THURSDAY, MAY 25, 1876

LORD CARNARVON'S VIVISECTION BILL

THE Report of the Royal Commission appointed to consider the question of Vivisection has led to the introduction of a bill into Parliament, the clauses of which restrict the practice of experiments upon living animals to a very great extent. According to the act—

(1) Experiments must be performed with a view only to the advancement, by new discovery, of knowledge which will be useful for saving or prolonging human life, or alleviating human suffering.

(2) In a registered place.

(3) By a person holding a licence from one of her Majesty's principal Secretaries of State.

(4) The animal must, during the whole experiment, be under the complete influence of some anæsthetic, [not urari ; and,

(5) Must be killed before it recovers from the influence of the anæsthetic.

(6) The experiment shall not be performed for demonstrational purposes ; nor,

(7) For the purpose of attaining manual skill.

It is but natural to suppose that concomitantly with the rapid advances which have, within the last century or so, been made in our knowledge of scientific method, similar progress has occurred in the theory of legislation. And yet our leading politicians, in introducing the above quoted Bill, are bold enough to advance, as a motive for the legal machinery they are endeavouring to enforce, the idea that there is any real substantiality in the notion that the lengthening of human life and the alleviation of human suffering can form any direct stimulation to physiological work. In so doing they show how little they are capable of appreciating the spirit of the higher philosopher, whose thoughts and temptations to investigate, however much they may be disguised by secondary motives, are but the involuntary secretion, as it may be termed, of his individual brain. They do not even seem to know that one of the most fundamental of the data of scientific method precludes the possibility of preconceived ideas of any kind forming part of a correctly stated problem.

Next with reference to the licence which must, according to the Bill, be held by all who desire to practice vivisection, we cannot help feeling that any legislation which at all interferes with higher mental work is cumbersome in the extreme ; for it appears to us to be quite unjustifiable to trammel in the least, the genuine and honourable exercise of original power, whatever way it tends to show itself. There can be no doubt that the genuine student of biology, in as far as he is a pure student, should be in no way restricted in his researches. The Duke of Somerset's objection also deserves special notice, for "important discoveries are often made by comparatively unknown men, rather than by the most prominent physicians and surgeons, and yet such students were to be prevented from prosecuting their researches."

With regard to educational physiology, quite a different influence is at work. We are among those who think that for the purpose of demonstrating physiological facts to students, vivisectional experiments are, notwithstanding the opinion of Sir James Paget and others to the contrary, not absolutely necessary. One of the physiologists examined before the Commission brought forward the case of the teaching of surgery in our medical schools, in which science the opportunities for obtaining independent practical skill on the living body are *nil;* and yet we cannot believe that many serious mistakes occur from the want of it.

Such being the case, the supervision of public institutions where physiology is taught is quite in accordance with our views, as are the restrictions with reference to the employment of anæsthetics, and the destruction of the subjects of experiment before they have recovered consciousness.

As to the exemption of Cats and Dogs, we never heard anything more ludicrous, and we are glad that Lord Winmarleigh—as a member of the Royal Commission his opinion is weighty—objected to the restriction as unnecessary. It may be true, as Lord Carnarvon remarked in the House last Monday night, that the employment of these animals has slightly encouraged theft in their direction ; but that this should be, by sober men, accepted as a reason for taxing physiologists to purchase more expensive animals, when a few more stringent sentences in the police courts would remove the evil, seems feeble in the extreme.

Looking at the Bill from a general point of view, its great defect is, in our estimation, its separate existence. The genuine spirit which actuates our nation, if we are not mistaken, is one which looks with disgust at the infliction of pain when unattended with the highest advantages. That this is not the case in some foreign countries we know, and can more fully realise since Dr. Klein has given his evidence before the Royal Commission. No doubt, as Lord Carnarvon remarked, "students are more and more in the habit of frequenting foreign Schools and returning to this country with the traditions and modes of these Schools." Would not a clause or so attached to the previously existing Cruelty to Animals' Act, however, cover all the requirements of the case by enabling an inspector, or a private individual, to prosecute any one performing a vivisection for simple demonstration purposes, or if he publishes results which show that due precaution has not been taken to reduce pain to a minimum in the animal operated on ?

WILSON'S "PREHISTORIC MAN"

Prehistoric Man : Researches into the Origin of Civilisation in the Old and the New World. By Daniel Wilson, LL.D. Third Edition. (Macmillan and Co., 1876.)

DR. DANIEL WILSON claims the merit of having introduced the useful term *prehistoric*, first employed (he says) in 1851, in his "Prehistoric Annals of Scotland." There its meaning was limited to races preceding the oldest historical nations of Northern Europe. But in the first edition of his "Prehistoric Man," published in 1862, it had become a general term for tribes ancient or modern in chronology, as to whom written history fails to afford information, and who are only known through archæology. The adoption of the word by Sir John Lubbock in the title of his "Prehistoric Times," published in 1865, and its incorporation into the name of the "Congress of Prehistoric Archæology," which held its first meeting at Neuchâtel in 1866, brought it into general currency.

The present third edition of Dr. Wilson's "Prehistoric Man" contains the principal dissertations of the original work. These are especially the account of the earthworks of the mound-builders of Western America, of the native-copper mines worked by the indigenes in the Lake Superior district, the details of stone and shell implements in America, and studies of American craniology The book has been now expanded so as to bring the new European evidence into connection with the American investigations, and in the course of correcting, various rash statements made in the previous editions have been pruned away. It is of course not necessary to go over the contents as though the work were new, but the following are among the points calling for remark :—

Living at Toronto as Professor of History at the local University, and having had special opportunities of studying the indigenes of North America and their antiquities, Dr. Wilson sees the problems of general ethnology from a peculiar point of view, which is often an advantageous one. For instance, as an archæologist living within reach of the above-mentioned native copper workings of Lake Superior, he was naturally led to give due attention to the interesting intermediate stage here represented between the Stone Age proper and the Metal Age proper. The tribes of the district had got so far as to discover that the copper they found in blocks was a malleable stone of great value for making hatchets and other tools of, but they had not arrived at the next stages, those of learning to smelt copper from the ore, and to alloy it with tin. Such an intermediate stage may possibly have at some time existed also in the Old World (vol. i., p. 230). Dr. Wilson's remarks are interesting both on the use of native copper among the northern tribes of the continent, and on the manufacture of bronze in Mexico and Peru. But the author's American surroundings perhaps incline him to ascribe too readily to the native tribes an absolute independence in the development of their civilisation, uninfluenced during historic centuries (as he says) by any reflex of the civilisation of the Ancient World. We do not think that he ought to have assumed (vol. i. p. 224) that the art of bronze-making was developed in the native-born civilisation of Mexico and Peru. He seems to recognise (vol. ii. p. 60) Humboldt's argument, that the Mexican astronomical calendar came from Asia, and if so, why should not the art of bronze-making have come thence too, and at no very ancient date? Dr. Wilson himself points out the likeness between the mirrors of polished bronze found in the royal tombs of Peru and those now in use in Japan (vol. i. p. 244).

There are two assertions often made as to the inhabitants of the part of America with which Dr. Wilson is well acquainted. One is that the skull and face of the English race in the United States are becoming assimilated to the type of the North American Indians. On this Dr. Wilson's remark is simply negative : "I can scarcely imagine anyone who has had abundant opportunities of familiarising himself with the features of the Indian and the New Englander, tracing any approximation in the one to the other" (vol. ii. p. 329). The other assertion touches the intellectual powers of the Negro as compared with the white race. For instance, Sir Charles Lyell was told in Boston (as many other Englishmen have been) as a reason for the coloured children being taught separately from the whites, that although up to the age of fourteen the Negro children advanced in education as fast as the white children, after that point it became difficult to carry them on further. Dr. Wilson regards this statement as a mere excuse, intended to justify a separation really made through caste-prejudices (vol. ii. p. 325). Dr. Wilson's testimony is of consequence on these two points, which rest on so considerable authority, that they ought without delay to be settled one way or the other. We can only hope he will find time to go more fully into them, considering their importance as throwing light on climatic modification of race on the one hand, and intellectual difference between races on the other.

Dr. Wilson is evidently more critical as an ethnologist and antiquary than as a comparative philologist. It is a pity that among the new matter inserted in this edition, he should have put in a passage which may lead uninstructed readers to believe that a connection has been really made out between the Guarani of Brazil and the Agaw of the Nile region, or between the Akkadian or Babylonia and any American language (vol. ii. p. 346). Dr. Wilson mentions certain theories propounded by Mr. Hyde Clarke, but he does not even produce the evidence on which he relies. On the contrary, it may be said with some confidence, that as yet no philologist has proved any prehistoric connection whatever between any language of America and any language of the Old World, except of course, near the shores of Behring's Straits.

In fairness to Dr. Wilson, however, the value of other of his linguistic contributions must be acknowledged ; for instance, his list of imitative names of animals in Algonquin dialects, and his remarks on the Chinook jargon, and the *Pigeon*-English (*i.e. Business*-English) of the Chinese ports. The specimen of the latter (vol. ii. p. 333) is the introduction of a new English customer to a Chinese merchant :—"Mi chinchin you, this one velly good flin belong mi ; mi wantchie you do plopel pigeon along he all same fashion along mi," &c. On the whole Dr. Wilson is to be congratulated on the reappearance and revision of his work.

EDWARD B. TYLOR

THE ARALO-CASPIAN REGION

The Shores of Lake Aral. By Herbert Wood, Major R.E., F.R.G.S., &c. (London : Smith, Elder and Co., 1876.)

FROM the earliest times down to the present day there has always been a certain amount of mystery and uncertainty hanging around the Aralo-Caspian region. Major Wood in the work before us shows that the physical history of this ever-changing region is largely sufficient to account for this mysterious halo. Major Wood had an unusual opportunity for exploring Lake

Aral and the regions around it in 1874, having been allowed to accompany an expedition sent out under the auspices of the Russian Geographical Society to examine the Amúdarya. The results of this visit, as contained in the masterly work under notice, show that he took excellent advantage of so favourable an opportunity. Some of the most important of these results as regards the past and present physical condition of the Aralo-Caspian region were described by Major Wood in three papers which appeared in NATURE, vol. xi. p. 229, and vol. xii. pp. 51 and 313. To these papers we would refer those who want to get a succinct idea of some of the important conclusions which Major Wood has reached; but all who take an interest in physical geography generally, and this region in particular, we would advise to procure the work under notice.

The two main points discussed by Major Wood are the past and present condition of the Amúdarya or Oxus, and the existence at one time of a great Asiatic fresh-water Mediterranean Sea, of which the Black Sea, the Caspian, and Lake Aral are only remnants, and having communication by the region to the north of the last-mentioned lake with the Arctic Ocean. How small a change in the present conditions of the Black Sea would serve to give rise to such a great inland sea as Major Wood, on good grounds, supposes once to have spread its waters over a wide extent of Asia and Europe, may be seen from the following extract:—

"Supposing the outlet of the Bosphorus to be closed to the height of two hundred and twenty feet above sea-level, the superfluous waters of the Black Sea basin, which now flow off to the Mediterranean, would rise in level and encroach on the south Russian steppes and the lower Danube plains, though the coasts of Asia Minor, which form the southern boundary, would be but little changed on account of their steepness. On attaining a height of about twenty-three feet above sea-level[1] the waters would escape by the line of the Manytsch into the basin of the Caspian, and, after having filled it up also, would flood the country intervening between it and Lake Aral. In their ascent to this basin the waters would chiefly pass by the Emba steppes from the north-east of the Caspian basin, and from Balkhân Bay on the south-east, up the country crossed by the Uzboy channel of the old Oxus; for between the two seas lies the elevated plateau of Ust-Urt. This high ground has several detached portions near the Caspian shore, while the remainder of its surface is covered with numerous bowl-shaped depressions. These would, in all probability, have received the rising waters by ravines which enter the body of Ust-Urt from the low steppes upon its north and upon its south, and the aspect of the plateau would thus have been changed into that of the lake and marsh sprinkled highland whose traces remain to-day.

"In this imaginary reconstruction of the Asiatic Mediterranean, the moment the rising waters reached a point at about two hundred and ten feet above the sea, and which is situated at the head of the now dry gulf Abougir, they would have entered into and filled up the basin of Lake Aral."

Many indications exist at the present day pointing to the great probability of the existence, at some perhaps not very remote period, of such an inland sea. The fauna of the basins of the Black, the Caspian, and the Aral Seas are nearly identical; a glance at the fine map which accompanies the volume shows that the region to the north of the Aral is covered with lakelets, and evidence exists that in historical times the Aral was joined to the north part of the Caspian. The amount of evidence, historical and physical, produced by Major Wood in support of the ideas developed in his work, is very great, and we think in the main convincing.

The author devotes a number of chapters to the Amúdarya, the lower course of which he has explored with the greatest minuteness; indeed he seems familiar with every mile of it. He gives a clear and detailed account of the lower arms of the Amú—which are not at all of the nature of a delta—by which it discharges itself into Lake Aral. No dependence can be placed on the permanence of these outlets, nor indeed it would seem upon that of any part of the Amú for the last 400 miles of its course. It is known that at one time it flowed into the Caspian, and Major Wood's work and map show how this could easily have been, and could easily be again brought about at the present day. From Tchardjui an old bed is seen to strike westwards to the Balkhan Bay of the Caspian, and from this branch again Major Wood adduces evidence to prove that, periodically at least, another must have struck south-westwards into the Attrek, which has been so much in the front recently. The Amú, indeed, throughout historical and no doubt prehistorical times, has been an ever-changing river, in its lower course at any rate; its frequent and perplexing changes being caused partly by the physical conditions which regulate its flow, and partly by the interference of man; for at the present as in past times the river is tapped at several places for the purpose of irrigating the desert regions which lie to the west. The river divides at Khodjeili into three main branches, which carry its water to Lake Aral; but these seem to be ever shifting, and the region embraced between them, inhabited by the poor Karakalpaks, seems to be mostly a swamp.

Major Wood also devotes some space to an account of the Syrdarya or Jaxartes, which at one time discharged a considerable proportion of its waters by the Jany Darya into the Amú, and thus probably ultimately into the Caspian. Major Wood traversed the district between the lower Amú and Fort Peroffsky, the Kizzel Koom desert, and came across distinct traces of a former channel. But altogether the amount of evidence, historical and physical, which he brings forward to show the changes which have taken place in the region under consideration is almost bewildering. Greek, Arabic, Russian, and Chinese writers of all ages are quoted; indeed Major Wood seems to have collected every important scrap of writing that bears on the region he is investigating. This historical evidence, combined with the physical conditions of the region with which he has made himself thoroughly familiar, enable him to make out a strong case on behalf of all the points he desires to establish. The work must always be regarded as a standard reference-book on the hydrography of the Aralo-Caspian region. But it is something more; notwithstanding that it endeavours to solve some very hard questions, it is never dry, never uninteresting. It contains a record of a pleasant and profitable journey from Samara on the Volga to the Russian ports on the Syr, a

[1] This is the height of the surface of the lake, which exists in the bed of the Western Manytsch, at its higher extremity, though the level of the banks, at the bifurcation of the Eastern and Western Manytsch channels, is more. M. Hommaire de Hell stated this height to be nearly ninety feet above the sea, which is not very incorrect, though perhaps slightly in excess of reality.

cruise down the Sea of Aral, and up the Amú, and, as we have said, a journey across the dreary desert of Kizzel Koom. Major Wood conveys, we think, a clearer and more vivid idea of the region indicated, its aspects, and its inhabitants, their characteristics and habits, than any other author we know. The maps which accompany the volume are a great assistance. We may note that they give the present level of the Caspian as 85 feet below that of the ocean, Lake Aral being 158 feet above sea-level. This, we presume, may be taken as authoritative for the present, and it ought to be noted, as the statements on the point in various authorities differ in a most remarkable way.

Major Wood naturally speaks of the conduct of Russia in Asia with warm approval, and indicates several beneficial results which have followed her recent conquests. He believes that of all European powers she, partly from the simplicity of her Government, and partly on account of her ethnic affinities, is best suited to wean the wandering hordes of Central Asia to a settled and civilised life. We strongly recommend Major Wood's work as one of substantial value and great interest. But why has a work of such importance and so full of details, been allowed to go forth without an index. We hope this omission will be remedied at the first opportunity.

