THURSDAY, MARCH 5, 1874

## PROFESSOR HUXLEY AT ABERDEEN

THE Address just given by the Lord Rector of Aberdeen University, and published *in extenso* in the March number of the *Contemporary Review*, is second in importance to none of the similar utterances which have been heard of late years. It bears in every line the stamp of a master mind. The many topics touched on, the apparent diversity of which has alarmed the shallow critic of the *Times*, are all grouped round one central idea—the advancement of Science; and there is not only a splendid unity throughout the Address, and no "uncertain sound," which, coming as it does from a Royal Commissioner charged with a special survey of our scientific needs, as well as a Lord Rector, may well fill us with confidence for his advocacy, even if one despairs of much improvement being effected in the lifetime of the present generation. It is indeed to be feared, as Mr. Huxley himself anticipates, that on many points he will be "The Rector who was always beaten;" if so, it is none the less certain that his defeats will become "victories in the hands of his successors."

It is especially fitting that the Address, dealing, as it did by its title, with "Universities: Actual and Ideal," should have been delivered in connection with one of the Scotch Universities, which, in regard to scientific research and teaching, rank higher than the older English Universities, given up in the main to "elementary teaching of youths under twenty," as the ideal University must take rank above them. We cannot too much thank Prof. Huxley for bringing out this point sharply, and quoting Mr. Mark Pattison to intensify it, all the more because the *Times* has taken hold of another sentence of the address, to point out the importance of a "pause" in the Reforms at Oxford and Cambridge, as if things were moving too fast! Surely the older English Universities may at least approach the level of the Scotch Universities, to say nothing of the French and German ones, in the matter of the higher teaching and of research before this "pause" is insisted on?

And, more than this, we conceive it to be possible that the present Government may not treat the Report of the Commission appointed to inquire into the Revenues of the Colleges at Oxford and Cambridge as mere waste paper. It has frequently been roundly asserted that the political distinctions between Liberals and Conservatives by no means represent the line of demarcation between those most and least anxious for University reforms. However this may be, it is well known that one of the most enlightened and far-seeing among University reformers, so far as the highest functions of a University are concerned, is a member of the present Government. Let us hope, therefore, that the magnitude of the pause may have been exaggerated; that the Heads after all may not oversleep themselves, that the last of Endowment may be even as the first, Endowment being, according to Professor Huxley, a foreign element,

"Which silently dropped into the soil of Universities like the grain of mustard-seed in the parable; and, like that grain, grew into a tree in whose branches a whole aviary of fowls took shelter. . . . It differed from the preceding, in its original design to serve as a prop to the young plant, not to be a parasite upon it. The charitable and the humane, blessed with wealth, were very early penetrated by the misery of the poor student. And the wise saw that intellectual ability is not so common or so unimportant a gift that it should be allowed to run to waste upon mere handicrafts and chares. The man who was a blessing to his contemporaries, but who so often has been converted into a curse, by the blind adherence of his posterity to the letter, rather than to the spirit, of his wishes—I mean the 'pious founder'—gave money and lands, that the student who was rich in brain and poor in all else might be taken from the plough or from the stithy, and enabled to devote himself to the higher service of mankind; and built colleges and halls in which he might be not only housed and fed, but taught.

"The colleges were very generally placed in strict subordination to the University by their founders; but, in many cases, their endowment, consisting of land, has undergone an 'unearned increment,' which has given these societies a continually increasing weight and importance as against the unendowed, or fixedly endowed, University. In Pharaoh's dream the seven lean kine ate up the seven fat ones. In the reality of historical fact, the fat Colleges have eaten up the lean Universities."

We have already, in NATURE, referred to Prof. Huxley's suggested reforms in respect to the Medical Curriculum, and we may therefore pass lightly over this part of his Address, expressing a hope, however, that his reference to this subject at length may be indicative that it will be considered by the Commission of which he is so distinguished a member.

