt but this is the key to the cases that come to us again and again of minute forms suddenly changing into forms wholly unlike. It is happily amongst the virtues of the man of science to "rejoice in the truth," even though it be found at his expense; and true workers, earnest seekers for Nature's methods, in the obscurest fields of her action, will not murmur that this source of danger to younger microscopists has been pointed out, or recalled to them.

And now I bid you as your President farewell. It has been all pleasure to me to serve you. It has enlarged my friendships and my interests; and although my work has linked me with the Society for many years, I have derived much profit from this more organic union with it; and it is a source of encouragement to me, and will, I am sure, be to you, that, after having done with simple pleasure what I could, I am to be succeeded in this place of honour by so distinguished a student of the phenomena of minute life as Dr. Hudson. I can but wish him as happy a tenure of office as mine has been.

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. x. No. 2 (Baltimore, January 1888).—In the opening paper (pp. 99–130), entitled "Soluble Quintic Equations with Commensurable Coefficients," G. P. Young develops at some length the application of his general method, described in vol. vi., to the solution of twenty quintic equations, such as $x^5 - 10x^3 - 20x^2 - 1505x - 7412 = 0$.—Mr. D. Barcroft discusses (pp. 131–40) forms of non-singular quintic curves. The subject is profusely illustrated by drawings of 47 curves on twelve large pages (interpolated between pp. 140 and 141).—F. Morley (pp. 141–48) writes on critic centres in cubics.—The expression of syzygies among perpetuants by means of partitions, by Captain P. A. MacMahon, R.A. (pp. 149–68), is a very interesting addition to the author's previous papers on the subject.—The number concludes with three short papers: "Démonstration directe de la formule Jacobienne de la transformation cubique," by the Abbé Faà de Bruno; note on geometric inferences from algebraic symmetry, by F. Morley; and "Surfaces telles que l'origine se projette sur chaque normale au milieu des centres de courbure principaux" (pp. 175–86), by P. Appell.

Rivista Scientifico-Industriale, January 31.—On chemical valency, by Prof. Fr. Mangini. The probable cause of valency, that is, the varying proportions with which the atoms of the simple bodies combine with hydrogen, or its equivalent chlorine, to form molecules, is here attributed to the varying degrees of motion assumed to be pre-existent and inherent in the atoms themselves. A numerical coincidence is pointed out between the acoustic, luminous, and chemical phenomena, seven being the number of the chief musical notes, of the chief colours in the spectrum, and, as is now generally admitted, of the chemical valencies. It is further to be noted that the temperature required to produce the spectral lines varies with the valencies of the different elements. Thus, a much higher temperature is required for the polyvalent than for the monovalent alkalines, and in all these phenomena a connection is seen to exist between the heat required to show the spectral lines and the quantivalence of the atoms. Another nexus is found between the allotropic state and the number of vibrations needed to produce the spectroscopic phenomena. This highly suggestive paper will be continued in a future number of the *Rivista*.

Bulletins de la Société d'Anthropologie de Paris, tome x. fasc. 3 (Paris, 1887).—On the various methods of measuring the thorax, by Dr. E. Maurel. The writer, in enumerating the various instruments in use for this purpose, gives the preference to those designed by MM. Woillez, Niely, and Fourmentin, by which a graphic representation of the dimensions of the chest is obtained; although he claims to have improved upon their design in an instrument to which he has given the name stethograph.—On a Breton amulet, called "Kistin Spagn," by M. Bonnemère. Under this name the people of Locmariaque treasure a seed, probably a cashew nut, or, according to some, the seed of the mahogany-tree, which is brought home by Breton sailors. The nut is carefully scraped and boiled in new milk, when it is supposed to be a sovereign remedy against intestinal disorders. By some of the peasant women, however, the nut is pierced and worn on a chain, with their keys, scissors, &c., as an amulet. Singularly enough, it is found that even in Paris these nuts are believed to be specifics against various diseases, more especially the gout, three or four when carried in the trousers pocket being regarded as capable of warding off this malady.—On calves born with so-called bull-dog heads, by M. Dareste. Animals of this description were at one time characterized in South America as constituting a distinct race, but the gradual diminution in their numbers since the cattle of the pampas have acquired a marketable value leads to the inference that they are being killed when first dropped, in order to eliminate deformed animals from the herds, and this opinion of the deformity of the so-called "natos-calves" is confirmed by the presence of other abnormalities in all the animals of this description which have been examined in Europe.—On the colour of the hair and eyes in Limagne, near the Monts-de-Dôme, by Dr. Pommerol. These observations refer to 200 individuals, and appear to indicate that, taken generally, one-fourth of the population have light hair, and three-fourths dark hair, while light and dark eyes are equally frequent.—On the worship of Taranis in popular traditions of Auvergne, by Dr. Pommerol. The writer believes that under this name we have the Gallic representative of the supreme god of the heavens, and wielder of thunder and storms; and that the custom still prevalent in France of building an uncut stone into the gable or roof-top of a house, or hammering into the newly finished walls an irregularly formed metal, wooden, or stone cross, or mallet, to keep bad luck from the building, is a survival of the ancient usage of averting evil by the help of emblems connected with the worship of the supreme gods, as Baal's stone, Jupiter's thunderbolt, or Thor's hammer.—Circumcision in its social and religious significance, by M. Lafargue. The fact that this rite was practised among the Egyptians long before its adoption by the Hebrews has led to the inference that its practice was due to hygienic considerations only. But the author believes that we have here merely one of the numerous forms of mutilations submitted to by primæval men with a view of propitiating their deities, and of which we have such varied and striking evidence among different peoples, as the Assyrians and Aztecs, as well as among the black races; while survivals of similar faith in the efficacy of voluntarily inflicted suffering and mutilation are to be traced in the mythology of the Greeks and Romans.—On the influence of their surrounding medium on the peoples of Central Asia, by M. de Ujfalvy. Referring to the services recently rendered to science by Richthofen in unravelling the tissue of misconceptions in regard to the geognosy of Central Asia, due to the theories of Humboldt, Klaproth, and others, the writer considers the influence which the soil and their surroundings have had on the inhabitants of the four distinct zones into which the first-named of these *savants* has subdivided the Asiatic continent. Thus, while the central zone, by the general levelling of the surface through the chemical disintegration of the rocks, and the absence of streams to enrich the soil, compels men to follow a nomadic, or pastoral, rather than a settled life, the peripheral zone abounds in rich and fertile lands, yielding abundant opportunities for the exercise of human industry, and a corresponding advance in mental and social development. The intermediate zones correspond ethnographically with the transitional character of their geognostic features. Next to the extraordinary influence of the varied configurations of Asia on the destinies of its inhabitants, M. de Ujfalvy points out the importance of loess formations as factors in determining the spread and establishment of civilization. This part of the subject is treated at great length, and deserves the careful attention of the palæologist no less than the student of ethnography, seeing that the loess constitutes an important agent in the preservation of the animal and industrial remains of prehistoric ages.—On the nervous system, considered from a physico-chemical point of view, by Dr. Fauvelle. Here the nervous system of man is regarded as a physical apparatus, presenting certain analogies with an electric pile.—Anthropology and philology, with reference to the