OUR BOOK SHELF

La Théorie des Plantes Carnivores et Irritables. Par Edouard Morren. (Bruxelles: F. Hayez, 1876.)

IN this pamphlet, a report of an address given at the annual public meeting of the scientific section of the Royal Academy of Belgium, on Dec. 16, 1875, Prof. Morren gives an admirable *résumé* of the present state of our knowledge on these two branches of vegetable physiology. As regards the now well-known phenomena of carnivorous plants, he gives the most essential points of the observations of Darwin, Hooker, Lawson Tait, Reess and Will, the author himself, and others: and, in contrast to his relative, M. Charles Morren, he gives his full adhesion to the view that nitrogenous substances are actually digested by the leaves of *Drosera*, *Pinguicula*, and *Nepenthes.* He points out, indeed, that the theory is not a new one, having been promulgated by Burnett in 1829, as respects *Sarracenia;* and by Curtis in 1834, and Canby in 1868, as to *Dionæa;* and also, he might have added, by Dr. Lindley, in his "Ladies' Botany," published in 1834. In his introductory remarks Prof. Morren insists on the identity of the process of nutrition in the animal and vegetable kingdoms. The second portion of the discourse is devoted to the elucidation of the phenomena of "Motility" as exhibited in the irritability of the leaves of *Mimosa*, the stamens of *Berberis*, and other organs which exhibit similar peculiarities; the aggregation of protoplasm as seen in the "tentacles" of *Drosera;* the apparently spontaneous movements of zoospores, climbing plants, &c. Anyone desiring to obtain a general idea of what is at present known on these interesting subjects could not do better than consult Prof. Morren's lecture. It is pleasant to find a tribute to "la science Anglaise" in connection with vegetable physiology.

A. W. B.

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. No notice is taken of anonymous communications.*]

Supposed New Laurentian Fossil

WHEN a man finds that he has made a mistake, the best thing he can do is frankly to acknowledge and explicitly to correct it.

I lose no time, therefore, in making known to the readers of NATURE that the notice of a New Laurentian Fossil which I published in its columns three weeks since, was written under a complete misapprehension of the real nature of the body. So far from being calcareous, as I had been led to believe by the information I had received from the geologist who found the specimen, it proves to consist of alternating layers of felspar and quartz—the former simulating an organic structure like that of *Stromatopora*, and the latter occupying what had been supposed to be the cavities of that structure—together constituting what is known to petrologists as "graphic granite."

The conclusions I had drawn from a cursory examination of the sections first sent me by Mr. Thomson, instead of being confirmed by a more minute study of thinner sections, proved to be altogether untenable; what I had supposed to be piles of flattened chamberlets in the thickness of each lamella, turning out to be mere fissures in the felspar, arranged with extraordinary regularity; and what had seemed to be a vertical tubular structure, proving to be mere striation.

The examination of numerous sections of this body, and a comparison of them with sections of the "graphic granite" found in its neighbourhood, has now satisfied me that the former presents no other indication of organic origin, than is afforded by the *Stromatopora*-like disposition of its alternating lamellæ; and that this is so nearly approached in the latter, as to show that the agencies which produced the "graphic granite" were competent to have produced the supposed Harris fossil.

Whether these agencies were entirely inorganic, or whether the "graphic granite" itself may not be a metamorphic form of an ancient organic structure (metamorphoses nearly as strange having undoubtedly happened), is a question which is not at present to be decided by anyone's *ipse dixit.* When a petrologist shall have succeeded in *making* a graphic granite, he will be entitled to speak with assurance of its purely mineral nature.

It will doubtless be triumphantly urged by those who maintain *Eozöon* to be a "pseudomorph," that as I have had to confess myself completely mistaken in regard to the Harris specimen, I am just as likely to have been wrong in regard to the Canadian ophicalcite. To this I have simply to reply that my mistake in the present case has arisen entirely from undue haste, and has been corrected by my own more careful study; which has satisfied me of the *entire absence*, in the Harris specimen, of those Foraminiferal characters which seem to me unmistakably recognisable in the Canadian *Eozöon.*

In the memorable discussion at which I was present in Paris, on the flint implements found associated with the Abbeville jaw, it was the *entire absence*, on the surface of those worked flints, of the staining, the dendrites, the patina, and the wearing of the edges, characteristic of the genuine implements, which satisfied the English experts of the factitious character of the former. But, so far from anyone being led by this discussion to call in question the fashioning of the genuine implements by men coeval with the river-gravels of the Somme, it only brought out more fully the strength of that case, by showing what complete reliance might be placed upon the characters of antiquity which they presented. And so, in the present instance, the striking contrast in the microscopic appearances presented by two bodies bearing a close resemblance in general structure, seems to me only to bring out the organic characters of the one more decidedly, by comparison with the purely mineral characters of the other.

WILLIAM B. CARPENTER

Theory of Electrical Induction

I WAS hoping someone of eminence would tell us what he thought of the arguments of Prof. Volpicelli, or whether no clearer view of induction had been arrived at. Prof. Clerk Maxwell's letter of last week brings back the subject to its natural point of view to one whose ideas are based upon potential, but at the same time it leaves some points doubtful which have a particular bearing on the whole theory. Might I therefore be allowed to ask information from him, by explaining the ideas which have been impressed upon me about this, by reading his book "Electricity and Magnetism," though they are removed *toto cælo* from the ideas expressed by the phraseology of Prof. Volpicelli, and that of the usual text-books.

We know nothing of electricity except as a force. We may speak of it as a fluid, and use a corresponding terminology, but it is always measured as force. A conductor is a body in which these forces immediately equilibriate themselves at the expense of calling into play other forces of the same or of opposite kind amongst the molecules of the dielectric. These forces give rise to the diminishing potentials as they are equilibriated over greater and greater surfaces. When another conductor is brought nto the neighbourhood, since throughout it the electrical forces are in equilibrium amongst themselves, the various molecular forces are as before manifested only at the surface, and they are necessarily negative where the conductor obtrudes into regions of higher positive potential than its own mean, and positive where it lies in the regions of lower positive potential. But not only this, the molecular forces which keep the electrical forces in the dielectric in equilibrium cannot thus simply be pushed, as it were, backwards and forwards, but must fall into equilibrium in their own way—in other words there is a redistribution of electricity both on the inductor and inducer, which can only be determined by properly drawing the equipotential surfaces corresponding to the new arrangement (if possible). The state of stress of the particles of the dielectric surrounding any small conductor is not affected by its total motion of translation, except that as it is moved from the other conductors it is redistributed on the surface.

If now we draw a series of equipotential surfaces, that particular one which corresponds to the potential of the conductor will divide it, as Prof. Clerk Maxwell says, into two parts, on one of which is negative electricity, and on the other positive, in other words the state of stress of the particles outside the conductor is of one kind on one side, and of the opposite kind on the other. Now comes my first question. If this is the case how can it be said that there is either more positive electricity on the inducer nearest the inductor as Prof. Clerk Maxwell says, or less as Prof. Volpicelli says, than at the other end, when in fact there is none, but the force is negative? No doubt we can take for mathematical purposes a negative quantity as the sum of two others, one positive and the other negative and greater, but can the existence of the positive quantity be called a "fact" in consequence?

There is a way, however, in which we might be inclined to say that the positive electricity is least nearest the positive inductor, but this looked at in the same way as before, raises a second question. If we make a small conductor touch any part of the induced conductor, and then try it in the usual way, we might say that the spot on which we touched it when the small conductor was most electrified had the greatest amount of electricity upon it, and might determine its kind. But before doing this we ought to ask what will be the effect of bringing the new conductor into the neighbourhood, and this depends on its shape and size. The equipotential surfaces will all be altered, and the alteration may be such that the one belonging to the first induced conductor may leave the new one entirely on the positive or entirely on the negative side, or may divide it into two like the first induced conductor. In connecting with the earth we make the new conductor so large that the old one is all on the negative side; and the fact that by breaking contact we can keep the old conductor charged with negative electricity shows that we may take any smaller part from the wholly negative side and it will also show the same electricity, as in inductive machines. If the new conductor be so shaped or so large that it cuts through the neutral equipotential surface, on removing it only the balance of the forces called into play will be left to be equilibriated by the molecular forces, and that balance may be positive though the contact was on the negative side of the former neutral surface. In this way only could a finite conductor take positive electricity from the negative side, but in this case it is due to induction on the new conductor as temporarily forming part of the old, and not to the original induction on the first conductor. What experimental proof, then, is there, or can there be, if these principles are true, that there is *any* positive electricity nearest the positive inductor before the distribution is disturbed by too long or large a conductor being brought into the field? and how, therefore, is Melloni's theory true?

Also, might not a point if properly placed on the negative side, cut through the neutral equipotential surface and so discharge positive electricity?

I should be glad to know, from a good authority, that we may thus explain these phenomena by a reference to force alone and not to hypothetical fluids, and without meddling with such useful, perhaps, but unmechanical ideas as "bound" and "free."

J. F. BLAKE

Dynamometers and Units of Force

IN NATURE (vol. xiv., p. 29) Prof. Barrett says "it would be interesting to know on what grounds Prof. Hennessy bases his emphatic and reiterated assertion." The assertion referred to is contained in my former communication (NATURE, vol. xiii., p. 466). The grounds on which it is based are as follows:—In order to accurately measure units of force according to the C. G. S. system, spring balances which could be depended upon to the $\frac{1}{981}$ of a gramme or $\frac{1}{63}$ of a grain nearly would be required. In mechanics the forces to be compared and measured usually amount to several kilogrammes, and powerful spring dynamometers are most suitable for their estimation. Dynamometers such as those alluded to as being sent for exhibition from the College of Science to South Kensington are of this kind. By experiment I have found them unfit for the estimation of small units of force. I should be much interested in seeing Prof. Barrett or Dr. Ball measuring a C. G. S. unit or $\frac{1}{981}$ of a gramme by the aid of one of these dynamometers. It should be remembered that in this discussion I all through refer to these dynamometers and others of a similar kind employed in mechanics. I was already aware of the belief expressed by Sir William Thomson and Prof. Tait, that spring balances, "*if* carefully constructed," would rival or even surpass the ordinary balance. While thus referring to the possible perfection of the spring balance with the qualifying particle "*if*," they justly remark that the pendulum is the most delicate of all instruments for the measurement of force. A pendulum will probably always furnish the best means for measuring force in absolute measure, whether by large or small units; and I entertain strong doubts as to whether the spring balance can ever supersede the beam balance for accurate determinations of weight. In no department of experimental inquiry are such minute quantities weighed, and nowhere is greater accuracy in determining differences of weight required than in chemical analysis, and chemists almost universally employ the beam balance in preference to the spring balance in their most delicate analytical researches.

In my former communication I mentioned that the dynamometers alluded to could not be depended on within the tenth of a kilogramme. In saying this I have spoken of them in the most favourable terms, for the larger one can scarcely be depended upon within the fifth of a kilogramme.

Prof. Barrett quotes a statement as "occurring in Prof. Hennessy's own syllabus," which implies that I had adopted and used the C. G. S. system. The words quoted belong to a syllabus written by Dr. Ball for the session 1874–75. I entered on my duties after the commencement of that session, and my name was attached to new editions of the syllabus instead of the name of its author, while the part of the syllabus relating to mechanics remained untouched. I had been always under the impression that Prof. Barrett was perfectly aware that I was not the author of this syllabus, and although technically it might be regarded as the syllabus of applied mathematics in the College until a new one could be prepared and published with the sanction of the Science and Art Department, it seems scarcely correct in a scientific discussion to quote it as expressive of the views of a person who was well known not to be its author.

Prof. Barrett, in his first letter, laid much stress on the introduction of spring dynamometers into Dr. Ball's courses on mechanics for the estimation of force in absolute measure; as if such an employment of these instruments was entirely new. It is but just to observe that dynamometers of the same kind, and graduated in the same way, have been long since employed in other courses of mechanics, and such instruments are figured and described in some of the most common elementary books used in the colleges of Europe. With reference to the dynamical units which I prefer to employ in my courses of mechanics, Prof. Barrett uses the phrase, "a mixed system of kilogrammeters and foot-pounds." I never mix the two kinds of units. I keep them perfectly distinct. I employ both, because in the practical applications of mechanics, students may be called upon to apply one or the other. As far as I have been able to ascertain, these are the units in most general use among engineers throughout the world; and I should as soon expect mechanicians to adopt the C. G. S. system as to hear that bankers adopted our smallest coin as the unit of account instead of the sovereign, and to see the prices of stocks in the money market no longer quoted in pounds but in farthings.

HENRY HENNESSY

Royal College of Science for Ireland

THE POTATO DISEASE[1]

II.

THE Peronosporeæ are usually divided into two genera, viz.—Cystopus and Peronospora: with the former the potato disease has no connection.

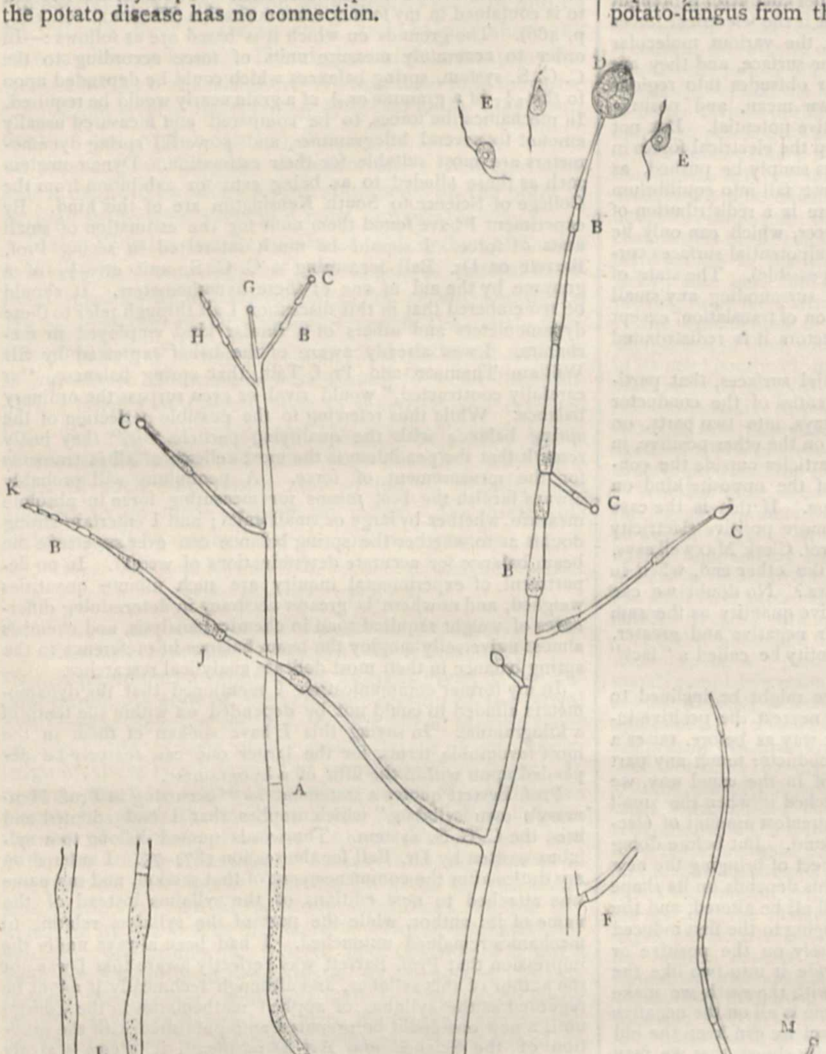

FIG. 7.—*Peronospora infestans*, Mont., × 250 dia. From De Bary's slide, No. III. A, A, septate conidiophores; B, B, vesicular swellings; C, C, immature conidia; D, conidium, showing differentiation of its contents; E, E, free zoospores; F, frequent mode of attachment of branch.

II.—PERONOSPORA, *Corda*.