The Lord Rector points out that while he would drop Zoology and Botany in the Medical Curriculum, he would make them part of the Arts Curriculum; and after remarking that the Faculties of Theology, Law, and Medicine are technical schools, intended to equip men who have received general culture with the special knowledge which is needed for the proper performance of the duties of clergymen, lawyers, and medical practitioners, he adds,—

"I have no sort of doubt that, in view of the relation of Physical Science to the practical life of the present day, it has the same right as Theology, Law, and Medicine, to a Faculty of its own in which men shall be trained to be professional men of science. It may be doubted whether Universities are the places for technical schools of Engineering, or Applied Chemistry, or Agriculture. But there can surely be little question that instruction in the branches of Science which lie at the foundation of these Arts, of a far more advanced and special character than could, with any propriety, be included in the ordinary Arts Curriculum, ought to be obtainable by means of a duly organised Faculty of Science in every University.

"The establishment of such a Faculty would have the additional advantage of providing, in some measure, for one of the greatest wants of our time and country. I mean the proper support and encouragement of original research."

This at once brings us to what we consider by far the most important part of the Address, the Lord Rector's opinions on the endowment of unremunerative research:—

"The other day, an emphatic friend of mine committed himself to the opinion that, in England, it is better for a man's worldly prospects to be a drunkard, than to be smitten with the divine dipsomania of the original investigator. I am inclined to think he was not far wrong. And, be it observed, that the question is not, whether such a man shall be able to make as much out of his abilities as his brother, of like ability, who goes into Law, or Engineering, or Commerce; it is not a question of 'maintaining a due number of saddle horses,' as George Eliot somewhere puts it—it is a question of living or starving.

"If a student of my own subject shows power and originality, I dare not advise him to adopt a scientific career; for, supposing he is able to maintain himself until he has attained distinction, I cannot give him the assurance that any amount of proficiency in the Biological Sciences will be convertible into, even the most modest, bread and cheese. And I believe that the case is as bad, or perhaps worse, with other branches of Science. In this respect Britain, whose immense wealth and prosperity hang upon the thread of Applied Science, is far behind France, and infinitely behind Germany.

"And the worst of it is, that it is very difficult to see one's way to any immediate remedy for this state of affairs which shall be free from a tendency to become worse than the disease.

"Great schemes for the Endowment of Research have been proposed. It has been suggested, that Laboratories for all branches of Physical Science, provided with every apparatus needed by the investigator, shall be established by the State; and shall be accessible, under due conditions and regulations, to all properly qualified persons. I see no objection to the principle of such a proposal. If it be legitimate to spend great sums of money on public Libraries and public Collections of Painting and Sculpture, in aid of the man of letters, or the Artist, or for the mere sake of affording pleasure to the general public, I apprehend that it cannot be illegitimate to do as much for the promotion of scientific investigation. To take the lowest ground, as a mere investment of money, the latter is likely to be much more immediately profitable. To my mind, the difficulty in the way of such schemes is not theoretical, but practical. Given the laboratories, how are the investigators to be maintained? What career is open to those who have been thus encouraged to leave bread-winning pursuits? If they are to be provided for by endowment, we come back to the College Fellowship system, the results of which, for Literature, have not been so brilliant that one would wish to see it extended to Science; unless some much better securities than at present exist can be taken that it will foster real work. You know that among the Bees, it depends on the kind of cell in which the egg is deposited, and the quantity and quality of food which is supplied to the grub, whether it shall turn out a busy little worker or a big idle queen. And, in the human hive, the cells of the endowed larvæ are always tending to enlarge, and their food to improve, until we get queens, beautiful to behold, but which gather no honey and build no comb.

"I do not say that these difficulties may not be overcome, but their gravity is not to be lightly estimated."

It is pointed out that the creation of Faculties of Science will, to a certain extent, remedy the present lamentable condition of things to which we have so often called attention.