Philippines, by M. O. Beauregard. This is a lengthy treatise on the products, language, sociology, and history of the islands, based chiefly on Spanish authorities.—Report, by M. Topinard, of the excavation of the Neolithic grotto of Feigneux (Oise), in which was found a skull that had been trepanned both before and after death. These finds were specially rich, including four skulls which bore traces of having been compressed; and, considered generally, this deposit may be regarded as a pendant to that of Orrouy.—(1) On a burial ground of the Stone Age at Crécy-en-Brie; (2) on cut flints in the alluvial sand below Paris; and (3) on a prehistoric work-place at Fontenay-aux-Roses, by M. Thieullen. The writer draws attention to the frequency with which the larger debris of cut flints are found near water, and always in localities favourable to the existence of prehistoric man, while from the character of the great ossuaries, in which, as at Crécy-en-Brie, the remains of men and women of all ages, and children, are found, he believes we may assume that the men of the period lived in family rather than in tribal association.—A study of the brain of Bertillon, by MM. Chudzinski and Manouvrier. A *résumé* of the results of this carefully conducted cerebral analysis, which are here given in detail, shows generally, *inter alia*, a large development of the anterior portion of the brain in all directions; a relatively inferior development in point of size in the temporal lobes, and in the cerebellum; and great ramification in the fossæ.

THE *Izvestia* of the Russian Geographical Society (xxiii. part 5) contains, besides Dr. Bunge's preliminary report about his expedition to the New Siberia Islands, a lecture on the problems of scientific geography by Dr. Petri, who was appointed in October last Professor of Geography and Anthropology at the St. Petersburg University; a paper by M. Rovinsky on the beliefs of the Montenegrins; M. Nikolsky's sketch of fishing on Lake Aral, a valuable contribution to the knowledge of the fishes inhabiting Lake Aral, and especially the lower Amu-daria, their habits, and the modes of fishing; and notes by General Stebnitsky on recent pendulum observations, on M. Boguslavsky's work on the Volga, and on W. J. Havenga's map of Sumatra.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 2.—"On Tidal Currents in the Open Ocean." By J. Y. Buchanan, F.R.S.

This paper gives details of some current observations which I made in the open ocean north of the Canary Islands in October 1883 in the course of the surveying expedition preliminary to the laying of a telegraph cable between these islands and the mainland of Spain. This expedition consisted of two steamers, the *Dacia* and the *International*, belonging to the India-rubber, Gutta-percha, and Telegraph Works Company (Limited), of Silvertown. The chief scientific results gained during it were the confirmation of the view—which was suggested by the density and temperature of the bottom water observed in this part of the Atlantic during the cruise of the *Challenger*—that the overflow of warm concentrated sea-water from the Mediterranean at the bottom of the Straits of Gibraltar was the cause of the abnormally high density and temperature of the bottom water in this part of the ocean, and the preparation of a complete survey of the bed of the ocean in this district. During the progress of the work several very remarkable "oceanic shoals" were discovered and surveyed, notably the "Coral Patch" in lat. 34° 57′ N., long. 11° 57′ W., with a depth of 400 to 500 fathoms, and the "Dacia Bank," in lat. 31° 9′ N., long. 13° 34′ W., with a minimum depth of 49 fathoms. In sounding over both of these banks conclusive evidence was obtained of the existence of actual vertical precipices in some positions on their flanks; and from the very great average steepness all round, it is rendered in every way probable that, if they were laid dry, they would form mountain peaks as precipitous and inaccessible as any to be found on land. The dredging on the Coral Patch showed it to consist of deep-sea corals, principally *Lophohelia prolifera*, growing with the utmost luxuriance and attached to dead stems of the same species, already getting coated with peroxide of manganese.

For the purposes of the survey of the "Dacia Bank" a buoy was anchored on its edge, and on the afternoon of October 21 I spent some hours in a boat made fast to it, and observed the current in strength and direction. The following is a summary of the results:—

Hour p.m.	2.15	2.40	3.30	4.6
Direction (true)	N. 11° E.	N. 41° E.	N. 56° E.	N. 101° E.
Rate (knots per hour)	0·47	0·30	0·26	0·30

It will be seen from these observations that in two hours the current had shifted its direction through 90°, and had passed through a minimum velocity of 0′·26 per hour without there having been any period of "slack water." The observations are too few in number to make it worth while submitting them to analysis; but a little study of them will show that they indicate a current which is the resultant of a continuous current and a periodic one. A constant current running south-east by east, combined with a tidal current running north-north-west and south-south-east, the maximum velocity of which, in either direction, is twice that of the permanent current, would give a resultant agreeing fairly with that observed.