The fungus of the potato disease was first placed under the genus Botrytis Mich., but Corda established Peronospora to receive the species with non-septate threads. Unfortunately for the genus, and for *P. infestans* in particular, the threads of the latter are always more or less septate, and this character effectually separates the potato-fungus from the *Saprolegnieæ* (as at present defined) where septa are unknown. De Bary now proposes the establishment of another new genus (under the name of Phytophthora) to receive the potato-fungus, the chief character of the proposed new genus resting on the development of, not one, but several spores (conidia) successively at the end of each branch of the aerial threads of the fungus (conidiophores). This character has been known to fungologists since the potato-fungus was first described, although it has generally been esteemed of specific rather than of generic value. The Rev. M. J. Berkeley in illustrating the potato-fungus for the Royal Horticultural Society, figures the conidia as being pushed off the branches (Pl. 13. Fig. 12*, 14). The same phenomenon is illustrated in the Micrographic Dictionary (Pl. 20, Fig. 6). I have also recorded the habit in the secondary condition of the fungus where the oogonia are successively pushed off the supporting threads.

As so much attention has of late been directed towards the Peronosporeæ it is more than ever necessary that the characters of the family should be correctly known, and this is especially important as regards the nature of the secondary state of these fungi: a brief statement of the sexual condition may therefore be useful. The female cells (oogonia) are borne sometimes on the tips of mycelial threads, sometimes as sessile bodies on different parts of the threads and sometimes intercalated within the threads themselves, after the manner of the illustrations on Figs. 1, 3, and 4. The male organs (antheridia) are usually smaller and carried on finer threads, not as a rule anatomatically distinct from the oogonium-bearing threads. The contact of the antheridium with the oogonium, gives rise to the oospore or resting-spore.

Peronospora infestans, Mont., in its aerial state has been so often and so accurately described by Berkeley, De Bary, and others, that any further illustration or description is almost unnecessary. It must be confessed, however, that the figures first published by Messrs. Berkeley and Broome (in connection with Dr. Montagne) and latterly by De Bary, have only too many times been copied and recopied without reference to the fungus itself. There is therefore no apology required for publishing the present illustration (Fig. 7) which is new, and I trust exact. It is a camera lucida reproduction enlarged 250 diameters of a group of conidiophores as supplied by Prof. A. De Bary

[1] Continued from vol. xiii., p. 527.

to the Royal Agricultural Society, on their Slide No. III. (The three free zoospores are from a drawing by De Bary.) The septate aerial branches of the fungus, named conidiophores are seen at A A. The characteristic vesicular swellings peculiar to the potato-fungus at B B. Immature conidia at C C, and mature conidia at D, the latter showing the contents differentiating into zoospores. The zoospores are shown free at E E. The mycelium and conidiophores of *Peronospora infestans* are generally furnished with septa (A A) but this character is liable to great variation. The conidia are at first terminal (G) with no swelling on the thread below, but as the threads grow they push off the old conidia and continue to produce new ones on each newly formed apex. De Bary explains this phenomenon by saying, "When the first conidium is ripe, it is pushed to the side by an unequal swelling of the point to which it is attached. The top of this swollen portion then begins to grow in the original direction of the branch into a new conical point; and when this has reached a length equal to that of a conidium, or a conidium and a half, a new conidium is produced at the apex." I take this to be only partially correct, for the more reasonable explanation of the vesicular swellings on the threads is that the thread is constantly making an effort to produce new conidia, and each swelling is really an *abortive conidium*: each of these pieces will grow in water if free, as will the immature dust-like conidia (C C) the latter are being pushed off at M M. On looking at point B, it will be seen that the swellings there illustrated have never produced terminal conidia at all, but that each successive swelling is in itself an *attempt* to become one. Instead of these bodies *when terminal* growing to the length of "a conidium or a conidium and a half" they commonly remain the mere fourth or sixth part of a conidium in length, and often less, and never produce conidia. At J will be seen a double swelling: the first effort of the thread fell short, and the attempt to produce the conidium was renewed: such double swellings are common; a terminal one occurs at K. Vesicular swellings occur on all parts of the conidiophore; they are frequent at the base, commonly irregular as at L and always (to me) represent an attempt at fruit production.

It may just be well to remark that the suggestion as to the possibility of the oospores of *P. infestans* being ultimately found on some plant different from *Solanum tuberosum* is very old, and that Mr. Berkeley has recently found the potato-fungus growing upon the garden Petunia, this plant, we believe, has not been given in any previous list, and its importance must not be overlooked, for the Petunias come from the native country of the potato, one garden species even coming from Chili.

Prof. De Bary is not right in his surmise that he was "perhaps" the first to call attention to the perennial mycelium of the potato-fungus in 1863; Mr. Berkeley did this in 1846 and the fact has been confirmed by many observers since. The subject is thoroughly old and is discussed in our popular books; for instance—see vol. xiv. of the "International Series" Fungi (p. 156), where Dr. M. C. Cooke says, "The Peronospora of the potato is thus perennial by means of its mycelium." Most fungi depends for their existence upon "perennial mycelium." The "spawn" of the common mushroom is a good and well known example. A mycelium may however be perennial and yet produce oospores.

WORTHINGTON G. SMITH

OUR ASTRONOMICAL COLUMN

THE OCCULTATION OF SATURN, AUGUST 7, A.M.—Perhaps some observers who are provided with good telescopes may be induced to look for the occultation of the planet Saturn, on the morning of August 7, although (in the south of England) the immersion does not take place until half an hour after sunrise, and at emersion Saturn is only some five degrees above the south-western horizon.

Reference is made to the phenomenon here with the view to illustrate the use of the method of distributing predictions over a given geographical area, explained by Mr. W. S. B. Woolhouse in the *Companion to the Almanac* for 1871, as applicable to the phases of a solar eclipse, to the approximate prediction of the times of immersion and emersion of a star or planet in a lunar occultation, and the angles on the moon's limb at which they occur, at any place within the given area or very near to it. It is founded upon the assumption that the value to be determined is a linear algebraic function of the latitude and longitude of the place, for which the calculation is to be made. On this assumption the time (t), of any phase, &c., may be expressed thus:—

$$t = c + p.\ \mathrm{L} + q.\ \mathrm{M}.$$

where c, p, and q are three constants to be found.

If now direct calculations of the particulars of any phenomenon be made for three places moderately distant as Greenwich, Dublin, and Edinburgh, the constants will be determined by the substitution of the results, which supply the three equations of condition necessary. If the difference Greenwich—Dublin be called h, and Greenwich—Edinburgh k, then, as calculated by Mr. Woolhouse:—

$$p = 0{\cdot}1425\,h - 0{\cdot}2840\,k$$
$$q = 0{\cdot}05014\,h - 0{\cdot}02137\,k$$
$$c = \mathrm{G} - 1{\cdot}4772\,k.$$

G being the result of the computation for Greenwich.
Also L is latitude — 50°, expressed in degrees and decimals.
And M is longitude from Greenwich, + if east, – if west, in minutes of *time* and decimals.

Applying this method to the occultation of Saturn we have, by direct computation for Greenwich, Dublin, and Edinburgh (astronomical times at Greenwich, Aug. 6):—

	Immersion.	Emersion.	Angle N.Pt. Immersion.	Angle N.Pt. Emersion.
	h. m.	h. m.		°
Greenwich ...	17 7·53 ...	18 3·10 ...	94·6 ...	331,1
Dublin ...	17 0·25 ...	18 2·35 ...	107·6 ...	319,0
Edinburgh ...	17 0·25 ...	18 2·38 ...	111·2 ...	313,8

The necessary data being taken from the *Nautical Almanac*, and the angles expressed as usual in that work.

Thus we find for Greenwich time of immersion and emersion at any place in this country, and for the angles on the moon's limb from north point:—

		h. m.
Immersion ...	Aug. 6	17 9·05 – 1·03 L + 0·21 M.
Emersion ...	,,	18 3·24 – 0·10 L + 0·02 M.
		°
Angle Imm.		90·3 + 2·9 L – 0·3 M.
Angle Em.		336·3 – 3·5 L + 0·2 M.

The differences between the results of these equations and direct calculations for Exeter and Liverpool are:—

	Exeter.	Liverpool.
	m.	m.
Immersion	– 0·2	+ 0·2
Emersion	+ 0·1	– 0·3
	°	°
Angle Imm.	+ 0·3	– 0·2
Angle Em.	+ 0·1	+ 0·1

In this manner have been derived the following particulars, as regards the occultation in question, which will illustrate the applicability of Mr. Woolhouse's method to such phenomena:—

	G.M.T. of Immersion.	G.M.T. of Emersion.	Angles from N. point. Imm.	Em.
	h. m.	h. m.	°	°
Aberdeen ...	16 59·9 ...	18 2·4 ...	113 ...	310
Cambridge ...	17 6·9 ...	18 3·0 ...	98 ...	329
Exeter	17 5·6 ...	18 2·7 ...	96 ...	331
Glasgow ...	16 59·4 ...	18 2·3 ...	112 ...	312
Liverpool ...	17 2·8 ...	18 3·0 ...	104 ...	322
Manchester ...	17 3·6 ...	18 2·7 ...	103 ...	322
Nottingham ...	17 5·9 ...	18 2·9 ...	99 ...	326
Oxford	17 6·1 ...	18 3 0 ...	97 ...	329
Portsmouth ...	17 7·3 ...	18 3·1 ...	94 ...	332
York	17 4·9 ...	18 2·8 ...	102 ...	322

NEW RED STAR.—Mr. Birmingham, Millbrook, Tuam, mentions (*A. N.*, 2,092) his having remarked an intensely red star, 8·5 magnitude, which is not in Schjellerup's catalogue (*Vierteljahrschrift der Astron. Gesellschaft*, ix. Jahrgang, Heft 4). From the approximate position given the star appears to be No. 3,168, + 36° in *Durchmusterung*, where it is also estimated 8·5, and its position 1855·0 is R.A. 18h. 27m. 19s., N.P.D. 53° 7'. It has not been found in any other catalogue.

THE DOUBLE STAR Σ 3,121.—This object well merits the attention of observers who are in the possession of large telescopes. Baron Dembowski seems to have given it up for the present as beyond his instrumental means. It is evidently a binary of no long period. For comparison we have—

Struve	... 1832·31	Position	20·0°	Distance	0·85"
Dembowski..	1866·22	,,	189·7	,,	0·68
,,	1872·23	,,	210·5	,,	a wedge
,,	1875·31	,,	252·0	,,	oval.

The place of this star for 1876·0 is in R.A. 9h. 10m. 32s., N.P.D. 60° 53'·8.

THE LOAN COLLECTION CONFERENCES.

THE work in connection with the South Kensington Conferences has been carried on heartily and successfully during the past week. The number of visitors to the collection has been, all things considered, satisfactory, and the conference-room is always well filled.

Of the papers in the Section of Mechanics read on the 17th inst., M. Tresca's, on the "Flow of Solids," possessed some novelty and interest. From his experiments he drew inferences as to the proper form and mode of application of tools, explained the theory of many of the adjustments which workmen have found out by rule of thumb, and indicated extensions of the use of the principles now reduced into formulæ. He added that, in his belief, these mechanical laws ought to be pursued into physiology, and that the accretion of cell to cell was a mechanical phenomenon.

The conversazione given by the Physical Society the same evening was brilliant and successful.

At the meeting of the Chemical Section last Thursday, Dr. Frankland gave a long and highly important address, mainly on eudiometric apparatus. This address we give this week *in extenso*. Dr. J. H. Gilbert, F.R.S., then gave an interesting lecture on "Some Points connected with Vegetation." Mr. W. F. Donkin, M. A., then gave a description of the ozone apparatus of Sir B. Brodie, Bart., F.R.S., after which Prof. Andrews, F.R.S., concluded the meeting with an account of some experimental investigations in connection with the physical constitution of gases.

On Friday was held the second Conference in connection with the Physical Section. The conference-room throughout the day was unusually well filled. The first communication was from Prof. Tyndall, F.R.S., on the "Reflection of Sound." With the help of Mr. Cotterell, his assistant, he reproduced some of the experiments with sensitive flames with which he has made scientific audiences so familiar.

Dr. Stone spoke on the subject of "Just Intonation and the Limits of Audible Sound." Mr. R. H. M. Bosanquet, M.A., spoke on "Instruments of Just Intonation," and explained the construction of the enharmonic harmonium contributed by him to the collection.

Mr. F. Galton, F.R.S., in his remarks "On the Limits of Audible Sound," spoke of experiments which he had been trying for some time past on the susceptibility of various animals to the highest notes, such as those of extremely small whistles. He had arrived at the conclusion that no animals were so sensitive to sounds of the character in question as cats, which, of course, were the animals produced by natural selection to prey upon those other animals which in nature produced such sounds—namely, mice.

Prof. W. G. Adams, F.R.S., spoke on the late Sir C. Wheatstone's acoustical discoveries, and Mr. W. Chappell followed with a discourse "On Ancient Musical Science."

Mr. J. Baillie Hamilton spoke on Æolian instruments. He gave a history of the attempts in Europe to combine wind and string, and coming down to the present time he spoke of his own experiments. He has found that a metallic ring of suitable elasticity well supplies the place of a string's constraint on a vibrator. Variations in the shape of the ring produce differences of tone. Thus, passing from the circle to almond-shaped rings, all qualities from the flute to the horn are created.

M. Tresca referred to the still existing monuments of the history of science. For various reasons, want of appreciation, want of care, &c., many instruments of historical interest are lost. France is relatively well off in its historical instruments, and it is well represented in this exhibition. M. Tresca then referred to the instruments in the collection France has sent over, giving a graphic sketch of their history and the history of the progress of the sciences they have helped forward. The Earl of Rosse, F.R.S., made a brief communication on the thermopiles which he is now using in connection with the telescopes belonging to the late Earl, after which Mr. De la Rue described his electric batteries of a novel construction. The Cavaliere Prof. De Eccher made a communication on the instruments sent over from Italy.

The conversazione given by the Geographical Society on Saturday evening was in all respects a successful one; more than 2,000 persons accepted the invitations sent out.

In the second meeting of the Mechanical Section on Monday, the first paper was by Prof. Kennedy, on "Reuleaux's Collection of Kinematic Models." Prof. Kennedy explained the general principles and some of the details of these educational models designed by their constructor for the illustration of the theory of machines. Mr. W. Barnaby, C.B., then read a paper on "Naval Architecture," which we hope to publish in our next number. Mr. W. Froude, F.R.S. then gave a short lecture on "Fluid Resistance," detailing many of his experiments. The other papers read were by Mr. Thomas Stevenson, on "Lighthouses," M. le Général Morin on "Ventilation," Messrs. Dent on "Time-measurers," and Mr. J. N. Douglass, C.E., on "Instruments contributed by the Trinity House."

The Chemical Section met again on Tuesday. The President, Dr. Frankland, F.R.S., read a communication from M. le Professeur Frémy, the French Chemist, on the Diminution of Scientific Research. M. Frémy has founded and carried on during the last twelve years a laboratory for the prosecution of original investigations by students who have completed their scientific studies. The experience which he has gained is such as to lead him to the conclusion that it is necessary to invoke state aid in order to restore research to that position which it should occupy. As the State chooses its officers and engineers after a severe course of study, and then ensures their regular advancement in its service, M. Frémy claims a similar boon on behalf of pure science, which renders such invaluable services to the community. He proposes that the scientific service should consist of five grades, with salaries rising from a minimum of 120*l*. to 800*l*. per annum, and that the fitness of candidates for entrance to it should be decided by a jury of men of acknowledged scientific reputation, independence, and integrity. This jury should make known in official reports the claims of the various candidates to advancement, thus securing public criticism, and removing all opportunities of intrigue or favour. Prof. Roscoe, F.R.S., then gave a lecture on Vanadium and its Compounds, exhibiting on the table the collection of these substances contributed by himself to the Loan Collection, representing the results of his admirably conducted series of researches in connection with this particular one of those metals designated by the chemist as "rare." The President, in thanking Prof. Roscoe, remarked, in reference to the value of scientific research, that it could not be too widely known that all the greatest results to which it had conduced had been obtained primarily by devotion to purely abstract science—practical applications having unexpectedly followed upon discovery. Prof. Guthrie, F.R.S., then gave an account of his researches on "Cryohydrates and Water of Crystallisation," a subject on which he has been working for the last three years. Prof. Williamson, F.R.S., gave an address on the "Manufacture of Steel," limiting his attention chiefly to the modes devised for the obviation and repression of the escape of carbonic oxide gas from molten steel during the casting and cooling process, after leaving the Bessemer or Siemens-Martin furnace. Mr. W. C. Roberts, F.R.S., subsequently read a paper, on the "Apparatus used by the late Prof. Graham in his Researches." The principal interest attaching to these pieces of apparatus was the simplicity of the means by which the late Master of the Mint established such important discoveries as the law of the diffusion of gases, the principle of the endosmotic action of fluids, and the consequent division of chemical substances into crystalloids and colloids. Mr. W. N. Hartley read a paper on the existence of "Liquid Carbonic Acid in the Cavities of Crystals," Dr. Gladstone, F.R.S., following with a short address on the electrolysis of organic compounds with the copper zinc couple. Dr. Frankland, in closing the Chemical Conference, congratulated the audience upon the success which had attended the proceedings throughout the two meetings.