"It is possible to place the scientific inquirer in a position in which he shall have ample leisure and opportunity for original work, and yet shall give a fair and tangible equivalent for those privileges. The establishment of a Faculty of Science in every University implies that of a corresponding number of Professorial chairs, the incumbents of which need not be so burdened with teaching as to deprive them of ample leisure for original work. I do not think that it is any impediment to an original investigator to have to devote a moderate portion of his time to lecturing, or superintending practical instruction. On the contrary, I think it may be, and often is, a benefit to be obliged to take a comprehensive survey of your subject; or to bring your results to a point, and give them, as it were, a tangible objective existence. The besetting sins of the investigator are two: the one is the desire to put aside a subject, the general bearings of which he has mastered himself, and pass on to something which has the attraction of novelty; and the other, the desire for too much perfection, which leads him to

> "'Add and alter many times
> Till all be ripe and rotten;'

to spend the energies which should be reserved for action, in whitening the decks and polishing the guns.

"The necessity for producing results for the instruction of others, seems to me to be a more effectual check on these tendencies than even the love of usefulness or the ambition of fame."

It would indeed be a happy solution of the difficulty if it could be solved in this way, but we confess that on this point we fear that the system advocated by Mr. Huxley will not be all that is needed.

In the first place, take the present appointments to Chairs; are they, as a rule, given to the most distinguished investigators? If not, why not, and why should the present system be altered? In our opinion the present system of appointing teachers is good so long as large ranges of knowledge have to be professed. Take many of our present professors; are they as encumbered by teaching as the German professors are for instance? and yet where are their researches? do they not figure much more often in the "List of Examiners" than in the "Philosophical Transactions"? If these things are so, no benefit will accrue from a mere increase of numbers unless the present pay be largely increased.

There is also another most important point, and here again we quote from the Address:—

"It is commonly supposed that anyone who knows a subject is competent to teach it; and no one seems to doubt that anyone who knows a subject is competent to examine in it. I believe both these opinions to be serious mistakes: the latter, perhaps, the more serious of the two. In the first place, I do not believe that anyone who is not, or has not been, a teacher is really qualified to examine advanced students. And in the second place, examination is an art, and a difficult one, which has to be learned like all other arts."

Are then investigators to be made teachers and examiners in order that they may live, regardless of the fact that they cannot teach, and though they may be ignorant of the "art" of examining?

We believe that powers of teaching and powers of investigation by no means go together, though they are united in some great men like Mr. Huxley; and we believe, further, that on this ground alone the idea of making a man teach in order that he may carry on researches is bad in principle: it is even worse than this, because it is apt to cause the public to underrate research—to think that the end of all research is to teach, while in point of fact the end and aim of the acquisition and teaching of all old knowledge is the acquirement of new knowledge.

It is a source of satisfaction to us that Prof. Huxley agrees with us on the main point, for we are certain that when once the principle is conceded, practical methods of carrying it out, among which undoubtedly that insisted on by the Lord Rector will find place, can easily be found; methods against which no objection can be urged, and from the application of which a tremendous increase in the rate of advancement of knowledge in this country may be anticipated.

## *POST-TERTIARY GEOLOGY**

*The Great Ice-Age and its relation to the Antiquity of Man.* By James Geikie. (W. Isbister and Co. 1874.)

II.

WE must next turn to beds which furnish conclusive proof of a return of cold conditions, the well-known shell-bearing clays found here and there along the coast of Scotland. The fossils and the physical condition of these beds both concur in telling the same tale, that an Arctic climate again prevailed in Britain. These deposits are marine, and have not been met with at a greater height above the sea than 360 feet, and they were therefore formed towards the termination of the period during which the land was emerging from the sea. Evidence of a similar change of climate is, however, found in the interior of the country. In the Highland glens and the high valleys of the Southern Uplands morainic deposits, distinguishable from those of the earlier ice period, are of common occurrence, sometimes scattered loosely over the mountain slopes, sometimes arranged in ridges or lines of mounds across the valleys after the fashion of terminal moraines. The climate, therefore, must have become again severe enough to allow of the accumulation of ice; but, since the second set of glaciers is shown by the moraines which they have left behind them to have been confined to the high ground, and each restricted to its own valley, the cold must have been far less intense than during the period of the first glaciation.