No measurements were made of the under current, but, by sinking a tow-net made fast to a sounding-line, it was seen to be running at a depth of 75 fathoms in the same direction as the surface current and apparently with much the same velocity. In the channels between the Canary Islands, where even on the shallowest ridges there is over 1000 fathoms of water, the tidal current reaches to the very bottom, and its scouring action is shown by the nature of the bottom. To seaward, in 1800 or 2000 fathoms, the bottom is a fine Globigerina ooze, which gets coarser and sandier as the water shoals in the channels, till on the summit ridge there is generally no loose deposit at all, and the bottom is rock or coral coated with black oxide of manganese. Round the western end of Teneriffe the tide runs violently, causing rips and overfalls. Much rocky ground is met with in the North Atlantic in depths of 1300 and 1400 fathoms, especially on the ridge which appears to extend through the whole length of that ocean. It is not unlikely that the summit edge of this ridge may be swept clean through the greater part of its length, and it must be remembered that the removal of sediment from one part of the ocean bottom means its deposit in greater abundance in others, especially in hollows in the neighbourhood of the ridge. Hence a sounding in "ooze" or "mud" in one position furnishes no argument against the trustworthiness of another sounding in the vicinity and in equally deep water on "rock" or "hard ground."

It is evident, then, that the power of shoals to transform the tidal wave into tidal currents furnishes a natural agency which tends to limit the indefinite shoaling of the water by the continual deposition of loose sediment. On the other hand, these currents, in sweeping clean the rocky eminences at the bottom of the ocean, prepare a lodging-place for deep-sea corals, and assist in bringing food to them when settled, thus enabling them to build up their pillar-like banks, of which a very fine example is furnished by the "Coral Patch" above referred to. There can be little doubt that it is reducing more or less rapidly the depth of the water above it. The "Dacia Bank" and the "Seine Bank" are examples where limiting conditions, probably of temperature, appear to have been reached. The water may be too warm for the deep-sea species; and not warm enough for the tropical, *par excellence*, reef-building species.

A remarkable cluster of banks resembling those above described occurs off the Brazilian coast, between the Agulhas reef and the islands of Trinidad and Martin Vaz. Some of them are named, as the Jaseur, the Montague, and the Victoria banks; with from 25 to 30 fathoms, and completely surrounded by deep water. Further north is the dangerous Rocas, lying close to the route of steamers from North America and Europe to South American ports. Further south, again, are two suggestive soundings, one of 19 fathoms, in lat. 32° 40′ S., long. 47° 0′ W., marked "Nelson, 1859," and the other of 72 fathoms, in lat. 37° 50′ S., long. 49° 50′ W., marked "Sutlej, 1863," in the chart. Seamen are not usually mistaken as to whether they have or have not found bottom in depths such as 19 or 72 fathoms, and there is little doubt that careful search would reveal the existence of shoals in these localities. But the search must be diligent and methodical, always following the lead of the soundings as they shoal. The careful and detailed study of these oceanic shoals or embryo islands is of great importance for oceanographical science, and it would not be easy to find more interesting work for the marine surveyor.

March 1.—"On the Changes produced by Magnetization in the Dimensions of Rings and Rods of Iron and of some other Metals." By Shelford Bidwell, F.R.S.

Linnean Society, February 16.—W. Carruthers, F.R.S., President, in the chair.—Mr. Spencer Moore exhibited, and made some remarks upon, specimens illustrative of the *Palmella* state *Draparnaldia glomerata*.—Mr. D. Morris (Royal Gardens, Kew) exhibited a specimen of wood of *Hieronyma alchornioides* received from Trinidad, showing in its fissures mineral deposits, which on chemical analysis proved to be calcic carbonate. For comparison, Mr. Morris also exhibited and made some observations upon some deposits of calcic phosphate in teak. Some of these (described by Sir Fred. Abel, Quart. Journ. Chem. Soc. xv. 91), are 6 feet in length, 6 inches in breadth, and from $\frac{1}{8}$ inch to $\frac{3}{8}$ inch in thickness. Deposits in bamboo known as *tabasheer* (silicate) were shown, as also pearls (carbonate of lime) from cocoa-nuts, received from Dr. Sydney T. Hickson (see NATURE, vol. xxxvi. p. 157). All these specimens were from the Museum of Economic Botany of Kew.—Dr. Burn Murdock exhibited and offered remarks upon the intra-marginal (so-called) veins in the section *Areolata* of the genus *Erythroxylon*, of which *E. coca* is the most familiar species. These lines are due to a thickening of the parenchymatous tissue which takes place in the bud stage, and are in no way connected with the venation of the leaf.—Mr. G. F. Sherwood exhibited a collection of photographs taken in Samoa, illustrating the scenery and people, together with a number of necklets formed with strings of various bright-coloured seeds.—The first paper of the evening was read by Mr. H. N. Ridley, on self-fertilization and cleistogamy in orchids. Three common methods of self-fertilization were explained: (1) by the breaking up of the pollen mass, and falling of the dust either directly upon the stigma, or into the lips whence it comes into contact with the stigma; (2) by the falling of the pollen masses as a whole from the clinandrum into the stigma; and (3) by the falling forward of the pollinia from the clinandrum, or the anther cap, the caudicle and gland remaining attached to the column. An interesting discussion followed, in which Prof. Marshall Ward, the Rev. G. Henslow, and Mr. A. W. Bennett took part.—A paper was then read by Dr. John Rae, F.R.S., entitled "Notes on some of the Birds and Mammals of Hudson's Bay Territory." Dr. Rae, whose long residence in Northern and Arctic America enabled him to speak authoritatively from personal observation, gave an interesting account of the migration of the Canada goose, snow goose, aud blue-winged goose, and of the habits of the American hare and lemming. He particularly referred to the belief entertained by some of the Indian tribes he had met with, and to which he himself gave credence, that certain species of small birds are assisted on their migrations by being carried on the backs of the Canada geese. Mr. J. E. Harting, in criticising this paper, gave an exposition of the views held by leading ornithologists on the subject of the American Canada and snow geese, their relationship and nomenclature, and pointed out that the story of small birds being carried by larger ones is not confined to North America, but is current in South-Eastern Europe, Palestine, and Arabia, where trustworthy evidence has been obtained that wagtails and other small birds travel on the backs of cranes. He added that one instance was known to him of such an occurrence in England, a short-eared owl having been seen to arrive on the north coast of Yorkshire carrying on its back a golden-crested wren, which was secured by the observer.