Yesterday the Section of Physics met for the third time, when the following papers were to be read:—

Prof. J. Clerk Maxwell, "On the Equilibrium of Heterogeneous Bodies;" Prof. Andrews, "On the Liquid and Gaseous States of Bodies;" M. Sarasin-Diodati, "On M. de la Rive's Experiments in Statical Electricity;" M. Lemström, "Sur l'Aurore Boréale;" Baron F. de Wrangell, "On a New Form of Voltameter;" Il Commendatore Professore Blaserna, "Sur l'état Variable des Courants Electriques;" Mr. Warren de la Rue, "On Astronomical Photography;" Mr. Ranyard, "On the Instruments lent by the Royal Astronomical Society;" Mr. Brooke, "On Magnetic Registration, and on the Corrections of the Magnetometers;" Prof. Carey Foster, "On Electrical Measurements;" Herr Prof. Dr. Rijke, "On the Historical Instruments from Leyden and Cassel;" the Rev. R. Main, "On a Telescope of Sir W. Herschel's."

The third meeting of the Mechanical Section is held to-day.

The first meeting in the Section of Biology will take place to-morrow, when the following papers will be read:—Dr. J. B. Sanderson, the President, "On Methods of Physiological Measurement and Registration;" Prof. Marey "On various Instruments for Investigating and Registering Vital Movements;" Dr. Hooker "On the Plan of the New Laboratory for Investigations relating to the Physiology of Plants at Kew;" Prof. Dyer "On various Apparatus for Investigating and Registering the Growth of Plants contributed by the Physiological Laboratory of Bremen;" Dr. P. L. Sclater "On Drawings contributed by the Zoological Society;" Dr. Brunton "On a new Myographic Apparatus;" Dr. Klein "On Recording Apparatus exhibited by the Physiological Institute of the University of Prague;" M. E. A. Schafer "On recent Improvements in Recording Apparatus."

The Science and Art Department are organising a series of popular lectures to be given on the evenings of the free days. Demonstrations of the objects in the galleries are also now given by the exhibitors or other competent persons at frequent intervals during the day.

SECTION—CHEMISTRY.

Opening Address by the President, Dr. Frankland, F.R.S.

THE Conference which I have been requested to open to-day has for its object the discussion of the merits and defects of the various forms of chemical apparatus exhibited in these buildings; and the criticism of the original investigations which are here illustrated, partly by the instruments used in them, and partly by the chemical compounds, to the discovery of which they have led.

Various objects interesting to chemists have been displayed in former international exhibitions, but it may be safely asserted that such a collection as this, which has been brought together in these buildings, has never before been seen; neither has there before been the opportunity for discussion and criticism, by men eminent in science from all parts of Europe, which is now afforded.

Such a collection of apparatus and products, gathered from all parts of Europe is useful in disclosing, to chemical investigators and others, the best sources whence to procure apparatus; it is interesting historically and as showing the improvements in chemical apparatus during the present century; and it is instructive in the comparisons it affords of the various forms of instruments used for the same purpose in different countries, and by different experimenters.

The entire novelty of such a collection as that belonging to this section has rendered the attainment of the object sought for, on the present occasion, exceedingly difficult. The workers in science have hitherto had no inducement to preserve the *instruments* with which they experimented. When an investigation was finished the apparatus employed was dismantled and converted to other uses. Still less inducement has there been to preserve the *chemical compounds* resulting from research, although their creation required, in many cases, a great expenditure of time and labour. The chief object of preparing such compounds has hitherto been, in most cases, merely to ascertain their existence, to show their molecular relations to previously known bodies, and to ascertain a few of their leading properties such as colour, specific gravity, vapour density, melting point, boiling point, and chemical composition. They have been weighed and measured and then dismissed out of existence. And thus the present collection of chemical preparations is but the merest skeleton of a complete exposition of all known chemical compounds.

It is, indeed, remarkable, that whilst *natural* chemical compounds are exhibited in almost endlessly multiplied specimens in the mineralogical collections of our national museums, the *artificial* compounds which have resulted from research, or have been the foundation of important theories and generalisations, have nowhere been honoured by admission into national collections. The neglect, not to say contempt, with which these productions of the laboratory have been treated, cannot be justified on the ground of their want of national utility. It is true that from an exclusively commercial point of view, no one of them can lay claim to the importance of coal, iron, silver, and gold. Still, many of them, such as the paraffins, the coal-tar colours, and many of the compounds of sulphur, potassium, sodium, and ammonium, have contributed, in an important degree, to the wealth and prosperity of this and other states. Had these artificial compounds remained undiscovered, how different would now have been the condition of the industries of bleaching, dyeing, calico-printing, glass-making, and the manufactures connected with the production of artificial light. Many of these artificial compounds have become of the most essential importance to the physician, the artist, the telegraphist, the engineer, and the manufacturer, and it cannot be doubted that many more would soon come into active service for such purposes if they were better known.

But not alone on the ground of utility and incentive to the further useful discovery of technical applications would I plead for the establishment of national museums of chemical preparations; such collections would be of the highest interest both to the student and the investigator. They would call vividly before the mind the results of labours which can only otherwise become known by a tedious search through the transactions of learned societies. An intelligent study of a properly arranged collection of artificial chemical compounds would show the progressive triumph of mind over matter—not over masses moved by mechanical agencies—for monuments of this the engineer and the architect need only bid the inquirer, in the language of Wren's tablet, to "look around him"—but over the ultimate atoms which, in these compounds, are compelled to submit themselves to the will of man, and to form new structures, seen only, in most cases, by the discoverer himself, and the qualities and uses of which are but very imperfectly ascertained. Nine-tenths of these compounds are no better known than islands which have been seen only from the deck of a ship and whose position has been accurately marked upon a chart. But a collection of them, if properly kept up, would represent the actual condition of our knowledge of chemical facts, and, if properly arranged, would suggest to the observant student the direction of future investigation.

I know of no other incentive to research which would be more likely to call original inquirers into existence. The student wishing to commence a chemical investigation is always confronted at the outset by the difficulty of finding the boundary line between the known and the unknown, and this difficulty must obviously increase from year to year owing to the continued expansion of the circle of knowledge. It has led to a suggestion emanating from the British Association, that chemists who are intimately acquainted with particular departments of their science should suggest subjects of research for the benefit of students. Much may be said no doubt in favour of such a scheme; but it appears to me that the development of original talent in the young investigator would be more surely promoted by giving him the means of selecting for himself a subject for experimental inquiry, rather than by inducing him to follow the less invigorating plan of working out the suggestions of others. I venture, therefore, thus prominently to call attention to the non-existence, in any country, of a museum of artificial compounds, and to the great value, both economical, scientific, and educational, which such a museum would possess. I feel convinced that if such museums were established in the capitals of Europe, chemical investigators throughout the world would gladly contribute their new products to them, and thus keep them abreast of the discoveries of chemical science.

Amongst the groups of objects in the Chemical Section, not the least interesting is that which consists of *Apparatus and Contrivances employed in the Generation and Application of Heat.* The great advances which have been made in the modes of producing and applying heat for chemical purposes are strikingly conspicuous. The cumbrous furnaces of the earlier operators, constructed in fireproof vaults, have gradually been replaced by simple and elegant contrivances, which would scarcely look out of place upon a drawing-room table. The time is still fresh in the recollection of many of us, when the fusion of a silicate for quantitative analysis, or the heating to redness of oxide of copper for the combustion of an organic compound, required in each case the expenditure of much time and trouble in the lighting of a coke or charcoal furnace. Now these operations are performed in small gas furnaces with or without air blast. Conspicuous amongst these inventions are the gas-burners of Bunsen and Hofmann, the oxy-coal gas furnaces of Deville, the blast gas furnaces of Griffin, and the hot blast gas furnaces of Fletcher. Of these fundamental inventions many ingenious modifications for special purposes have been devised, amongst which I may mention the valuable contrivances of Finkener, Mitscherlich, Wallace and Müncke. The blast gas-burners of Hofmann and Bunsen, the blast gas-furnaces of Deville, Griffin, and Bunsen, and the furnaces for organic analysis by Hofmann, Bunsen, Finkener, Mitscherlich, and Müncke, are amongst the exhibits illustrating the application of heat in chemical operations.

These burners and furnaces command a range of temperature from the gentlest ignition up to the most intense heat procurable by chemical means; but the temperature produced by such combinations as those of oxygen and hydrogen, or oxygen and carbon, enormously high though it be, now no longer suffices, and recourse must be had to the still more intense heat of the electric discharge. The electric current and the stream of sparks are now not unfrequently called into requisition by the chemist, and from this point of view the electric lamp and the apparatus of Hofmann and others for the decomposition of gases by the spark-stream must be classed with chemical furnaces.

To apparatus for the application of heat belong the various forms of water, steam, and air baths, or drying closets. Convenient contrivances of this class invented by Bunsen, Mitscherlich, Habermann, and Müncke, are exhibited by Messrs. Warmbrunn, Quilitz and Co., Mr. Johann Lentz, and Mr. Julius Schober all of Berlin, and by Mr. C. Desaga of Heidelberg.

In the application of gas to chemical purposes, regulators of pressure and temperature are often of the utmost importance, in order that operations requiring the prolonged and regular action of heat may not require the constant attention of the operator. The ingenious and effective contrivances of Bunsen and Kramer, for this purpose are exhibited.

Closely connected again with appliances for raising temperature are those intended for its reduction—the refrigerators or condensers.—The Liebig's condenser is still the refrigerator almost exclusively used, but few pieces of apparatus have been so much modified and refined, as will be seen on comparing the original design with the present construction—the final light and convenient form having been given to it by my late friend Mr. B. F. Duppa. Most manufacturers of chemical apparatus exhibit various forms of this condenser.

Sprengel Pumps.—Of the comparatively recent appliances for facilitating chemical work, few can lay claim to higher merit than the invention of Dr. Hermann Sprengel, in the year 1865, for the production of vacua by the fall of liquids in tubes; and yet this invention remained for many years dormant, until the late Master of the Mint applied the mercurial pump to the extraction and collection of occluded gases, and Bunsen the water-pump to hastening the filtration of liquids. Without the mercurial pump the elements of the organic matter in potable waters could not be determined, and the highly interesting results which this pump has quite recently achieved in the hands of Mr. Crookes, come home to every one who has seen the various forms of the radiometer.

Bunsen's application of the water-pump to filtration has done much to shorten one of the most tedious and troublesome operations of gravimetrical analysis.

Dr. Sprengel's invention has, moreover, nearly abolished the use of the air-pump in chemical laboratories, and I need not therefore, perhaps, bring under the special notice of this section the various improvements in air-pumps which are illustrated by the exhibits in the Physical Section.

Models, diagrams, apparatus and chemicals used in the teaching of chemistry, include numerous exhibits of great interest. It is to be regretted, however, that models and plans of chemical laboratories are not more numerously represented. The important improvements which have been introduced of late years, and the numerous laboratories of truly palatial proportions which have been built, in almost every case at the cost of the State, would have rendered a complete exposition of their plans and fittings most instructive and interesting. Dr. de Loos, has, however, sent us a model of the chemical laboratory in the secondary Town School of Leyden. And we have from Mr. Waterhouse plans of the Owens College laboratories in Manchester. The latter were devised after the professor of Chemistry and the architect had visited all the great laboratories of Europe, and for compactness, economy of space, appropriateness of fittings, and ventilation, they are unsurpassed.

In illustration of the permanent fittings of laboratories, we have from the Chemical Institute of the University of Strassburg a diagram showing elevation, section, and plan of a "digestorium," or iron closet, for use in dangerous operations in which explosions are liable to occur. This is a contrivance which ought never to be absent from a laboratory in which research is carried on.

Prof. Roscoe exhibits a beautiful and effective series of diagrams and models illustrating the processes carried on in alkali works, and Mr. Henry Deacon a sectional model of his ingenious apparatus for exposing porous materials and currents of gases to mutual action.

Dr. de Loos, of Leyden, has sent drawings of gas works used for teaching technical chemistry in secondary schools.

We are indebted to Mr. Spence, of Manchester, for a series of specimens illustrating his process for the manufacture of ammonia-alum. To Messrs. Roberts, Dale and Co. for specimens illustrating the manufacture of oxalic acid. To Messrs. Calvert and Co. for similar illustrations of the manufacture of carbolic, cressylic and picric acids.

Messrs. Hargreaves and Robinson exhibit plans and specimens in connection with their new process of manufacturing sulphate of soda directly from sulphurous acid, steam, air, and salt; whereby the intermediate production of sulphuric acid is avoided. A chemical factory is generally conspicuous in the landscape by a series of huge and ugly leaden vitriol-chambers. Should the new process prove as successful as the inventors anticipate, these leaden chambers will almost entirely disappear, and the aspect of chemical factories will undergo a more profound modification than any which has occurred during the last half century.

The splendid platinum apparatus of Messrs. Johnson and Matthey for the concentration of sulphuric acid, will also contribute much to compactness in chemical works, by the abolition of cumbrous leaden pans and long ranges of glass retorts.

Not only is the sense of sight thus likely to be relieved, but that of smell, which, in the case of chemical works, is perhaps of even more importance, is also gradually being subjected to less offence by the adoption of Mond's process for the recovery of sulphur from soda-waste. The vast mounds of this material which surround alkali works, not only pollute the air with sulphuretted hydrogen; but also the neighbouring streams, with an offensive drainage which is very destructive to fish life. Herr Mond has succeeded in profitably extracting the sulphur—the offending constituent of the waste—and Messrs. John Hutchinson & Co. of Widness, exhibit specimens illustrating this important process.

Dr. Van Rijn, of Venlo, Netherlands, exhibits fine crystals of potash and chrome alums. One of the Octohedrons of potash alum weighs no less than 11 lbs.

Messrs. W. J. Norris and Brother of Calder Chemical Works have sent specimens useful in teaching the technology of lichen colours, sulphate of alumina, and bichromate of potash.

Messrs. Brooke, Simpson, and Spiller contribute a fine series of specimens illustrating the technology of coal-tar colours.

Lastly, several magnificent series of specimens have been sent over by members of the German Chemical Society.

They comprise, firstly, some items of much historical interest. Thus, we have from Prof. Wöhler the first specimens of boron and aluminium ever prepared. And, from the same chemist, another historical specimen which, it is no exaggeration to say, is the most interesting now in existence, for, after the discovery of oxygen, it marks the greatest epoch in chemical science. I allude to this specimen of the first organic compound prepared synthetically from its elements by Wöhler, without the aid of vitality. If the work of the army of chemists who have successfully attacked the problems of organic chemistry during the last quarter of a century were to be described in one word, that word would be SYNTHESIS. In this specimen of urea we have then the germ of that vast amount of synthetical work which has done so much to dispel the superstition of vital force and to win for chemistry the position of an exact science. In the absence of a specimen of the first oxygen from Priestley's laboratory in 1774, it seems to me that this specimen of the first synthesised urea made in 1828 is, historically, the most interesting chemical the world has to show.

Secondly, we have a beautiful collection of all the compounds discovered by Liebig, but I need not dwell upon them, as they have been so recently described by their exhibitor, Prof. Hofmann, in his Faraday lecture delivered to the Fellows of the English Chemical Society.

And thirdly, there are several interesting series of specimens illustrating the researches of Biedermann, Weltzien, Michaelis, Hübner, Hofmann, Lieberman, Oppenheim, Pinner, Wichelhaus, Tiemann, and others.