The second period of cold, however, passed away, and the record of its gradual disappearance is written for us in this way. In many of the upland valleys concentric lines of mounds, each marking the terminal moraine of a glacier, are arranged one within the other, and as we ascend these piles are found to grow more and more puny, till they at last vanish altogether. From this we see, as clearly as if the operation had gone on before our eyes, how each glacier shrank back step by step into the heart of the mountain glens, and at last yielded to the gradual amelioration of the climate, and melted entirely away. Another train of reasoning leads us to the same conclusion. The rising of the land was not continuous, but broken every now and then by pauses, and during each of these the sea cut a notch or shelf in the rocks and occasionally spread out terraces of shingle and silt, forming what are known as Raised Beaches. These beaches occur at many different levels, from 1,500 feet down to a few yards above the mean-tide level. The higher of these beaches furnish evidence of somewhat Arctic conditions, but as we descend in the series these traces become less pronounced.

We are now approaching the close of the glacial epoch, and the climate, though still colder than now, was approximating to what it is at present.

The author goes on to show, from a consideration of submerged forests, how the elevation of the land went on till Britain was raised above its present level, and probably connected by a land surface with the mainland of Europe; and points out how the continental climate thus produced will account for the dense forests which formerly clothed our island, while a return to insular conditions resulted in a decay of the woods and the growth of peat mosses.

Lastly, our country became again dissevered from the continent, and the submergence which brought about this change went on till the land was sunk somewhat below its present level; while it rose into its present position, low level raised beaches were formed, among which the well-known 25-feet-beach is most conspicuous.

Such then is the succession of physical changes which the Drift-deposits show has taken place in our island.

The author has passed in review also the contemporaneous formations of Scandinavia, Switzerland, and North America, and pointed out how the story they tell agrees in its main features with that deduced from our own glacial formations.

Had he done no more than this he would have produced a work of surpassing interest and value, but the concluding chapters of his book will perhaps attract more attention than any other part of it, for they deal with a question that comes in a measure personally home to us, the antiquity of man and the date of his first appearance in Britain.

The oldest races of men of which traces have yet been discovered are known as the Stone-folk, because they fashioned their implements out of stone and seem to have been unacquainted with the use of metals. These Stone-folk are clearly distinguishable into two classes—the older, known as Palæolithic, merely chipped stones into shape; the later, or Neolithic, had advanced a step farther, and constructed tools highly polished and otherwise more finished than those of their predecessors. We also find associated with the traces of Palæolithic man a group of mammals now wholly or locally extinct, while the mammals accompanying the remains of Neolithic man are many of them still indigenous to the country. In connection with this subject the author has brought prominently into notice a fact which had not received the attention it deserves, that nowhere have any signs been detected of gradual improvement on the part of Palæolithic man, by which he may have passed from abject barbarism to the more advanced skill of his Neolithic successor, but that, on the contrary, the two races are everywhere sharply marked off from one another. In the same way the accompanying groups of mammals are essentially distinct, and we nowhere find traces of the dying out of the one and the gradual coming in of the other. But one inference can be drawn from these facts: between the time when the Palæolithic race inhabited Britain and the coming in of the Neolithic race a long interval must have elapsed, during which man was by some means or other driven out of the country, and went through elsewhere the long series of modifications by which he was himself advanced in civilisation, while at the same time the group of animals associated with him became totally changed. Now we know of no physical change since the second glaciation of the country which could have been the cause of such a migration, for all the evidence both here and elsewhere tends to show, that whatever change of climate has occurred between that event and the present day has been

* Continued fro p. 321.

steadily in the same direction—that of improvement. But the great submergence, and severe period which followed it, would exactly bring about the required result, if it can be only shown that the age of Palæolithic man preceded these occurrences.