Chemical Society, February 16.—Mr. W. Crookes, F.R.S., in the chair.—The following papers were read:—Chemical investigation of Wackenroder's solution, and explanation of the formation of its constituents, by Prof. Debus, F.R.S. Wackenroder's solution is obtained by passing hydrogen sulphide into an aqueous solution of sulphur dioxide until the latter is decomposed. It has been considered to contain sulphur in suspension and pentathionic acid in solution, although neither the acid nor its salts have been prepared pure, and, in consequence, Spring has denied the existence of the acid, regarding it as a solution of sulphur in tetrathionic acid. The author finds that Wackenroder's solution contains: (1) sulphur in suspension in very minute drops, (2) a new allotropic modification of sulphur, (3), in simple solution, and in the colloidal condition, (3) traces of trithionic acid, (4) tetrathionic acid, (5) pentathionic acid, and (6) a polythionic acid containing more sulphur than the penta-acid, probably hexathionic acid. Pure potassium and copper pentathionates were prepared, and the reactions of the polythionates studied, among the most interesting of which are the spontaneous changes in aqueous solution shown by the equations—

$$(a)\ K_2S_5O_6 = K_2S_4O_6 + S;\ (b)\ 2K_2S_4O_6 = K_2S_3O_6 + K_2S_5O_6;$$
$$(c)\ 2K_2S_3O_6 = K_2S_4O_6 + K_2SO_4 + SO_2;\ (d)\ 3K_2S_3O_6 = K_2S_5O_6 + 2K_2SO_4 + 2SO_2;$$

the reactions (*a*) and (*b*) occurring in either direction with equal facility. The final products of the action of hydrogen sulphide on tetra- and penta-thionic acids are water and sulphur. The polythionic acids can also be obtained by the action of sulphur dioxide on potassium thiosulphate or on the chlorides of sulphur. The concluding portion of the paper was devoted to a discussion of the formulæ of the polythionates.—Potilizin's law of the mutual displacement of chlorine and bromine, by Prof. Thorpe, F.R.S., and Mr. J. W. Rodger. On heating bromine with an equivalent quantity of an anhydrous metallic chloride in a sealed glass tube, free from air, to the temperature of the melting-point of zinc, Potilizin found that the amount of chlorine displaced by bromine was greater the higher the atomic weight of the metal in the chloride; and further, that, if A be the atomic weight of the metal, p the percentage of chlorine displaced from its chloride when treated as above, and E its valency, the formula $\frac{A}{pE^2}$ = a constant held good in the case of fourteen chlorides. To test the validity of this law, the authors heated the chlorides of sodium, potassium, silver, strontium, barium and lead with bromine at 350°–450°, and found that, with the exception of silver chloride, in which the deviation was not so marked, the amount of chlorine displaced was considerably less than that required by Potilizin's law, and in all cases stood in no definite relation either to the duration of heating or to the atomic weight of the metal of the chloride used, although most chlorine was displaced from the chloride of highest molecular weight when several were heated simultaneously. These experiments therefore disprove the validity of Potilizin's law.—A gasometric method of determining nitrous acid, by Dr. P. F. Frankland. Based on the interaction of urea and nitrous acid.—The action of some specific micro-organisms on nitric acid, by the same. The author has investigated the behaviour, when grown in nutritive solutions containing nitrates, of a number of micro-organisms obtained from air and water, and cultivated in a state of purity. Of thirty-two different forms so examined, sixteen or seventeen, and particularly *Bacillus ramosus* and *B. pestifer*, were found to reduce the nitrate to nitrite more or less completely, whilst the remainder were quite destitute of this power. The behaviour of the organisms was not altered in this respect by excluding air from the solutions in which they were cultivated.—The action of phosphorus pentachloride on salicylaldehyde, by Mr. C. M. Stuart.—Some interactions of nitrogen chlorophosphuret, by Mr. W. Couldridge.—Action of alcohols on ethereal salts in presence of small quantities of sodic alkylate, by Prof. Purdie and Mr. W. Marshall.—Note on the densities of cerium sulphate solutions, by Dr. B. Brauner. The values of the densities of solutions of the anhydrous and of the hydrated salt are identical for solutions of equal concentration.

ERRATUM.—P. 406, second column, line 9 (from top), *for* $v = (n^2 - 1)(n^2 + 2)$ *read* $v = (n^2 - 1)/(n^2 + 2)$.