We come now to a review of that sub-division of the Chemical Section which illustrates original research, viz., chemical compounds discovered in certain specific investigations, and apparatus used in the prosecution of research. Whilst the sub-division which I have been describing illustrates for the most part the training of the young chemist in habits of observation and in the use of apparatus and processes, the one we are now considering aims at representing, so far as it can be objectively represented, the highest outcome of this training—the additions to our knowledge acquired through the accurate methods of observation and experiment which it is the function of the chemical instructor to teach. I have already remarked on the interest and importance of exhibits of this class, and it is to be regretted that out of so many chemical investigators so few have exhibited. It is characteristic of the direction long taken by chemical research, that of about 25 exhibitors only two have contributed mineral as distinguished from organic products.

Prof. Roscoe exhibits sixty-five compounds of vanadium discovered and investigated by himself. This classical research stands out as a model of thoroughness, and not only clearly discloses the habits of a comparatively rare metal, but brings to light some new and interesting facts in connection with the theory of atomicity. As Prof. Roscoe has consented to deliver an address on these compounds, we shall have an opportunity of discussing the peculiarities and anomalies which have presented themselves in the course of this investigation.

The water of crystallisation of salts has been the subject of some controversy amongst chemists of late. It is generally considered to be present in atomic proportions, however complex these may sometimes be, and most chemists are inclined to regard the bond of union between this water and the salt proper in the light of a *molecular*, as distinguished from an *atomic*, attraction. Mr. Walcott Gibbs, however, has recently endeavoured to show that the union is strictly atomic, and subject to the ordinary laws of atomicity. The subject has attracted the attention of Prof. Guthrie, who has attacked it from a new side, and obtained results which throw much light on this question. He has promised to give us an address on the subject at the next Chemical Conference. Prof. Guthrie also exhibits—

Nitroxide of Amylen.—Discovered by the exhibitor. Of historical interest as being the first instance in which nitroxyl NO_2 was shown to behave as a halogen in uniting directly with an olefine to form a body homologous with "Dutch liquid." The composition of the body is $C_5H_{10}(NO_2)_2$.

Sulphide of Œnanthyl.—Discovered by the exhibitor, and of historical interest as being the first instance in which a term of a higher alcohol series was made from terms of lower alcohols. It is formed by the action of zinc ethyl on sulpho-chloride of amylen.

And Nitrate of Amyl.—Discovered by M. Balard. Its therapeutic action was discovered, and its introduction into the pharmacopœia recommended, by the exhibitor; and it is now coming into use in tetanic and other nervous affections.

A series of twenty-three specimens of hydrocarbons derived from Pennsylvanian petroleum is exhibited by Prof. Schorlemmer. They form a striking record of the skill with which a most laborious and difficult investigation has been conducted.

Very interesting and important are the ethyl compounds derived from the isolated radical methyl exhibited by Mr. W. H. Darling. The results of some experiments made by myself seemed to indicate that the products of the action of chlorine upon methyl were not ethyl compounds; but the experiments of Schorlemmer and Darling conducted with much larger quantities of material, show that my conclusion was erroneous. Mr. Darling exhibits ethylic chloride, ethylic alcohol, ethylidenic chloride and sodic acetate, all made from electrolytic methyl.

Mr. Perkin has sent a large collection of specimens illustrating his researches on mauveine, artificial alizarin, artificial coumarin, glyoxylic acid, and other subjects. His investigation of glyoxylic acid seems to have at last put an end to the controversy as to the possibility of two semimolecules of hydroxyl being united with one and the same atom of carbon. I will not, however, anticipate Mr. Perkin, who will, I trust, personally give us an account of his researches.

Amongst the other exhibits in this department are numerous and important contributions from the laboratories of St. Petersburg, Louvain and Edinburgh. For several years past chemical research has been actively carried on in Russia.

The apparatus used in Research exhibited in the Chemical Section has suffered much from the depredations of the physicists, for although chemistry is essentially founded upon measurements of weight and volume, the instruments used for such determinations have been swept almost *en masse* into the section of measurement; nevertheless, the chemical section contains several objects of unusual interest. The apparatus with which chemists, both ancient and modern, prosecuted their researches was generally of a simple description and often dismantled as soon as the necessary operations were completed, consequently it was far less likely to be preserved than the more expensive and elaborate contrivances of the physicist. Here, however, is Black's balance presented to the Science and Art Museum of Edinburgh, by the Right Hon. Lyon Playfair. Upon this balance Dr. Black ascertained in 1757, the loss of weight suffered by carbonate of magnesia and limestone when exposed to heat. Hales previously used a balance for this purpose, but the instrument before us was certainly one of the first employed for quantitative chemistry. The balances used by Cavendish, Davy, Young, and Dalton are here, and each one of them has its own historical interest for the chemist The balance of Cavendish is probably the instrument with which in 1783 or 1784 he first ascertained that a globe filled with a mixture of oxygen and hydrogen gases underwent no alteration in weight when the mixture was exploded.

From gravimetric instruments we are naturally led to volumetric apparatus used in quantitative chemistry, and I will now, in conclusion, briefly direct the attention of the conference to apparatus used in the analysis of gases, in the hope that a discussion of the merits and defects of the numerous instruments now before me may have the effect of directing a larger share of attention to eudiometric chemistry than has hitherto been accorded to it. This branch of chemical analysis originated in the attempts of Fontana, Landriani, Scheele, Priestley, Cavendish, Gay Lussac, Dalton, and others, to determine the volume of oxygen in samples of atmospheric air taken from various localities. In these primitive instruments air was exposed to the action of some substance either solid, liquid, or gaseous, which combined with the oxygen and left the nitrogen unacted upon. The chief substances used were phosphorus, potassic sulphide, nitric oxide, a solution of nitric oxide in ferrous sulphate, and a mixture of sulphur and iron filings. Many of the instruments were of simple or even rude construction, and little calculated to inspire confidence in the results. Nevertheless, the accuracy of a determination often depends much more upon the skill of the operator than upon the construction of the instrument used; and thus Cavendish, with nitric oxide as his reagent and water as the confining liquid, made many hundred analyses of air, collected in various localities, in 1781, and found the percentage of oxygen to be invariably 20·83, a number nearly identical with those obtained by Bunsen and Regnault with much more perfect means. But the average chemist of that day obtained the most discordant results with the same apparatus and materials, and would doubtless also do so at the present day. By improved apparatus and methods the work of the average chemist is made to equal, or nearly so, that of the most skilful.

Volta introduced a new reagent—hydrogen—for the determination of oxygen, and he was the first to employ the electric spark in eudiometry. The use of mercury instead of water for confining the gases eliminated, the source of fallacy caused by transfusion through the latter liquid, and lastly, Bunsen, in the year 1839, brought Volta's eudiometer to its highest degree of perfection.

The President then proceeded to describe and criticise the various forms of apparatus for the analysis of gaseous mixtures, and concluded as follows:—

Such are the modern developments of the eudiometer now at the disposal of chemists. For rapidity of working and delicacy of measurement they leave nothing to be desired; indeed, as regards delicacy, it may be doubted whether amongst all the instruments for measurement in this exhibition, there is one which can, like some of these eudiometers, give a distinct value in weight or volume to the one-fourteen-millionth part of a gramme of matter. Their drawback is their fragility, and any modifications to diminish this would doubtless be welcomed by chemists, since, chiefly for these reasons, eudiometry is still very rarely practised in chemical laboratories.

THE PRESS ON THE LOAN COLLECTION

IN continuation of our article in last week's number we proceed to give a few more selections from the principal organs of public opinion, indicative of the light in which they regard the scientific collection which has been brought together at South Kensington. Last week we confined ourselves mainly to the daily press; this week we are able to cull the opinions of the principal weekly papers. Public opinion as thus expressed, it will be seen, all but unanimously approves of the collection as creditable to its organizers and to the country at large, as beneficial to the progress of science, and as calculated to have an important educative influence on the British public. We think the collection of public opinion as thus expressed will serve a good purpose. It will show to those men of science who have been more or less connected with the organization of the Loan Collection that their efforts have met with the approval of the intelligent and unprejudiced portion of their non-scientific fellow-countrymen, that these efforts have been unexpectedly successful, and that public opinion points to a permanent successor as the natural outcome of this temporary collection.

The *Saturday Review* seldom gives way to unmeasured approval of any human effort; it is therefore extremely gratifying to find so severe a critic having nothing but praise to bestow on the collection. The following are a few extracts from last Saturday's number:—

"Mr. Spottiswoode, in his address as President of the first of the Conferences which have been arranged in connection with the Loan Collection of Scientific Apparatus at South Kensington, said that he was disposed to regard this Exhibition as marking an epoch in the history of science; and there are undoubtedly reasons why it may be expected to exercise a deep and beneficial influence on the prospects of scientific culture in this country. We have here brought together, not only a collection of remarkable instruments from all parts of the civilized world, and representing almost every school and period of research, but also a numerous gathering of the men who are at the present moment engaged in extending still further the range of discovery, and the practical application of its results. It has often been a reproach against this country on the part of foreigners that it is indifferent to science except in the forms in which it can be turned to immediate commercial profit; and this criticism, though unjust to the heroic self-sacrifice which has characterised many of our leading scientific pioneers, must be admitted to be in a certain degree true as to the general attitude of the public. . . . . In this country the Executive usually hesitates to do anything unless there is a strong pressure of opinion, and it is tolerably certain that science will have little to hope for from that quarter until it has the public at its back; and it is to it, therefore, that an appeal should be made. It may be hoped that the present Exhibition will be the beginning of a movement of this kind. The fact that it is opened under the auspices of a Government department would seem to show that there is not wanting a certain sympathy on that side; but whether any large, substantial measures will ever be taken, will chiefly depend on the interest which such a presentation of science excites among the community at large. Again, an Exhibition of this kind is useful in bringing to light the actual operations of the scientific world, the problems which have been solved, and those others which are still in a nebulous condition, with just here and there a clue peeping out; and thus the interchange of ideas is promoted. . . . . At present this sort of co operation is loose, fragmentary, and disjointed; but an Exhibition brings the scattered experimentalists into systematic communication. Thus, both in the world of science proper and outside of it, a keener interest is likely to be cultivated in regard to scientific matters, and researches will consequently be conducted with greater spirit and efficiency, and better prospects of success. . . . . To persons of scientific training, or with even a rudimentary taste for such things, it is easy to conceive what service such an Exhibition will render. They will read the Handbook, an admirable summary of the chief branches of scientific study by competent authorities, and examine the objects exhibited; and thus lay up a store of suggestive information as a supplement to or a foundation for private studies. But there will also be a large body of people who will chiefly bring away from the galleries an impression of their own stupendous ignorance in such matters. This in itself, however, will be a good thing, for it may be expected, in some cases at least, to stimulate a desire to know something, and after that to know more. Even the dullest and least imaginative minds can hardly fail to be touched by the sight of the instruments by which the old masters achieved their triumphs, or of their earliest works. . . . . On the other hand, this Exhibition displays in a striking manner the wealth and luxury of scientific apparatus at the present day."

After giving examples of the intimate connection which subsists between the progress of science and the improvement of its mechanism, the article concludes thus:—

"It is impossible here to go through such an Exhibition in detail, and we can only say that it reflects much credit on those with whom it has originated, and that it is to be hoped that it may not be a mere passing show, but may develop into some permanent organization."

The *Academy* of last Saturday has "a first or introductory notice" of some length on the collection.

"The Special Loan Collection of Scientific Apparatus," the *Academy* says, "which was honoured by a private visit from her Majesty on Saturday last, and thrown open to the public on Monday, is one of very great interest and value. The Lord President of the Council may well be congratulated on the success of the undertaking, and we must all feel grateful to him for having given us an exhibition in which, for once, purely commercial interests have been made to give way to the 'higher aim of disseminating as widely as possible a knowledge of the different methods of science.' The Exhibition is in many respects the most instructive and remarkable that has been held at South Kensington, and though it may not have any great effect on the advancement of science or on the industrial progress of this country, it cannot fail to awaken a very general interest in those methods of abstract scientific research of which the public know so little; and it will afford an opportunity, which may never occur again, of examining at leisure under the same roof the rude, simple instruments used by the pioneers of science, and the complex, delicate apparatus with which investigators of the present day have made their discoveries. We trust, too, that the Exhibition may give an impulse to the cause of scientific education in this country, and that it may lead to a better appreciation of the reasons which have led men of science to advocate Government endowment of scientific research, and the establishment of Physical Observatories, at home and abroad, which may have the same beneficial influence on the progress of other sciences that Astronomical Observatories have had on the progress of astronomy. May we hope, too, that the Exhibition will lead to the creation of a museum for the illustration of physical, chemical, and mechanical sciences somewhat of the nature of the 'Conservatoire des Arts et Métiers,' in Paris? The formation of such a museum was one of the recommendations of the Commission on Scientific Instruction, and we believe it would go far, by affording adequate opportunities for study, to render the sciences alluded to as popular as those of botany, geology, and zoology."

Last week we quoted the opinion of *Iron*; the same paper has another interesting article this week, on "Science at South Kensington," in which it says that the success of the Exhibition affords an additional instance of the certain, if tardy, fructification of a valuable idea. "Years ago the conception of a great focus of science somewhere in the metropolis was formed in at least one great mind." The article then refers to the original intention of making the Albert Hall an institutional memorial, its employment as a place of scientific meetings and conferences having been strongly advocated. With its present uses, "the building has lost all its signification, as its position at South Kensington has lost all its appropriateness. We therefore cordially welcome the realisation of the spiritual part of the original plan, although it has been brought about by indirect means." The article then goes on to refer to the successful development of loan collections during the last few years, and the superior educational value possessed by special collections over large international exhibitions. As carried out at South Kensington, this value is largely owing to classification, "a point kept distinctly in view in arranging the Exhibition of Scientific Apparatus." The article then proceeds :—

"The problem of classification has been triumphantly solved. . . . . Success is absolute and complete.

"The institution of conferences during the Exhibition can hardly be regarded as other than a most valuable innovation, and precisely what was wanted—not to popularise the Exhibition, but to give it that life and movement without which the best institutions are apt to become stagnant, and be passed heedlessly by in an age of hurry and bustle. . . . There is no slackness at South Kensington, and conferences form an interesting and important part of the programme of the Scientific Exhibition which it is rumoured will probably prove the nucleus of a Scientific Museum analogous to the Conservatoire des Arts et Métiers at Paris. It would certainly be shortsighted policy to allow the splendid collection of objects now brought together for the first time in the world's history to be redistributed—scattered all over Europe, in odds and ends which teach little or nothing apart, but are of inestimable value when together. The want of a permanent national institution devoted to science can now be supplied in the least costly and most efficacious manner, that is to say, the vital part composed of the scientists and their instruments. As for the showy part—the outward and visible sign—the Central Hall of Science, it will come in time. If Albert Hall, after having failed as a music-hall, fails also as a circus and as a skating-rink, the country may one day be able to buy it up cheap, and convert it to a legitimate use."

The *British Journal of Photography* says :—

"There is now open in the Exhibition Buildings, South Kensington, London, a large, varied, and most valuable collection of scientific apparatus and appliances. Its intrinsic value is great, its historical value much greater, but in its educational importance is to be found the chief value of this unique collection."

The *Gardeners' Chronicle* speaks thus :—

"The splendid collections of Scientific Apparatus now on view at South Kensington may not have any great interest or attraction for the general public, for whose taste the display is too technical and unintelligible. To the more thoughtful visitor, and especially to the student, the collection is rich in interest and suggestiveness. . . . The whole thing has been organised and got together so quietly that even among scientific men little or nothing was known about the proceedings till the last moment, and the extent and value of the collections has come upon them as a surprise."

Public opinion thus far, it will be seen, has nothing but admiration for the Loan Collection. The *Athenæum* is on the other side. We give its article without note or comment, as the collection can hold its own.

"The galleries containing the Loan Collection of Scientific Instruments are at length open to the public. Apparently no expenditure has been considered too great by those who have been engaged in bringing together in the course of a few weeks from every part of Europe all the relics of science that could be begged or borrowed from public institutions or private collections. Gentlemen have been sent on special missions from South Kensington, and their movements have been duly chronicled in Reuter's telegrams amongst the most important news from Italy and Germany. Where these gentlemen could not find time to go, ambassadors and their attachés have been pressed into the service of collecting. Special railway trains have, we are informed by our contemporary, NATURE, been built for the transit of instruments, and the result is a collection of brass, glass, and old iron relics, which has driven the daily press wild with enthusiasm.