There is no antecedent improbability in such a supposition; the mild periods that recurred during the formation of the Till may well have been warm enough to allow of northern mammals, and subsequently, as the climate improved, of Palæolithic man and southern forms migrating into our area, to be again driven out each time a return of cold brought the ice-sheet down over the lowlands, and finally expelled, never again to return, by the great submergence. But more than this, our author has shown how anomalies, hitherto inexplicable, receive an easy solution on this hypothesis; how, for instance, it accounts for the mingling of northern and southern forms of mammals in the palæolithic beds; and how it gives a reason for the fact that palæolithic river-gravels are confined to those parts of Britain which were not covered by the ice-sheet, while the palæolithic deposits found in caves are not so restricted.

The hypothesis therefore stands on a firm basis, and the conclusion is irresistible that Palæolithic man was of interglacial—may be of preglacial—date. Thus much had been dimly felt rather than demonstrated by previous thinkers; but Mr. J. Geikie has shed a flood of light on the subject by pointing out that man was driven out of our country by the great submergence; that Britain was not again peopled till the elevation that followed connected it with the continent; and that the colonists belonged to the Neolithic race. In this way he has satisfactorily accounted for the great gap that exists between the two divisions of the Stone-folk.

The reasonable limits of an article are well-nigh reached, but we have by no means exhausted the contents of this comprehensive volume. The chapter on lakes must not be passed by altogether, for besides being a lucid exposition of Prof. Ramsay's theory of the formation of rock-basins, it is illustrated by an admirable map and section of Loch Lomond, and by a beautiful chart of part of the western coast of Scotland, which shows that these hollows are not confined to the land, but are also dotted over the shallow bed of the adjoining sea in exactly the places where a glacialist would expect to find them. The chapter on the English Drift would itself furnish materials for a review, as would also the note distinguishing the formations which are considered to have yielded traces of ice action. On the latter head we may point out that the presence of glaciers or icebergs is not in itself proof of a glacial epoch. Where we find, as in the Permian beds, evidence of the presence of ice at localities so far apart as Ireland, the west of England, and the centre of Germany, it looks like an indication of wide-spread severity of climate; but such a case as the Brecciated Beds of the Ord is better explained by a local development of glaciers, specially as the fauna of the associated strata forbids the existence of a general low temperature. It is worthy of note that these periods, which give the most satisfactory indications of glacial conditions, come close upon others, when a genial climate prevailed far up into northern latitudes; the Permian, for instance, followed hard upon the Carboniferous, and the Miocene epoch, if the glacial character of portions of it be fairly established, would yield a still more striking instance. But these juxtapositions of strongly-contrasted phases of climate, so far from being matter for surprise, are a necessary result of Mr. Croll's theory, according to which each hemisphere would, during a period of high eccentricity, experience alternately the severity of a glacial epoch and eras of almost perpetual spring.

Space will allow us to point out one only of the numerous results which will probably follow from the conclusions of this work. They must lead to a revision of our nomenclature of the Tertiary strata. The conditions of the Pliocene epoch were merely the commencement of a series of changes which received their full development during the Glacial era; and the latter is linked on by an equally unbroken succession of events with modern days. If therefore we are to have a Post-tertiary, Quaternary, or Recent Period, it should on physical grounds include Pliocene times; while the continental character of the Miocene epoch in Europe, and the important events that brought it to an end, mark it out as the natural termination of the Tertiary era.

In conclusion we have only to express a hope that the imperfect sketch we have given of the Great Ice Age may lead many readers to arrive at a fuller appreciation of its merits by turning to the work itself.