Physical Society, February 25.—Prof. Reinold, F.R.S., President, in the chair.—The following papers were read:—Note on the efficiency of incandescent lamps with direct and alternating currents, by Prof. W. E. Ayrton, F.R.S., and Prof. J. Perry, F.R.S. This relates to the question whether the "efficiency" (candles per watt) is greater or less for alternating than for direct currents. Experiments made by Messrs. Shepherd and Wheatley, two of the students at the Central Institution (to whom the authors express their thanks for the valuable assistance rendered) show that no appreciable difference can be detected when the lamp is at the same candle-power. In performing the experiments, three-way switches in connection with Gramme and Ferranti machines were arranged so that the current through the lamp could be quickly changed from direct to alternating, or *vice versâ*, adjustable resistances having been previously placed in the two circuits to give equal readings on a Cardew voltmeter placed as a shunt to the lamp. The currents were measured by a reflecting dynamometer wound with fine wire in order to make the error, due to unequal current density over the section, negligible. The problem has also been investigated from theoretical considerations, but the results as yet deduced would not lead the authors to anticipate the equal efficiency found experimentally. An interesting discussion followed, in which Mr. Swinburne, Prof. S. P. Thompson, Mr. Boys, and the authors took part.—Observations of the height, length, and velocity of ocean waves, by the Hon. Ralph Abercomby. Several sets of observations were made by the author in the South Pacific in 1885. The heights were measured by a sensitive ameroid, and the length and velocity by a chronograph, assuming the length and speed of the vessel to be known. The largest waves observed in a heavy sea gave a height of 46 feet, length 765 feet, velocity 47 miles per hour, and time period of 16·5 secs. Great discrepancies exist between the results of different observers, which the author believes to be chiefly due to the comparative rarity of well-defined simple waves. Replying to a question from Mr. Baily, the author said the effect on the barometer of the difference of wind pressure on the two sides of a wave was negligible.—On the temperature at which nickel begins suddenly to lose its magnetic properties, by Mr. Herbert Tomlinson. Different authorities give different values, ranging from about 300° to 400° C. In investigating the subject the author found that the said temperature depends on the magnetizing force used; *e.g.* with magnetizing forces of 5, 99, and 182 units, the temperatures at which the permeability attained its maxima were 287° C., 248° C., and 242° C., and those corresponding to permeability = 0 were 333°, 392°, and 412° respectively. From the above results it will be seen that for small magnetizing forces the change of permeability from maximum to 0 is much more sudden than for the greater forces. As in iron, the permeability decreases as the magnetizing force increases. An experiment was shown in which a nickel plated brass wire was heated to dull redness whilst suspended between the poles of an electro-magnet, and allowed to cool. When the critical temperature was attained, the wire was suddenly attracted to one or other of the poles. In reply to Mr. Shelford Bidwell, the author stated that the changes in permeability due to ordinary atmospheric changes of temperature were considerable, when small magnetizing forces were used.—Experiments on electrolysis, by Mr. W. W. Haldane Gee, Mr. H. Holden, and Mr. C. H. Lees. Whilst studying some electrolytic polarization phenomena with palladium electrodes in dilute sulphuric acid (pure), a dense liquid was seen *after reversing the current* to flow downwards in streaks from the anode. The paper is devoted to the investigation of the character of the liquid streaks, and the authors conclude that the streaks are of concentrated sulphuric acid, formed by the union of the hydrogen (occluded by the electrode whilst serving as cathode) with the SO_4 liberated at the same electrode when the current is reversed. Similar streaks were found with phosphoric acid, &c. In their next paper the authors hope to describe some experiments in which these and similar effects become of great importance in changing the resistances of electrolytes.

Zoological Society, February 21.—Prof. W. H. Flower, F.R.S., President, in the chair.—Mr. A. Thomson exhibited a series of insects reared in the insect-house in the Society's Gardens during the past year, and read a report on the subject.—Prof. G. B. Howes read a note on the azygos veins of the Anurous Amphibia. The author described an individual specimen of *Rana temporaria*, in which the azygos vein (prerenal portion of the posterior cardinal) had been retained on one side, its relations differing in important details from that observed by Hochstetter in *Bombinator*. By way of supplementing that author's work, he had examined examples of a few genera not dealt with by Hochstetter. He recorded the presence of these veins in the only specimen of *Discoglossus* dissected, and in one of five individuals of *Alytes obstetricans*—facts which lent additional support to the views of Cope and Boulenger of the lowly affinities of the Discoglossidæ. He had failed to detect these vessels in the *Aglossa*; while he regarded their total absence in *Pelobates* and *Pelodytes* as fresh evidence of the Pelobatoid rather than the Discoglossid affinities of the last-named genus.—Mr. A. Smith-Woodward read the second part of his palæontological contributions to Selachian morphology.—Mr. Oldfield Thomas gave an account of the mammals obtained by Mr. G. F. Gaumer on Cozumel and Ruatan Islands, Gulf of Honduras.—A second paper by Mr. Thomas contained the description of a new and interesting annectent genus of Muridæ, based on a specimen which had been in the Paris Museum for some years. This was supplemented with remarks on the relation of the Old and New World members of the family.—Dr. G. H. Fowler exhibited and made some remarks on a new *Pennatula* from the Bahamas, the most interesting feature of which was the presence of immature antozooids at the dorsal end of the leaves, devoid of tentacles, but possessing a well-marked syphonoglyphe on the stomatidæum which disappears with the increasing age of the polyp. The species was proposed to be named *Pennatula bellissima*.