"According to the ordinary law of chances, a certain proportion of these instruments will be returned to the places whence they came all the worse for their journey across Europe, and we feel inclined to inquire whether it is certain that the worker in science will be the wiser for having seen them. The old and celebrated instruments have been repeatedly described and figured, and the new instruments, if useful, a man engaged in scientific research knows better than he knows the way to South Kensington. As to the curiosity-loving public, it will surely not be pretended that it is worth while to form such a collection for its amusement, but if it be the duty of government to gratify the craving of idlers, let us by all means at once appoint a Barnum to be Minister of Science; he will know how to make such exhibitions as this, and the School of Art needlework, a commercial success. But, no doubt, real instruction is intended, and if so, let us stop and ask whether the present is the best and cheapest plan of obtaining our object. The 'general public,' so far as can be judged from the experience of the first few days, regards the whole affair with indifference.

"In order to afford the means for studying the history of a science there is needed a continuous series of objects that will illustrate the development of thought step by step; such a collection cannot be brought together in a few weeks. It needs the patient labour and study of a lifetime devoted to it; but in this exhibition, as in collections made by the *nouveaux riches*, the extremely old and extremely curious have been brought side by side with the complicated results of modern workmanship; and we find none of the connecting links, to gather which requires a man well versed in the history of his subject, and the labour of a lifetime. . . . In fact, the collection required the control of a hand familiar with the history of astronomy. Objects that would have illustrated the development of the telescope during the seventeenth and eighteenth centuries should have been sought after more diligently than relics connected with great and popular names with which every one is familiar.

"The general 'Handbook to the Exhibition,' which has been published, is a remarkably good shilling's-worth of information, but, as might be expected, it contains treatises of very different merit. After some general considerations on instruments by Prof. Clerk Maxwell, which will possibly be above the heads of most of his readers, follow some interesting though rather general disquisitions on various subjects, which have evidently in most cases been written without reference to the instruments brought together. The names of Prof. Clerk Maxwell, Prof. Smith, Prof. Clifford, Mr. Spottiswoode, Prof. Tait, and others, will be a sufficient guarantee of the trustworthiness of the information given. The article on Astronomy is not equal to the others, and considering the opportunity that the author had of illustrating the history of his subject, it is particularly poor and superficial. The 'Handbook' in general will well repay more than a casual perusal."

We did not state that "special railway trains" had been built for the purpose referred to above.

NOTES

THE *Challenger* is expected home daily, and arrangements are being made for the ship being welcomed on its arrival at Sheerness by the Royal Society and the foreign men of science now in this country.

THE visitation of the Royal Observatory is fixed for Saturday, June 3.

THE Anniversary Meeting of the Royal Geographical Society was held on Monday. The total number of ordinary Fellows on the list at the end of April was 3,125. Sir H. Rawlinson, the President, presented the Founder's Medal to Lieut. Cameron, and the Patron's Medal to Mr. Lowther for Mr. J. Forrest, the Australian explorer. The annual geographical medals offered by the Society to the chief public schools were presented to the following successful competitors, viz. :—In physical geography, gold medal, John Wilkie, Liverpool College; bronze medal, Walter New, Dulwich College; and in political geography, gold medal, Thomas Knox, Haileybury College; bronze medal, W. M. H. Milner, Marlborough College. The President then delivered the annual address on the progress of geography, in the course of which he announced that he had received a communication from the Chancellor of the Exchequer that morning, that, considering the very great importance of the discoveries of Lieut. Cameron, her Majesty's Government had decided to share the expenses of the Expedition. A sum of 3,000*l*. will be handed over to the Royal Geographical Society on that account.

THERE is at present being erected in the Paris Observatory Gardens a house for the Bishofsheim transit instrument, which has been admirably constructed by Eichens. The house possesses many peculiarities, and was designed by M. Leverrier for the better insuring of equality of temperature. The roof can be removed on horizontal rails, and the walls are so perforated that there is a continual circulation of air in all parts. The frame of the house may be said to be pneumatic, as it has been constructed on a system analogous to that of the bones of birds. It is sure to work admirably.

THE Woodwardian Museum at Cambridge has this week received an important accession in the rich collection of fossils presented by the veteran geologist, Mr. J. W. Walton, of Bath. In many respects, this collection, little known and studied by palæontologists, corresponds for the Southern Jurassic rocks to that of Mr. Leckenby, already at Cambridge, for the contemporaneous Yorkshire beds; but in addition, the general series of fossils is very interesting. Mr. Walton's Cambrian fossils constitute one of the finest existing assemblages from these rocks. Mr. Keeping, who has superintended the transfer to Cambridge, estimates the number of specimens at a hundred thousand; the entire weight is nearly two tons and a half. Thus the opportunities for palæontological investigation, at Cambridge already very great, are largely increased.

BIOLOGICAL students at Cambridge, and many others, will regret the approaching departure of Dr. Martin, Fellow and Lecturer of Christ's College, who has accepted the Professorship of Natural History in the University of Baltimore. Dr. Martin has attained the highest honours both at London and at Cambridge in a wide range of subjects. He has been largely associated with biological instruction at University College, London, and at South Kensington, while his connection with Dr. Michael Foster in the development of biology at Cambridge has been of great value. His co-operation with Prof. Huxley in the production of the very successful "Course of Practical Instruction in Elementary Biology," is well known. Some compensation for Dr. Martin's loss at Cambridge may be found in the thought that biology in the United States will gain by the presence of a man so well versed in European methods, and especially in the systems of instruction worked out by Prof. Huxley, Dr. Foster, and others in England.

FROM the daily Weather Maps issued from Hamburg by the German Seewarte, which embrace the whole of Europe, except the extreme south and the extreme north, we observe a very remarkable distribution of the atmospheric pressure for some weeks back. Barometers have been constantly low in southern or eastern regions, and high in the west and north, resulting in a persistent prevalence of northerly and easterly winds over nearly the whole of the continent. The maps suggest that this state of things has probably extended far to north-westwards, and in accordance with this supposition letters from Iceland inform us that the Greenland and Spitzbergen ice descended, in the beginning of this month, on the north coast of that island to a very serious extent, filling the sea as far as the eye could reach. In this connection, the observations made by the Arctic Expedition will have a peculiar meteorological value.

M. HOUZEAU has been appointed Director of the Royal Observatory of Brussels.

THE results of the daily photographs taken by M. Janssen at his observatory at Montmartre are rather interesting. In February a number of spots were visible and photographed; this number was gradually reduced to two groups, each consisting of two large spots, which were visible on March 13. By March 18 only two spots were visible, the two others having disappeared owing to the rotation of the sun. The two last disappeared by March 25, and from that time up to May 20 not a single spot was recorded, the solar disc appearing quite homogeneous. Such a phenomenon is very rare, indeed, although we are nearing the minimum. The photographs taken by Janssen are 20 centimetres diameter on a collodion film, when the sky is clear. Under unfavourable circumstances, the diameter is reduced to 10 centimetres. M. Janssen takes his photographs irrespective of the presence of clouds. He uses his celebrated *revolver*, and operates before ten o'clock in the morning. He is using not only the instruments taken to Japan for the last Transit, but the very canvas, with the canvas rotating domes. No doubt the Minister for Public Instruction will give him very shortly the means of building a permanent observatory, which is to be styled the Paris Physical Observatory. M. Janssen is also asking the means to build a large refractor worth 200,000 francs.

THE *Nord-Deutsche Allgemeine Zeitung* states that the German Imperial Government proposes to establish a Meteorological Institution, the meteorological department being up to the present moment merely a part of the statistical office.

AT a recent meeting of the Birmingham Natural History Society, the meteorite which recently fell in Shropshire, and to which we referred at the time, was exhibited and described. The following resolution was very properly passed unanimously by the Society:—"That in the opinion of this meeting the meteorite exhibited should become the property of the nation, in order that it may be submitted to the fullest scientific investigation at the hands of the most competent authorities." The above resolution was passed in consequence of an application made to the finder of the meteorite on behalf of the Duke of Cleveland.

L'Explorateur of May 18 contains an account of the principal indigenous tribes of Eastern Siberia, taken from a recently-published work of M. Octave Sachot, "La Sibérie Orientale et l'Amérique Russe. Le Pôle Nord et ses Habitants." The information contained in the work seems to be mainly derived from the voluminous notes of an American engineer who sojourned for three years in the region in question.

M. TH. MAUREAU, an assistant in the Meteorological Service at the Paris Observatory, has been promoted, at the request of M. Leverrier, to the position of "Physicien-adjoiut," by M. Waddington. Although a young man, he has rendered important service in the previsional department of practical meteorology.

MR. A. SUTHERLAND, writing from Invergordon, Ross-shire, May 13, states:—For the last fortnight almost daily iridescent halos, of more or less completeness, have been noticed round the sun, towards evening. Those on the 5th and 10th were very brilliant. The former consisted of a rainbow-coloured circle reaching almost from the zenith to the horizon, and continued for two hours. The halo visible on the 10th was an almost complete example of the phenomenon, consisting of, when observed at 6.30 P.M., two iridescent circles (22° and 46°) with tangent arc and mock-suns. The inner circle of 22° showed more especially the red rays on its concavity, except at the parhelia, where it was brightly iridescent. A pale light stretched through the sun from one parhelion to the other, and somewhat beyond these. The tangent arc of this inner circle was also very bright and well defined. The larger circle was complete except where the hills on the horizon hid a small portion. The tangent arc was not observed above it, the sky being clear where it would be projected. The day had been very warm, but towards evening a cold north-easterly wind blew, and the part of the sky where the sun was had become somewhat misty before the appearance of the halo. Lately the north-easter has plentifully furnished the conditions for the "icy cloud" which makes these appearances possible.

THE *Pandora* is expected to leave Portsmouth to-day for her Arctic cruise.

PROF. O. C. MARSH, in a short paper on some characters of the genus *Coryphodon*, Owen, figures the skull of the American *Bathmodon* of Cope, which he shows to be undistinguishable from *Coryphodon*. This oldest known representative of the ungulate animals, found in the London clay of England, the *Argile plastique* of France, and the lower Eocene of Utah, Wyoming, and New Mexico, possessed, besides the full complement of teeth (44), five digits on each limb, and a third trochanter to the femur. The cerebellum was peculiarly small, and the cerebrum very large in proportion.

THE Prefect of the Seine has appointed a Commission composed of M. Alphaud, the chief engineer of the city, two other engineers, and the head of the Public Gardens to study some of the public works of London, such as the Metropolitan Railway, the gardening of the public parks, the sewage and water system, &c. The French Minister of Public Works will be represented in that Commission by M. de Villiers, chief engineer of Ponts-et-Chausées.

A COMMISSION has been appointed by the Prefect of the Seine to construct a number of primary clocks in Paris for the purpose of distributing the time by means of electricity. Up to the present time clockmakers have been obliged to make personal application at the Observatory to compare their chronometer with the standard chronometer, which is regulated by the observation of the celestial bodies once a week.

THE numbers of the *American Naturalist* for February and March contain, among other papers, one by Mr. A. Agassiz on Haeckel's Gastræal theory, one by Mr. H. D. Minot on the Summer Birds of the White Mountain Region, one by Dr. H. A. Hagan on the Development of Museums, one by Dr. J. G. Cooper on Californian Garden-Birds. There is also a reply by Dr. E. Coues to Mr. J. A. Allen's "Availability of certain Bartranian names in Ornithology." Dr. H. A. Hagan describes the Goshawk from among the Game Falcons of New England. Mr. Scudder describes the nature of the chirp of the Mole Cricket. Mr. Abbot writes on the indications of the antiquity of the Indians of North America, derived from a study of their relics.

WE observe from the recent numbers of the *Bulletin International* of the Paris Observatory that the annual reports for 1875 are being received, and in considerable numbers, from the presidents of the departmental meteorological commissions, as was earnestly requested some time ago by M. Leverrier, in order that the *Atlas Météorologique* for 1875, may appear with as little delay as possible. In proof of the activity and earnestness manifested by many of the departments, it may be stated that from the department of Bouches du Rhône tables of observations from thirty-one stations have been received—a number far from being too large if the meteorology of this part of France is to be prosecuted at all successfully with a view to its practical applications.

IN the same journal, of May 5, appears an interesting account by M. Piche, Secretary of the Meteorological Commission of the Basses-Pyrénées, of a sirocco which occurred in that department on September 1, 1874. On that occasion the shade-temperature near St. Jean-de-Luz rose from 78°·8 at 8 A.M. successively to 89°·6, 93°·2, 96°·8, and 101°·3. At Biarritz the temperature also rose to 101°·3, and the difference between the dry and wet bulbs at 4 P.M. amounted to 20°·7. The observations made at the nine meteorological stations of the department at the time, are given, but the number of stations is evidently too few to furnish the materials required for the investigation of this remarkable sirocco. An interesting point, however, is this—the almost unprecedented heat and drought at Biarritz occurred during a rapid and short-continued fall of the barometer, the heat and drought being at the maximum a little before the barometer fell to the lowest point.

WE have received *Osservazioni Meteorologiche*, anno v., No. 14, published under the direction of the well-known meteorologists, P. F. Denza and P. Maggi, by the Alpine Club of Italy. This number gives a full and detailed statement of the meteorological means and extremes during the second decade of April, 1876, at fifty-one stations situated on or in the immediate neighbourhood of the Alps and Apennines, the stations being at heights varying from 87 to 8,360 feet above the sea. The publication worthily occupies a well-marked sphere of operation, and its appearance thrice a month offers great facilities for the study of the meteorological changes in the course of the year along the slopes of these mountain ranges. It would much enhance the usefulness of the results if the barometric and thermometric means for 9 A.M. and 3 P.M. were given separately.

IN the *Fenland and Eastern Counties Meteorological Circular and Weather Report* for May there appear, in addition to the usual matter, the first of a series of papers by the Rev. W. Clement Ley, on wind laws, and a second notice of Mr. Buchan and Dr. Mitchell's paper on the weather and mortality of London, in which the author, Dr. J. M. Wilson, makes some interesting comparisons as regards a few of the most important diseases between the results obtained for London and those for Wisbeach.

AT a recent meeting of the Manchester Field Naturalists' and Archæologists' Society, Mr. Faraday gave an account of a plantation of the *Eucalyptus globulus*, at Hyères, in the department of Var, in the south of France. Three years ago M. Cortambert planted 2,000 seedlings a few inches high over one hectare of land. The trees are now about thirty feet high, the stems having a circumference of about fourteen inches at three feet from the ground. It has of course been necessary to thin the plantation. A branch in flower was recently laid on the table at a meeting of the French Central Society of Horticulture. The wood of the Eucalyptus is extensively used in Algeria for carriage building. Plantations of this tree are becoming numerous in the south of France.

THE full complement of sea-water required for the filling and successful maintenance of the marine tanks at the Westminster Aquarium—over 500,000 gallons—has been delivered, and the importation of marine specimens will be rapidly proceeded with. Many interesting examples of ocean life are already on view in the smaller tanks stationed in the Eastern Annexe.

THE additions to the Zoological Society's Gardens during the last week include a White-thighed Colobus (*Colobus bicolor*), from W. Africa, presented by Mr. A. J. Keason; a White-backed Trumpeter (*Psophia leucoptera*), from S. America, presented by Mr. H. S. Marks, A.R.A.; two Javan Fish Owls (*Ketupa javanica*), received in exchange; a Thar Goat (*Capra jemlaica*) born in the Gardens, the mother belonging to the collection of H.R.H. the Prince of Wales; a Falkland Island Thrush (*Turdus falklandicus*) from Chili, deposited.