A. H. Green

## *SCHWEINFURTH'S "HEART OF AFRICA"*

*The Heart of Africa; or, Three Years' Travels and Adventures in the Unexplored Regions of the Centre of Africa.* By Dr. Georg Schweinfurth. Translated by Ellen E. Frewer. 2 vols. (London: Sampson Low and Co., 1874.)

THE "Heart of Africa" is a valuable contribution to African literature, and we lay down the last volume with regret. This regret is enhanced by the grievous disappointment all geographers must feel that a man so capable and so reliable as Dr. Schweinfurth should have limited his scientific acquirements to botany and natural history without having qualified himself as a traveller by the use of astronomical instruments.

When we first glance at the elaborate map of the author's travels, embracing an extraordinary series of curves, zigzags, and the like, until we reach his most southern limit, we are delighted with this apparently valuable addition to geography, and we feel a first impulse to congratulate Germany as an ally in Central African Exploration, but to our complete dismay after these ardent expectations we find ourselves actually without one astronomical observation.

As geographers, we really have a right to complain. If Dr. Schweinfurth had been an uneducated adventurer, or even a mere sportsman attracted to wild countries by a love of wandering, we should have regretted a barren geographical result after an arduous journey of three years. Dr. Schweinfurth is, on the contrary, a man of scientific education and a botanist—in addition to being an accomplished draughtsman. He is a man of cultivated tastes, and he evidently combines the qualities requisite for a traveller in wild countries. Why should he not have fitted himself prior to his voyage by a few months' study for the only practical and reliable work of a geographer or scientific traveller? In the absence of astronomical observations we can only regard his map as the author's *idea* of his journey. We have no compass bearings or any reference to such observations having been taken. We must therefore accept his map as simply a conscientious endeavour to introduce us to his wanderings; at the same time, geographically speaking, we can only allow that he has been wandering about in the "Heart of Africa." It is with regret, therefore, that we cannot accept him in the first rank of geographers. A future traveller over the same ground may contest every position; thus, instead of our author's journey having added to our geographical knowledge, it may simply add to those geographical strifes which are the inevitable results of un-scientific journeys.

Having, as a matter of duty, expressed this opinion upon a work otherwise most valuable, it is a pleasure to be able to grasp one geographical fact that is well established, and is independent of astronomical observations. This is the watershed towards the West which forms the boundary of the Nile Basin. The large flow of water discovered by Dr. Schweinfurth is passing towards the Atlantic. This at once disproves the theories laid down by Livingstone, but never accepted by geographers, that he rivers to the west of the Tanganika Lake flowed northward to the Nile. As Schweinfurth passed out of the Nile Basin in about 28° E. long., so also Livingstone arrived in a western watershed south of the equator in about the same meridian.

The botanical information collected by Dr. Schweinfurth is invaluable, and can only be estimated by a professional botanist. We envy the traveller in many of his floral rambles, which are described with the energy and vividness of an enthusiast. Nothing new has been added to the known list of African fauna. We conclude, from the description of the habits of the so-called "rock rabbit," that our author means the "hyrax," which, although resembling a rabbit in appearance, is not a rodent.

Dr. Schweinfurth having been properly supported by an introduction from the Berlin Academy was saved many difficulties to which other travellers have been subjected; he was well received by Djiaffer Pacha, the Governor-General of Soudan, at Khartoum, who handed him over to the care of one Ghattas, a Coptic slave trader and ivory merchant. Ghattas entrusted him to the guidance of his own people, who appear to have behaved extremely well. Dr. Schweinfurth had every opportunity of examining the mysteries of the slave trade, and he is perfectly right in his description of the immense importance of the Darfur and Kordofan route, by which vast multitudes are conveyed who can thus elude the cruisers on the White Nile. At the same time the author is in error and has been purposely deceived by his informants (themselves slave traders) when (p. 429, vol. ii.), speaking of the upper district of the White Nile, inclusive of the Albert and Victoria Lakes, as one of the territories that form the sources of the slave trade in north-eastern Africa, he says, "The expedition of Sir Samuel Baker has stopped this source. The annual produce in the most favourable years did not exceed 1,000." There were no less than ten slave stations situated in the territory under Sir Samuel Baker's command. In each of these stations were at least 1,000 slaves.