Royal Meteorological Society, February 15.—Dr. W. Marcet, F.R.S., President, in the chair.—The following papers were read:—Electrical and meteorological observations on the Peak of Teneriffe, by the Hon. Ralph Abercromby. The author made a trip to the Island of Teneriffe in October 1887, for the purpose of making some electrical and meteorological observations, and now gives some of the results which he obtained, which may be summarized as follows:—The electrical condition of the Peak of Teneriffe was found to be the same as in every other part of the world. The potential was moderately positive, from 100 to 150 volts, at 5 feet 5 inches from the ground, even at considerable altitudes; but the tension rose to 549 volts on the summit of the Peak, 12,200 feet, and to 247 volts on the top of the rock of Gayga, 7100 feet. A large number of halos were seen associated with local showers and cloud masses. The necessary ice-dust appeared to be formed by rising currents. The shadow of the Peak was seen projected against the sky at sunset. The idea of a south-west current flowing directly over the north-east Trade was found to be erroneous. There was always a regular vertical succession of air currents in intermediate directions at different levels from the surface upwards, so that the air was always circulating on a complicated screw system.—Rainfall of South Africa, 1842–1886, by Mr. W. B. Tripp. The author gives the rainfall statistics from all those stations situated in South Africa which possess records of ten complete years and upwards. He remarks upon the chronological succession of wet and dry years, and the consecutive years above and below the mean; and also describes the seasonal distribution of monthly maxima, and the extent over which monthly rains prevail. He concludes by comparing the curves of rainfall with those of sunspot energy.—Some methods of cloud measurements, by Mr. Nils Ekholm As exact cloud measurements afford almost the only easily available means of determining motions in the upper regions of the atmosphere, the author describes some methods which seem to him likely to give the best results. He also details the plans adopted at the Swedish Polar Station, Cap Thorsden, in Spitzbergen, and at the Upsala Observatory, for determining the direction and angular velocity of the clouds, and for making direct measurements of the height and absolute motions of the clouds.

EDINBURGH.

Royal Society, January 30.—The Rev. Prof. Flint, D.D., Vice-President, in the chair.—Prof. Nicholson read a paper on the causes of movements in general prices.—Prof. J. B. Haycraft and Dr. E. W. Carlier gave a demonstration of a method by which human blood may be withdrawn from the body and its fluidity preserved. Castor-oil is the medium in which the blood is suspended. The finger from which the blood is obtained is greased and plunged in the oil before the puncture is made, every precaution being taken to prevent contact of the blood with the air or with solid matter. In this way the blood may be preserved in a fluid state for a considerable time. As the drops of blood settle slowly in the oil, the corpuscles are seen to fall to the lower part of the drops, while the clear plasma remains above. Prof. Haycraft and Dr. Carlier believe that the human blood plasma has never before been demonstrated in an unaltered condition except in microscopic quantity. Coagulation eventually occurs, because the blood necessarily comes in contact with the sides of the wound made in the finger.—Mr. D. B Dott read a paper, written by himself in conjunction with Dr. Ralph Stockman, describing experiments which show that the ordinarily accepted formula of morphine is the correct one.—Mr. Robert Kidston read the first part of a paper on the fossil flora of the Staffordshire coal-fields, and also read a note on *Neuropteris plicata*, Sternb., and *Neuropteris rectinervis*, Kidston.—Mr. John Aitken communicated a note on a monochromatic rainbow seen at sunset.—Prof. Haycraft read a note on a "scratching centre" found in the spinal chord of some vertebrates.—Prof. Tait communicated an answer to Prof. Boltzman's strictures, which appeared in the *Sitzungsberichte* of the Vienna Academy, on his investigations on the kinetic theory of gases. This has been sent to the *Philosophical Magazine*.

PARIS.