SCIENTIFIC SERIALS

American Journal of Science and Arts, April 1876.—Prof. Wright, of Yale College, examined last year the gases obtained at moderate temperature from a stony meteorite of Iowa County; their chief constituent was carbon dioxide. He has further examined several other meteorites of both classes (stony and iron, five of each), and the results, here communicated, confirm his former conclusions. Not only do the stony meteorites give off much more gas at low temperatures than the iron, but the composition is quite distinct. In no case of the latter was the amount of carbon dioxide more than 20 per cent. at 500°, nor than 15 per cent. from the whole quantity evolved, and the volume of carbonic oxide was, in every case but one, considerably larger. In the chondrites, on the other hand, the percentage of carbonic oxide is very small, while the carbon dioxide is (with one slight exception) more than half of the total quantity of gas obtained up to red heat. At a temperature of about 350° it constitutes from 80 to 90 per cent. of the gaseous products, in all cases, while at the heat of 100° it forms somewhat more than 95 per cent. in the two cases examined in this respect. The hydrogen, on the other hand, progressively increases in quantity with rise in the temperature of evolution, and in the last portions given off at a red heat is generally the most important constituent. The evolution of those large volumes of carbon dioxide may be taken as characteristic of the stony meteorites, and its relation to the theory of comets and their trains is certainly of great significance.—Prof. Norton gives a succinct account of researches made with a view to determine the laws of the set of materials resulting from a transverse strain under various circumstances. He studied (1) sets from momentary strains, (2) sets from prolonged strains, and (3) duration of set, and variation of set with interval of time elapsed after the withdrawal of the stress. Some of the results are rather at variance, apparently, with the conception of the ultimate molecule, as made up of a limited number of precisely similar atoms endued with unvarying forces of attraction at certain distances and repulsion at other distances.—According to Prof. Le Conte, mountain ranges are formed wholly by a yielding of the crust along certain lines of horizontal pressure; not, however, by bending of the crust into a convex arch filled and sustained by a liquid beneath, but by a crushing or mashing together horizontally of the whole crust with the formation of close folds and a thickening or swelling upward of the squeezed mass. In an interesting paper he adduces evidence of this from the coast range of California, which is destitute of granite axes, and has been little changed by metamorphism or overlaid by igneous ejections.—Prof. Newcomb criticises somewhat unfavourably the physical theories of climate maintained in Croll's recent work on Climate and Time in their Geological Relations.—Prof. Mallet studies the constitutional formulæ of urea, uric acid, and their derivatives, and in an appendix Prof. Marsh describes the principal characters of the Brontotheridæ, with aid of some excellent plates.

Mind, April.—In this number Mr. G. H. Lewes draws attention to the absence of strictly defined technical terms in psychology, and "the deplorable and inevitable ambiguity" which in consequence clouds the discussion of psychological questions. After referring to various senses in which the words sensation, sensibility, consciousness are used, he puts the question: "are all changes in the sensitive organism to be included under the term consciousness, or only some changes?" We believe some psychologists would answer: no changes in an organism ought to be called consciousness.—Prof. W. Wundt of Leipsic contributes a solid paper on "Central Innervation and Consciousness." He accepts physical automatism as flowing from the doctrine of the conservation of energy. "If this principle lays claim to a universal validity, we cannot withdraw from it those movements which we are conscious of only as psychologically caused." What he means by psychological causation is not very clear.—M. Sidgwick's "Methods of Ethics" is ably reviewed by Prof. Bain, who while speaking of the work in terms of highest praise, finds, nevertheless, that justice has scarcely been done to utilitarian ethics, and when Mr. Sidgwick, finding no complete answer to the immoral paradox, "My performance of social duty is good not for me but for others," concludes that our cosmos of duty is in reality a chaos, Prof. Bain thinks that we have here "a sad ending to a great work;" and he proceeds to give a solution of his own, which some may consider little more than a restatement of the difficulty. The next paper is a criticism of Mr. Sidgwick's chapter on "Intuitionalism," by Mr. H. Calderwood, who endeavours to show that Mr. Sidgwick has "largely failed in the attempt to give a clear and fair representation of intuitionalism." The editor, Prof Croom Robertson, reviews Mr. Jevons's "Formal Logic." He praises the ability, ingenuity, and even success with which Mr. Jevons has laboured to construct a brand-new system, but is compelled at the same time to maintain the superiority of the methods of the traditional logic. —Mr. Shadworth H. Hodgson continues the work of distinguishing between philosophy and science. His present paper, "As Regards Psychology," is delightfully hard reading.—"Philosophy at Cambridge," is treated by Mr. H. Sidgwick.—A short kindly biography of James Hinton is written by Mr. J. F. Payne.—Critical notices, reports, correspondence, &c., make up the number.

Memorie della Società Spettroscopisti Italiani, November, 1875. —Prof. Bredichin writes an article on the spectra of certain nebulæ relating how he has adopted the plan of comparing the lines of the spectrum of the nebula with the Fraunhoffer lines of the sun. The spectrum of a Geisler tube of hydrogen is used as an intermediate means of comparison. The mean positions of the lines are 5003·9, 5957·9, 4859·2 respectively. The first two lines agree very closely with the iron lines 5005·0 and 5956·5. —A comparison of the solar diameters as obtained by the spectroscopic and transit methods by Secchi, Tacchini, and Rayet. The mean of the spectroscopic observations gave a diameter 1″·8 less than the latter method.

December 1875.—Father Secchi contributes a note on his researches on the distribution of heat on the solar disc.—Prof. Ricco writes on the perception and persistence of the sensation of colours. He throws a spectrum on a screen by reflection from an oscillating mirror, so that the spectrum is moved in a direction at right angles to its length backwards and forwards, and the shape of the apparent envelope of the coloured band shows that yellow is the most rapidly perceived colour, and the others decrease towards the red and blue.—Prof. Oudemanns writes on a method of heliometric measurement on the occasion of the transit of Venus.—Prof. Fergola writes on the dimensions of the earth, and researches on the position of the axis of figure with respect to the axis of rotation.

SOCIETIES AND ACADEMIES

London

Royal Society, May 18.—"Picrorocellin," by John Stenhouse, F.R.S., and Charles Edward Groves.

"On the Polarisation of Light by Crystals of Iodine," by Sir John Conroy, Bart., M.A. Communicated by A. G. Vernon Harcourt, Lee's Reader in Chemistry in the University of Oxford.

"Absorption-Spectra of Iodine," by Sir John Conroy, Bart., M.A. Communicated by A. G. Vernon Harcourt, Lee's Reader in Chemistry, University of Oxford.

Linnean Society, May 4.—Mr. G. Bentham, vice-president, in the chair.—Mr. G. Dawson Rowley and Mr. G. H. Parkes were elected Fellows of the Society.—Two foreign *savans* were chosen to fill the vacancies caused by death among the honorary members.—Mr. H. Trimen called attention to the photograph of a remarkable example of fasciated inflorescence occurring in *Fourcroya cubensis*, Haw. The specimen, coming under the observation of A. Ernst, of Caraccas, is recorded as 6½ feet high and 4 feet wide.—On behalf of Dr. Anderson there were shown specimens demonstrating the extraordinary diminutive eye of the Indian River Whale (*Platanista gangetica*), which animal to all intents and purposes must be well nigh blind; and likewise specimens of grasses (*Ischæmum rugosum* and *Paspalum scrobiculatum*) obtained from the stomach of the same creature, probably residual digesta of fish eaten by it.—Dr. Cobbold read a paper on Trematode parasites from gangetic dolphins. Three species were lucidly described, viz., *Distoma lancea*, *D. campula*, and *D. Andersoni*. The first of these was procured from the short-snouted Dolphin (*Orcella brevirostris*), a form more frequently captured in the Indian river estuaries. The last mentioned is entirely new to science. It and that immediately preceding (formerly designated *Campula oblonga*) were both obtained by Dr. J. Anderson from different specimens of the fluviatile Cetacean (*Platanista*). The special interest attached to the parasites in question may be thus summarised. 1. The circumstance of being obtained from Cetacean hosts not previously known to be infested by them. 2. *D. lancea* and *D. campula* have each only once before (forty and twenty years respectively) been seen by any observer, and in either case from a different kind of whale. 3. The localities whence hosts and the Entozoa have been procured being situated regionally thousands of miles apart. 4. Verification of statements based on prior limited data. 5. The completion of our knowledge respecting the morphology and arrangement of all their more important internal organs. The author went on to generalise regarding the aberrance of host not producing departure of parasitic type, the relative periodic frequency and effects of such lowly organisms in wild and domestic animals, and the close alliance of the Planarians to the forms treated.—Mr. W. T. Thiselton-Dyer read a paper on the genus *Hoodia*, with a diagnosis of a new species. He distinguishes three forms, viz., *H. Gordoni*, *H. Currori*, and *H. Barklyi*, and shows that in certain respects the genus *Decabelone* presents a close alliance. In the peculiarities of structure and recognition of parts of the floral envelope of *Hoodia* the author holds opinions diverging from those of Mr. Bentham, who previously had but a limited opportunity of examining this rare and interesting group of African plants. — Mr. W. Duppa Crotch read a paper on the migration and habits of the Norwegian Lemming. Specimens belonging to him and Mr. A. E. Alston, illustrated certain moot points in the economy of these animals.—The Rev. M. J. Berkeley communicated a report on the fungi collected in Kerguelen Island, during the stay of the Transit of Venus Expedition of 1874-5. This section of the Cryptogamic flora of the island appears to be poorly represented, in so far as number of species is concerned.—A note on *Arctomys dichrous*, an oddly-coloured kind of Marmot inhabiting Cabul, by Dr. J. Anderson, was announced.

Geological Society, May 10.—Prof. P. Martin Duncan, F.R.S., president, in the chair.—W. Borrer, James I'Anson, John William James, Mark Stirrup, and Charles Wilkinson were elected Fellows of the Society.—The following communications were read:—On some fossil reef-building corals from the Tertiary deposits of Tasmania, by Prof. P. Martin Duncan, F.R.S. The species described by the author were *Heliastræa tasmaniensis*, sp. n., *Thamnastræa sera*, sp. n., and a second species of *Thamnastræa*. Both these genera are composed of reef-building corals, and the species here described undoubtedly belonged to that category. They required the natural conditions peculiar to coral-reefs. The author noticed the facts as to the distribution of land and water in the Australian region in Lower Cainozoic times, which are revealed by the deposits belonging to that age, and indicated that although the insular distribution of the land may have been unfavourable to the growth of coral-reefs, the existence of a suitable sea-temperature in the latitude of Tasmania is insufficiently explained. A single relic of the old reef-building corals survives on the shores of Tasmania in the *Echinopora rosularia*, Lam., but all the other forms have died off. The coral isotherm would have to be 15° lat. south of its present position to enable reefs to flourish south of Cape Howe, and this could be caused only by a change in the arrangements of land and sea, and in the position of the polar axis. The author indicated the general arrangements of land which seemed to have prevailed, and noticed that at that period and even earlier the coral isotherm of 74° reached fully 25° north of its present position in the portion of the globe antipodean to Tasmania; but it would seem to require more than mere geographical changes to account for the existence of important reefs in western, central, and southern Europe and in Tasmania synchronously. The flora underlying the marine Cainozoic deposits of Victoria indicate tropical conditions, as do the Echinodermata of the succeeding strata (described in the following paper). The fossil plants of the Arctic regions, from the Carboniferous to the Miocene epoch, give evidence of the existence of higher temperatures and of other conditions of light than those now prevailing, but were the polar axis at right angles to the plane of the ecliptic, and were there no greater node than at present, there would be equal day and night at all points. The difficulty is to account for the present position of the axis on this supposition; but the author suggested that the great subsidences of Miocene lands, the formation of the southern ocean, and the vast upheavals of northern areas at the close of the Miocene epoch, may have sufficed to produce the present condition of things.—On the Echinodermata of the Australian Cainozoic (Tertiary) deposits, by Prof. P. Martin Duncan, F.R.S. In this paper, after noticing the history of our knowledge of Australian Tertiary Echinida, the author gave a list of the species at present known, amounting in all to twenty-three, and described the following as new species:—*Leiocidaris australiæ*, *Temnechinus lineatus*, *Arachnoides Loveni*, *A. elongatus*, *Rhynchopygus dysasteroides*, *Echinobrissus australiæ*, *Holaster australiæ*, *Maretia anomala*, *Eupatagus rotundus*, and *E. Laubei*. The author remarked upon the characters and synonymy of the previously known species, his most important statement being that the so-called genus *Hemipatagus* is in reality identical with the recent genus *Lovenia*, Gray, as clearly shown by fine specimens in his possession. The most marked genera of the existing Australian fauna are not represented, but are replaced by numerous Spatangoids; three species, however, are identical; but two of these have a very wide range. Of the remainder, nine are allied to recent Australian species, mostly from the north of the continent; six are allied to European and Asiatic Cretaceous forms; five are closely related to Nummulitic types; and one species appears to belong to a peculiar genus, namely, *Paradoxechinus novus*, Laube.—On the Miocene fossils of Haiti, by Mr. R. J. Lechmere Guppy, F.L.S.

Anthropological Institute, May 9.—Col. A. Lane-Fox, president, in the chair.—In a paper, with copious tables, under the title of Prehistoric names of weapons, Mr. Hyde Clarke traced an early chapter in the history of culture, showing that the names of weapons and tools were widely distributed among the aborigines of Africa, Asia, Australia, and America. He illustrated the archæological relation to the stone age by citing conformities between axe and knife and stone. In Africa, where stone weapons are so far as is known rare, the evidence of names is strong in affirmation of its having passed through a stone epoch.—Canon Rawlinson read a paper on the ethnography of the Cimbri. There were two theories respecting their origin—the one that they were Germans, the other that they were Celts. The evidence on both sides was slight, and very nearly balanced. The majority of the early writers were in favour of the Celtic view. Cæsar, who pronounced the Cimbri to be Germans, may not have met with any of pure blood. Much would depend on the meaning of the term yellow hair, and the reason for the employment of Celtic spies in the Cimbrian camp. The name Cimbri has so near a resemblance to Cymry (the *b* in Cambria being a usual Roman addition), that this was perhaps as good evidence as any in favour of the Celtic affinities of the race. On the whole Canon Rawlinson inclined to this view.—A short communication from Prof. Lubach, describing the "Hunebedden," or stone monuments in Holland, was read by the Director, Mr. E. W. Brabrook.

Entomological Society, May 3.—Sir Sidney Smith Saunders, C.M.G., vice-president, in the chair.—M. Jules Lichtenstein, of Montpellier, was balloted for and elected a foreign member.—The Rev. J. Hellins sent for exhibition various British Lepidoptera, recently submitted to M. Guenée for his opinion and determination. One of the most important was a *Noctua*, bearing some resemblance to *Xanthia ferruginea*, not known to M. Guenée, taken at Queenstown, flying over bramble blossoms, in July or August, 1872, by Mr. G. F. Mathew; it was also unknown, as European, to Dr. Standinger.—Mr. Distant exhibited a series of six examples of the butterfly, *Ithomia tutia*, Hewitson, from Costa Rica, showing a very considerable variation in markings to which the species is evidently liable. He also communicated some remarks on the *Rhopalocera* of Costa Rica, with descriptions of species not included in the Catalogue of Messrs. Butler and Druce, published in the "Proceedings of the Zoological Society" for 1874.—Mr. Douglas exhibited specimens of the Corozo Nut (*Phytelephas macrocarpa*), the vegetable ivory of commerce, of which the interiors were entirely eaten away by a species of *Caryoborus* (one of the *Bruchides*). A specimen of the beetle was shown, with nuts, from the London Docks, which had been recently imported from Guyaquil.—The Secretary read a letter he had received from the Foreign Office Department, enclosing a dispatch from her Majesty's Minister at Madrid, relative to the steps taken to check the ravages of the locust in Spain. It appeared that considerable apprehension was felt in many parts of Spain that the crops of various kinds would suffer greatly this year from the locust, and the Cortes had already voted a large sum to enable the Government to take measures to prevent this calamity, and by a Circular addressed to the Provincial Governors by the Minister of "Fomento," published in the Official Gazette, they were directed to make use of the military forces stationed within their respective districts to aid the population in this object. It was stated that thirteen provinces were threatened with this plague.