The last act of Sir Samuel Baker, on his homeward route, was to overtake three vessels from the Bohr, lat. 5°·20 N., with 700 slaves on board, which were openly on their route to pass the Government station of Fashoda! thus proving what Dr. Schweinfurth himself states respecting the connivance of the Egyptian officials, p. 442, vol. ii.—"In Kordofan, where there is a resident Egyptian Governor, the trade is truly enormous, and there is now as well the slave-trade from Darfur." In a cursory review of the slave-trade Dr. Schweinfurth makes a remark that few Englishmen would sanction, p. 433, vol. ii.—"Two great nations have speeded on the work, England in theory, North America in practice." If the payment of twenty millions sterling for emancipation was not the most practical, and not only theoretical, work, we really do not understand what practice means.

It would have been interesting had Dr. Schweinfurth given us more details of the ivory trade carried on by the people who acted as his chaperons in Africa. These were avowedly slave traders, and we should be gratified to learn that they formed some exception to the rule, and actually traded with merchandise instead of bartering slaves and stolen cattle for ivory.

The reward of ignorant ages to the returned traveller was general incredulity. Even in the present day there are ignorant persons who question the existence of cannibalism. Dr. Schweinfurth has arrived fresh from the cannibals of Monbuttoo with human skulls and bones almost warm from the saucepans of the savages. He can even describe the sauces which these gourmands use in their dainty dishes. Mushrooms and capsicums for a "sauce piquante aux champignons" are the literal civilised adjuncts for a dish off a stewed baby, only two days old, whose mother had deserted it! The baby was dying while the preparations for cooking it were already commenced. This is the real truth and no traveller's joke, as the babies and fond mothers would quickly discover should they visit the tribe of Monbuttoo. It may be asked, "How did Dr. Schweinfurth escape?" but it must be remembered that the Monbuttoo do not eat men of science, who are generally very lean. A fat missionary, with a family fresh from Exeter Hall, may meet with immediate attention, with the warm but brief Monbuttoo invitation, "walk in."

It would be useless for us to closely criticise this book. Few books are perfect. There may be a little excess of detail of the dull routine of African daily life that if omitted would have reduced two bulky volumes to a more convenient size. But on the other hand, some people like bulky volumes and enjoy as many pounds avoirdupois as they can obtain for their money; just as some people, especially the rural population, enjoy long sermons.

We cordially recommend all interested in exploration to read the book, at the same time reminding them that they may safely rely upon the high character and status of the author; for although Dr. Schweinfurth fails as a scientific geographer, he in no way fails as a scientific explorer devoted to the particular object of his studies—botany. In this branch of science he is better qualified than any former African traveller.

Such men as Dr. Schweinfurth will always have the regard and esteem of all true friends of Science; he belongs to the same metal that has already formed a wedge which will force open the secrets of inner Africa.

## OUR BOOK SHELF

*Adulterations of Food, with short Processes for their Detection.* By Rowland J. Atcherly, Ph.D., F.C.S. (London: W. Isbister & Co., 56, Ludgate Hill, 1874.)

THE attempt to notice the adulterations of food in 100 pages of large type is a somewhat rash one, and it is not therefore surprising that the author of the treatise is frequently compelled to dismiss his subject in a very cursory manner.

For two of the classes of readers whom he addresses, the dealer and consumer, the work will no doubt be of use, and it is also likely to be useful to the chemist, as affording him a brief conspectus of the most likely adulterants in any particular article. Of what use, however, the last 12 pages of letterpress describing the making and use of volumetric solution are to the "trained chemist," to whom the author addresses them, we are at a loss to conceive.