Academy of Sciences, February 27.—M. Janssen in the chair.—On the doctrine of the probability of error; the law of Gauss, by M. J. Bertrand. It is shown that the law of Gauss, based on the postulate, "The mean of the results of any number of measurements is the most probable value deducible from those measurements," is incapable of rigorous demonstration.—Artificial production of rhombohedric crystals of rubies, by MM. E. Fremy and A. Verneuil. Specimens were shown of these crystals produced by the method described at the meeting of March 14, 1887. These are very different from the rubies obtained by the authors in 1877, which were produced in a vitreous vein from which they were detached with great difficulty. The present gems are on the contrary produced in a porous and friable vein, where they occur in clusters of crystals in a state of great purity, and from which they may be easily removed. To effect this it suffices to throw the product of calcination into a flask of water and shake it violently. Then the vein being light remains in suspension in the water, while the heavier rubies are at once precipitated to the bottom. The gems are always rhombohedric, and in every respect comparable to the natural stones. They have the same colour and hardness, easily scratch topaz, become black when heated, regaining their beautiful pink tint when cooled, have a diamond-like brilliance, and perfectly regular crystalline form. The paper was followed by some remarks by M. Des Cloiseaux, to whom the specimens had been submitted for a thorough crystallographic examination.—On some general conditions under which nitrogen is fixed by vegetable soil, by M. Berthelot. The author had already established by a long series of experiments that certain argillaceous earths and certain sands have the property of fixing atmospheric nitrogen and enriching themselves by a slow and progressive process with organic nitrous substances obtained directly or indirectly from living organisms. Since then he has prosecuted the study of this interesting phenomenon, and here resumes the results of his further researches. Some experiments are also described on the transformation of the nitrates in the soil into nitrous combinations of organic character. His observations tend to the general conclusion that the earth should not be regarded as an inert mineral body, stable and invariable in its composition until disturbed by the process of vegetation, but as a body filled with living beings, and whose chemical composition and abundance of nitrogen vary and oscillate with the conditions determining the vitality of those beings.—On a method of quantitative analysis of chloroform, and on the solubility of this body in water, by MM. G. Chancel and F. Parmentier. Priority of discovery is claimed by the authors for this process, which, in a recent communication to the Academy, M. L. de Saint-Martin describes as new.—The Neolithic epoch at Champigny, by M. Emile Rivière. The results are described of the researches that have been carried on since 1867, by MM. Le Roy des Closages, Carbonnier, and the author, at the Neolithic station near the village of Champigny in the Department of the Seine. Here have been found numerous flint implements, scrapers, arrow-heads, polished hatchets, knives, besides four grind-stones and much coarse pottery curiously ornamented, all in association with the bones of the horse, pig, deer, roebuck, and ox. The material of some of the implements points at long migrations, or else a widespread intercourse with more or less remote tribes, the rocks used in their fabrication occurring in the region stretching from Belgium to Chiavenna in the Italian Alps.—Elements and ephemeris of the planet 272, by M. Charlois. These elements are the result of three observations made at the Observatory of Nice on February 4, 11, and 18.—Permanent deformation and thermodynamics (continued), by M. Marcel Brillouin. The chief feature of the present study is the determination of the consequences of the axiom of Clausius.—Experimental researches on the variations produced by a shock in the magnetic condition of a steel bar, by M. G. Berson. It is shown generally that the shocks or impacts given to steel bars have the effect of facilitating the disposition of the molecules in a given direction under the action of the stimulating forces, by diminishing for a very brief interval the molecular friction known as coercing force.—On the laws of chemical equilibrium, by M. H. Le Chatelier. This is a reply to a recent communication from M. Duhem claiming priority in connection with a law of thermo-chemistry lately enounced by the author.—Action of aniline on epichlorhydrine, by M. Ad. Fauconnier. Continuing the researches of M. Hörmann, the author has succeeded in obtaining one of that chemist's anticipated bases, which results from the combination of two molecules of aniline with one of epichlorhydrine. The mode of preparation and properties of this body are described.—On the respiration of corn yeast at various temperatures, by MM. Gréhant and Quinquaud. Continuing the classical studies of MM. Pasteur and Schützenberger, the authors have carried out a series of experiments to measure the volume of oxygen absorbed and of carbonic acid produced by yeast living at first in distilled water in the absence of sugar and in contact with a determined volume of air. They find that the relation $\frac{CO_2}{O}$ is variable with the temperature, so that the isolated yeast-cells would appear to behave differently from the fungi and tissues lacking chlorophyll, which give a constant relation $\frac{CO_2}{O}$ under all temperatures for the same individuals of the same species.

Astronomical Society, February 1.—M. Flammarion, President, in the chair.—M. Flammarion expressed his admiration of what he had seen at the Nice Observatory on a recent visit. In the great equatorial (30 inches aperture), the Orion nebula is splendid, stars of the sixteenth magnitude seem bright, and double stars from 0″·1 to 0″·3 apart are discovered.—M. Flammarion observed the lunar eclipse on January 28 at Nice. The moon remained easily visible during totality, and of a bright copper hue. The Nice Observatory is 375 metres above the level of the Mediterranean Sea. In the finder of the great equatorial the shadow was fringed with a transparent border about 2′ in breadth. MM. Henry Brothers and M. Trouvelot remarked the contrast this eclipse presented with that of October 1884, in which the moon nearly disappeared. M. Detaille said that he had been struck by the very fine colour of the moon; the earth's shadow, though ill-defined on the edge, was quite circular.—MM. Henry showed a photograph of the Pleiades taken with their 34-centimetre object-glass, and an exposure of four hours. The negative included stars down to the seventeenth magnitude. Much new nebulous matter is discovered in this photograph. One of the bright stars is enveloped in a dense nebula hitherto unseen. Several singular long thin streaks of nebulous matter extend in some cases from star to star to a considerable length.—M. Berteaux, geographical editor, presented the Society with a new map of the moon by M. C. Gaudibert, the well-known selenographer. This map has been made from M. Gaudibert's observations and revisals; it has been drawn by M. Tenet, and reproduced by heliography. The diameter of the disk is 64 centimetres.

BERLIN.

Physical Society, February 3.—Prof. von Helmholtz, President, in the chair.—Prof. Paul du Bois Reymond spoke on the difficulty of forming any conception of force acting across an intervening space. From among the various instances of such forces the speaker selected gravity for a thorough discussion. He explained the six properties characteristic of this force, pointing out that only two of them—viz. the proportionality to the mass, and the law of inverse squares of the distances—can be proved experimentally, while some of its other properties, as, for instance, the independence of gravity from the condition of motion of the mass, are much doubted by many observers. Prof. du Bois Reymond then discussed the ever-recurring endeavours in past times to arrive at some mechanical construction for gravity, endeavours which were in all cases unsatisfactory, since they were always dependent either on the fundamental properties of matter, which are themselves incomprehensible, or upon physical phenomena whose basis was still undetermined. Just as in the case of many problems the experiments for whose solution have been repeated until their inaccuracy was clearly proved, so also in the case of gravity has a mechanical conception been repeatedly sought for: hence it becomes necessary to show that gravity is beyond our comprehension, and the speaker proceeded to do this by showing that Lesage's theory of the impact action of the atoms of ether, which has been so long and persistently believed, while it explains the law of inverse squares does not explain the proportionality to the mass, and in certain special cases leads to perfectly impossible results. Gravity is therefore incomprehensible, and Newton's view that it is something inherently present in all matter is correct, since it is by means of this force alone that matter is made evident to us; indeed, as far as the matter itself is concerned, it may be entirely left out of account.—Prof. Helmholtz then explained how he is in the habit of treating the subject of gravity in his lectures. He represents it as being that law of Nature, established by experience, that every body when in the neighbourhood of another body is subject to an acceleration which is proportional to its mass, and diminishes in the ratio of the inverse square of the distance between them. Such a law of Nature as this, established as it is on the basis of experience, is on the whole not unsatisfactory.—The same speaker then briefly communicated the results of two researches which he had brought before the Academy of Sciences on the previous day. Of these one is due to Prof. Kundt, and has reference to the refractive power of metals. He has succeeded in constructing transparent prisms of metals, and thus determining their refractive index. The other, due to Prof. Hertz, has for its subject the rate of propagation of electro-dynamic action. By an extremely ingenious method, which the speaker explained, and which has been used by Prof. Hertz, in many of his previous researches, for the measurement of electrical vibrations, he has succeeded in proving that electricity is propagated along a metallic wire at the rate of 200,000 kilometres per second, and that electro-dynamic action passes through dielectrics with the velocity of light. These experiments thus provide the experimental confirmation of the Faraday-Maxwell theory of electro-dynamic action.