Geologists' Association, April 7.—Mr. Wm. Carruthers, F.R.S., president, in the chair.—On the volcanoes of Iceland, with special reference to those mountains which have recently erupted, by W. L. Watts. The vast mass of the Vatna-Jökull rests upon a base of tuff and agglomerate traversed in many places by intruded basaltic and other lavas. This mountain and its immediate neighbours constitute the highest and probably the oldest part of Iceland, for its lava streams are in a state of ruin and decay unequalled in any other part of the country, and it is girt upon its southern base by sea-cliffs, which must have been washed by the ocean when many other parts of Iceland were under water, unless a very serious depression has taken place since the southern outlying hills of the Vatna and Skaptar Jökulls were washed by the sea. The fires in the Vatna are not yet extinct. Crossing the deserts to the north of the Vatna Jökull, on the west is a large tract of lava, the greater part of which has flowed from Skaldbreith; whilst in front rise the Dyngjufjöll or Chamber Mountains, the volcanoes which caused so much damage to the north of Iceland last spring. These mountains are composed of palagonitic agglomerate, and are in many places traversed by dykes and masses of lava, whilst numerous protruding scoriaceous crags suggest that lava streams may lie beneath. The sides have been fissured and cracked by the violent earthquakes which preceded the eruption of last spring. In the latitude of 64° 45′ N., and extending eastward towards the sea shore, the country was found to be strewn with a light vitreous pumice, very vesicular, and assuming most beautiful shapes. The crater from which this was ejected is situated in the south corner of the Askja (oval wooden casket), the name given to an elevated piece of land enclosed upon all sides but the north-east by semi-detached sections of mountains. The fissures in this volcano were still in active eruption, sending forth vast volumes of steam, a dark granulated fetid earth which occasionally fell around in showers, and a little water. Copious floods of water had flowed down the sides of the volcano; this is the more remarkable, as the Dyngjufjölls are neither glacial nor snow-capped mountains. The Öskja-gjá (chasm of the oval wooden casket) is, moreover, at least thirty-eight geographical miles from the lake of Mývatn, and forty-five from the nearest sea-shore. The second centre of recent volcanic activity is situated in the Mývatns Orœfi, where the volcanic fires first made their appearance last year. After the violent earthquakes which at Christmas, 1873, shook the north-east of Iceland, a fissure twelve miles in length, and varying from one to thirty feet in breadth, opened in the west portion of the Mývatns Orœfi, and commenced to eject lava from fourteen or fifteen different points. Many of the smaller fissures formed by these earthquakes cast up stones and ashes, and lava welled up through them. The great discharge of lava, however, was from the great fissure, which formed a lava stream some thirteen miles in length, and varying from one to three in breadth; it has overflowed an older lava stream which had issued from a vent in the Mývatns Orœfi, called the Svinagjá. This fissure broke out again in March, and continued in a state of intermittent activity until the following April. The lava is basaltic, and differs from the ancient streams only in its not containing olivine. The fundamental rock of Iceland is the palagonitic tufa of sub-aqueous origin, disturbed and at times metamorphosed by enormous masses of amygaloidal basaltic lava; these are overlaid by sub-äerial lava streams, pumiceous tuffs, and agglomerates which have been formed by debacles and atmospheric influences. Trachytic lavas occur but sparingly, the trachytic band supposed to bisect the island from Cape Langaness to Rejkjaness being unsupported by investigation. Trachytes in a much altered condition have been found around and between Hekler and the geysers. Obsidian is seldom met with *in situ*; Mount Paul, however, in the heart of the Vatna Jökull, consists of this rock, whilst the pumiceous outburst of the Oskja-gjá must also be referred to it.

May 5.—Prof. J. Morris, F.G.S., vice-president, in the chair.—On the section of the chloritic marl and upper greensand on the northern side of Swanage Bay, by H. George Fordham, F.G.S.—Notes on the geology of the neighbourhood of Swanage, by W. R. Brodie.

Institution of Civil Engineers, May 9.—Mr. W. H. Barlow, vice-president, in the chair.—The first paper read was on the construction of railway wagons, with special reference to economy in dead weight, by W. R. Browne, Assoc. Inst. C.E.—The second paper read was on railway rolling-stock capacity, in relation to the dead weight of vehicles," by Mr. W. A. Adams, Assoc. Inst. C.E.

CAMBRIDGE

Philosophical Society, Feb. 28.—The following communication was made to the Society by Prof. Clerk Maxwell, on Bow's method of drawing diagrams in graphical statics, with illustrations from Peaucellier's cell:—A frame is a structure consisting of pieces jointed together at their extremities. In diagrams the joints are represented by points, and the pieces by straight lines joining the points. A diagram of stress is a figure such that the forces acting at each joint of the frame are represented in direction and magnitude by the sides of a polygon in the diagram of stress. When the diagram of stress is such that to the lines which meet in a point in the diagram correspond the sides of a polygon in the frame, the frame and the diagram are said to be reciprocal. Mr. R. H. Bow, C.E., F.R.S.E., in his "Economics of Construction in relation to Framed Structures," has pointed out a method of constructing reciprocal diagrams which applies to cases which I had formerly thought impracticable. Mr. Bow assigns a letter to each enclosed space of the frame, and also to each division of the surrounding space as separated by the lines of action of the external forces. When two pieces of the frame cross each other without being jointed, Mr. Bow treats them as if they were jointed. The forces at the point of intersection are represented by a parallelogram. In the diagram of stress the letters are placed at the points which correspond to the enclosed spaces of the frame. In Peaucellier's cell the three external forces acting at the centre and the two bracing points meet in a point in the diagonal through the other two angles of the rhombus. To every positive cell in which the centre is outside the rhombus corresponds a negative cell in which the centre is inside the rhombus, and if the point of concourse of the forces is outside the rhombus in one case it is inside in the other. Every line in the one figure is parallel to the corresponding line in the other, and the only difference is that the acute angles of the rhombus, in one figure correspond to the obtuse angles in the other. These two frames have the same diagram of stress, so that the stress of corresponding pieces in the two frames is the same.

March 23.—Mr. Pearson made a communication on a set of lunar distances taken by him under rather peculiar circumstances last autumn, Oct. 8.

March 27.—Mr. Anningson read a paper on the relation of the spinal cord to the tail in mammals.—On vital force, by Mr. H. F. Baxter.

MANCHESTER

Literary and Philosophical Society, Feb. 22.—Mr. E. Schunck, F.R.S., president, in the chair.—Notes on a collection of apparatus employed by Dr. Dalton in his researches, which is about to be exhibited (by the Council of the Literary and Philosophical Society of Manchester) at the Loan Exhibition of Scientific Apparatus at South Kensington, by Prof. Roscoe, F.R.S.—A letter from Mr. Arthur Wm. Waters, dated Naples, Feb. 9, 1876, was read by Mr. Baxendell, giving some account of the Naples Zoological Station.—On glacial action in the valley of the Wear, &c., by Prof. T. S. Aldis.

Feb. 29.—E. W. Binney, F.R.S., in the chair.—An account of some early experiments with ozone, and remarks upon its electrical origin, by J. B. Dancer, F.R.A.S.—Results of rain-gauge observations made at Eccles, near Manchester, during the year 1875, by Thomas Mackereth, F.R.A.S.

March 7.—Mr. E. Schunck, F.R.S., president, in the chair.—Mr. R. S. Dale exhibited specimens of crystals of sulphate of lead found in alum residue.—On the degree of accuracy displayed by druggists in the dispensing of physicians' prescriptions in different towns throughout England and Scotland, by Mr. William Thomson, F.C.S.

March 13.—Prof. W. Boyd Dawkins, F.R.S. in the chair.—Mr. Charles Bailey exhibited a series of slides illustrating similarities of structure in Dicotyledonous and Monocotyledonous stems.—Mr. R. D. Darbishire, F.G.S., exhibited a series of specimens of very young *Rhombus vulgaris* (Cuv.), showing (1), the two eyes on each side of the vertebral plane; (2), the removal of the eye from the underside to the dorsal edge; (3), the appearance of both eyes on the one (upper) side of the fish. He also communicated some notes made during a visit in the past summer to the Swedish shell-beds of Uddevalla and the neighbouring district, and exhibited a collection of the fossils of remarkable extent and beauty.—List of shells found in Cymmeran Bay, Anglesea. Corrections and additions, by Mr. John Plant, F.G.S. Addenda and corrigenda.

March 21.—Mr. E. Schunck, F.R.S., president, in the chair.

—Dr. Arthur Schuster exhibited an interesting collection of objects brought by him from Siam and the Western Himalayas. —On a graphical method of drawing spectra, by Mr. William Dodgson.—Evidence to prove that a bone from the Windy Knoll, Castleton, named by Prof. W. Boyd Dawkins, F.R.S., "Sacrum of young Bison," is a sacral bone of the Cave Bear (*Ursus spelæus*), by John Plant, F.G.S.

April 4.—Mr. E. Schunck, F.R.S., president, in the chair.—Prof. W. Boyd Dawkins, F.R.S., called the attention of the Society to the depreciation of silver which is now under the notice of a select committee of the House of Commons, and in connection with this called attention to the enormous mining wealth of the Nevada silver-mining district, a part of which he had had the opportunity of examining last autumn.—On some isomerides of alizarine, by Edward Schunck, F.R.S., and Dr. Hermann Roemer.—Prof. Boyd Dawkins, F.R.S., said with reference to the Windy Knoll bone, spoken of by Mr. Plant at the last meeting, that he had re-examined the evidence, and consulted Mr. Davis, of the British Museum, and found that he was mistaken in referring it to bison. The evidence of the jaws and teeth proves that the bear of Windy Knoll is not the cave, but the great fossil grizzly bear (*U. ferox fossilis* = *U. priscus*), as may be seen by a reference to the Quart. Geol. Journ., Lond., 1875, pp. 251–2.—The Eucalyptus near Rome, by Dr. R. Angus Smith, F.R.S., V.P.

April 18.—Annual General Meeting. — Mr. E. Schunck, F.R.S., president, in the chair.—The number on the roll on April 1, 1876, was 166.—Mr. Edward William Binney, F.R.S., F.G.S., was elected President.—Mr. W. E. A. Axon read a note on a church bell, at North Wooton, Somersetshire, dated A.D. 1265, in Arabic numerals, and on a MS. dated A.D. 1276, in which they are freely used.

VIENNA

Geological Society, March 7.—M. F. Karrer examined, together with M. Linzow from Odessa, the limestones and lime-sand beds of the environs of Odessa, and found that nearly the whole mass of them is composed of Foraminifers belonging to the genus Nubecularia, which attach themselves to various other bodies, and therefore appear in many different forms.—Director Ruecker stated the most recent results obtained concerning the division of the coal-strata of Ajka, in Hungary, and presented to the Society a rich collection of fossils from this country.—M. F. Posépny referred to the salt-pits of Bex, near Geuf, and argues that neither the salt-beds of the Alps nor those of other countries are bound to a fixed geological horizon.—Dr. R. Hörnes on the remains of Anthracotherium from Zoveneedo.

PARIS

Academy of Sciences, May 15.—Vice-Admiral Paris in the chair.—The following papers were read:—Meridian observations of small planets at the Greenwich and Marseilles Observatories during the first three months of 1876; communicated by M. Le Verrier.—Note on the theoretical and experimental determination of the relation of the two specific heats in perfect gases whose molecules are monatomic, by M. Yvon Villarceau. In the ideal case where each gaseous molecule consists of only one atom, the relation of the two specific heats would be independent of the chemical nature of the gas, and equal (the author showed) to 1·666. Now MM. Kundt and Warburg have lately obtained for mercury vapour the number 1·67. He suggests the possible existence of other monatomic gases. M. Berthelot reserved his assent to the conclusions regarding mercury vapour.—On a working model of a new system of navigation locks, applicable specially to cases where the surfaces of water of the canals are very variable, by M. de Caligny.—Second note on the bitter lakes of the Isthmus of Suez, by M. de Lesseps. Notwithstanding the solution of the bank of salt in the middle, and the evaporation, the saltness diminishes. This must be due to currents, produced through difference of density between the water of the lake and that of the extremities of the canal; the heavy water flows to the sea, while the surface currents bring in water that is less salt. Hence an orifice of small section may suffice to prevent large sheets of salt water, though far from the sea, being concentrated by the heat.—Study of several questions relative to the Suez Canal, M. de Lesseps. *Inter alia*, rain now falls at least twice a month; during the construction of the canal, previously to 1870, M. de Lesseps observed rain not more than once in the year.—On the danger of introduction of certain American vines into the vineyards of Europe, by M. Marès. This is on account of the phylloxera found in galls on the leaves of American vines.—Mineralogical and geological researches on the lavas of the dykes of Thera, by M. Fouqué. This memoir furnishes new data on the distinction of felspathic species, the simultaneous presence of several triclinic felspars in one rock, the structure of lava at the moment of effusion, and the bedding and production of tridymite in volcanic rocks.—On the phylloxera issue of the winter egg, by M. Boiteau. —Another note on the subject, by M. Lichtenstein.—On the presence of phylloxera in submerged vines, by M. Trouchaud.—On the effects produced by absence of cultivation at the surface of the soil, in vineyards attacked by Phylloxera, by M. François.—Ephemerides of the planet 162, by M. Rayet.—On determination of the temperature of solidification of liquids, and particularly of sulphur, by M. Gernez. The point of solidification is sometimes substituted for the point of fusion, being supposed identical with it; but the determination may be vitiated by phenomena of superfusion. M. Gernez utilises these phenomena to determine the temperature of solidification with great precision. He shows how the temperature of solidification varies in the different kinds of sulphur; only insoluble sulphur being constantly solidified at one temperature, 114°·3, whatever the temperature at which it has been fused.—On calorific spectra, by M. Aymonnet. He used a Bourbouze lamp, and a refracting system of flint. The heat maximum approaches the less refrangible part of the spectrum in proportion as the temperature of the source decreases. Flint becomes less diathermanous as the temperature falls; a solution of iodine in chloroform, more diathermanous. (The distribution of heat in the spectrum is indicated by numbers.)—On the presence of selenium in refined silver, by M. Debray. It is nearly always present, and comes from the sulphuric acid used in refining.—Chemical researches on vegetation (continued). Functions of leaves. Origin of carbon, by M. Corenwinder. Not only can leaves acquire carbon by their surface, but they can assimilate the carbon contained in the carbonic acid which circulates in their tissues.—On the heart of Crustacea, by M. Dogiel. The muscular bundles of the pericardium act in the opposite direction to those of the heart itself (they are dilators). The blood of Crustacea is to be considered as lymph, and their heart a lymphatic heart; its movements depending on the action of the nervous system on the muscular elements.—The limbs of the aquatic Salamander, fully extirpated, are not regenerated; note by M. Philipeaux. The basilar bones must be completely removed.—On the signification of the filament of the stamen, by M. Clos. He thinks it the analogue, not of the petiole, but of the nervure or median portion of the petals.—On the crystalline system of several substances presenting optic anomalies; theory of crystalline groups; explanation of dimorphism, by M. Mallard.—On a new mineral from the Pyrenees, by M. Bertrand. This, called Friedelite, is a hydrated silicate of protoxide of manganese.—On the flora of the sandstone of Fontainebleau, by M. Contejean.—On the antiseptic properties of borax, by M. Bedoin.—On a new motor based on the elastic force of solid bodies, by M. Arnaudeau.

CONTENTS

PAGE
LORD CARNARVON'S VIVISECTION BILL 65
WILSON'S "PREHISTORIC MAN" By EDWARD B. TYLOR, F.R.S. . . 65
THE ARALO-CASPIAN REGION 66
OUR BOOK SHELF 68
LETTERS TO THE EDITOR:—
Supposed New Laurentian Fossil.—Dr. WILLIAM B. CARPENTER, F.R.S. 68
Theory of Electrical Induction.—Rev. J. F. BLAKE 68
Dynamometers and Units of Force.—Prof. HENRY HENNESSY . . 69
THE POTATO DISEASE, II. By WORTHINGTON G. SMITH (*With Illustration*) 70
OUR ASTRONOMICAL COLUMN:—
The Occultation of Saturn, August 7, A.M. 71
New Red Star 72
The Double Star Σ 3,121 72
THE LOAN COLLECTION CONFERENCES 72
Section Chemistry.—Opening Address by the President, Dr. Frankland, F.R.S. 73
THE PRESS ON THE LOAN COLLECTION 76
NOTES 78
SCIENTIFIC SERIALS 81
SOCIETIES AND ACADEMIES 81

Nature. June 1st 1876.

C. Wyville Thomson

Engraved by C. H. Jeens, from a Photograph

London Published by Macmillan & Co