Meteorological Society, February 7.—Dr. Vettin, President, in the chair.—Lieut. Gross gave an account of a balloon voyage which he made on January 21, and described, while presenting the curves he had obtained, his meteorological observations made during this voyage with wet and dry bulb thermometers. One point of great interest which he described was that the balloon remained constantly at the upper surface of the layer of clouds which it was traversing, so that while the body of the balloon was above the clouds the car was completely immersed in the latter, notwithstanding that ballast was frequently thrown out.—Dr. Hellmann produced the curves of temperature for Northern Italy for the month of January, which showed that the cold in this region had been much more intense than in Berlin: the minimum temperature at Alessandria was $-16{\cdot}5°$ C.—Prof. Schwalbe spoke on the subject of earthquakes in their relationship to meteorological and cosmic phenomena. He proved, on the basis of a study of the literature of this subject extending over many years, that all sorts of meteorological phenomena, such as temperature, atmospheric pressure, wind, moisture, rain, dryness, atmospheric electricity, clouds, and even optical phenomena, have been referred to earthquakes, either as accompaniments or the outcome or the cause of the same. If the statistics of earthquakes are alone considered, or more especially if microseismic observations are taken into account, the above relationship admits of being readily established; but it breaks down completely if it is worked out in a really scientific way throughout the whole of any one or a series of years. The same remark holds good with respect of those cosmic relationships which have been supposed to exist by various writers, such as that the attraction of the moon and the sun is a cause of earthquakes; this view has recently been held by Falb, and although it is in complete antagonism to the results of careful scientific investigation it has nevertheless been largely accepted by laymen. Just as the whole of Falb's views admit readily of being disproved, so also do his prognostications of earthquakes. According to Falb, each lunar quarter-day may be considered to be essentially connected with the occurrence of an earthquake which may take place either five days sooner or three days later than this time; but, notwithstanding the concession of these wide limits as to time, it has not been found that these periods are always accompanied by an earthquake.

STOCKHOLM.

Royal Academy of Sciences, February 8.—Baron A. E. Nordenskiöld gave an account of a work he is now editing, entitled "Atlas, containing maps (copies) printed during the fifteenth and sixteenth centuries."—On the Aralo-Caspian Sea and the glaciation of the North of Europe, by Dr. H. Sjögren.—On the compression of the crust of the earth under the atmospheric pressure, by the same.—On the method used in computations concerning a certain Life Assurance Company, by Prof. Mittag-Leffler.—On the probability of divergence occurring in employing the hitherto usual methods to represent planetary pertubations analytically, by Prof. Gyldén.—On the Bacteria of the swine-plague, by Dr. E. Selander.—On the structure of Champia and Lomentaria, by Prof. Agardh.—On a series, by Dr. Lindman.—Contributions to the knowledge of the reactions of the plato-oxalate, by Dr. Söderbaum.—On the action of chloron on α- and β-naphthol, by Prof. Cleve.—On two β-amido-naphthalin-sulphon acids, by G. Forsling.—On the action of the metaphosphoric acid on di- and tri-oxides, by K. J. Johansson.—Contributions to the knowledge of carbo-hydrates; No. 2, on graminine, by Drs. Ekstrand and Johansson.—Contributions to the theory of the undulatory movement in a gaseous medium (continuation), by Prof. Bäcklund.—On the rhombic porphyry from the valley of Brumun in Norway, by H. Bäckström.—The form of the crystals, and the optical constants of hydro-carbostyrile, by the same.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Hand-bo k of Perspective: H. A. James (Chapman and Hall).—Elementary Hydrostatics: S. B. Mukerjee (Thacker).—Chambers's Encyclopædia, New Edition, vol. i. (Chambers).—The Flora of West Yorkshire: F. A. Lees (Reeve).—The Fisheries and Fishery Industries of the United States; Section 2, Geographical Review: G. B. Goode (Washington).—The Religious Sentiments of the Human Mind: D. G. Thompson (Longmans).—Incwadi Yami: J. W. Matthews (Low).—History of Portugal; E. McMurdo (Low).—Geometry in Space: edited by R. C. J. Nixon (Clarendon Press).—The World to Come: J. W. Reynolds (K. Paul).—Flora of the Hawaiian Islands: W. Hildebrand (Williams and Norgate).—Facts about Ireland: A. B. MacDowall (Stanford).—Everybody's Pocket Cyclopædia (Saxon).—On Cold as a Cause of Disease: W. H. Ransom (Williams and Norgate).—Bulletin de l'Académie Royale des Sciences de Belgique, No. 12 (Bruxelles).—Geological Magazine, March (Trübner).—Catalog der Conchylien-Sammlung, Sechste Lieferung (Paetel, Berlin).—Memoirs of the Boston Society of Natural History, vol. iv. Nos. 1 to 4 (Boston).—La Première Comète périodique de Tempel, 1867, ii. (Genève).

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