The information given in the part upon adulterations is generally sound, though the statement on p. 34 that prussic acid is found when nitro-benzol has been used as a flavouring is absurd; so far is this from being the case, that it would be an indication of the use of a genuine but insufficiently purified oil of bitter almonds. The process for detecting alum in bread on p. 15 is also very unsatisfactory, and certainly not adapted for the use of either dealer or consumer. The book concludes with 21 neatly executed cuts of various starches, chicory, cocoa, tea-leaves and adulterating leaves found in tea, &c., as seen under the microscope. In conclusion, we would advise the author in a future edition to considerably expand the part on adulteration and to entirely omit the part intended for the "trained chemist," leaving that person to obtain his information on volumetric solutions from the proper sources. R. J. F.

*An Easy Introduction to Chemistry.* Edited by the Rev. Arthur Rigg, M.A., late Principal of the College, Chester. (Rivingtons: London, Oxford, and Cambridge, 1873.)

THE present work, founded, as the editor states, on a "First Book of Chemistry," by Dr. Worthington Hooker, published in America, is intended for the use of children. Mr. Rigg calls attention to the inquiries of "young persons" as generally suggested by their observations of things touched and handled, and states that his aim has been "To supply information in a form which it is hoped may be intelligible and interesting to all parties concerned in thus learning to read the ever open book of nature."

The intention is a worthy one, and we have no doubt that the work will serve its purpose in instructing some of its readers, though we doubt if it will prove very intelligible for "persons" so young as those to whom the style of its commencement would seem to prescribe its use. We do not say this with any desire to find fault, for it would indeed be difficult to place the information in a simpler form than has been done, but because of the great difficulty of convincing young minds of the alterability of matter. Either talking or reading alone is quite incompetent to do this. Without experimental illustration they are utterly meaningless except to well-advanced intellects, and even there cannot do much, as anyone can tell who has had the honour of meeting the chemist whose knowledge extends not beyond books. In fact, chemistry is not to be taught without the laboratory and its experiments, and Mr. Rigg has shown his sense of their importance by the insertion of 46 beautifully-executed woodcuts of experiments and a frontispiece of a laboratory with its apparatus and fittings.

Excepting in a school, however, the "young persons" of the preface are not likely to meet with the actual experiments of which illustrations are supplied, and those that are of sufficient age to go to such a school might surely have a rather more advanced book placed in their hands. The question, however, which a reviewer ought to ask himself is, Is the book such a one as would fairly carry out the author's intention? and to this we must, in this case, answer "Yes." Granting the possibility of teaching chemistry to young children, Mr. Rigg's book would certainly serve its purpose well. With regard to his facts, Mr. Rigg is, as a rule, sound; but we must demur to his statement on p. 134, that "If (silica) is to these (grasses and grain) and other plants very much what bones are to animals;" and again, on p. 167, "Every stalk of grain or grass is chiefly wood. In both cases fine particles of flint are scattered in the wood to make it firm enough to stand even in a gale of wind." The experiments of Sachs and others have long since disproved this theory. Such blemishes as these are, however, of but little moment when the main principles of the science are the object of teaching, and on these Mr. Rigg is perfectly orthodox. We must, in conclusion, compliment the publishers on the very elegant get-up of the book.

*Die Rohstoffe des Pflanzenreiches: Versuch einer technischen Rohstofflehre des Pflanzenreiches.* Von Dr. Julius Wiesner. (Leipzig: Engelmann, 1873. London: Williams and Norgate.)

THIS is one of those elaborate German works which seem as if they were intended completely to exhaust the subject of which they treat. Every substance of economical or technical importance which is obtained from the vegetable kingdom is treated of in detail from the point of view of its practical utility rather than its physiological history; its chemical, mechanical, and microscopical properties, the mode of its preparation or manufacture, and its utility in the arts or commerce, are described. The book is, in fact, a repertorium of technical botany.

## LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

### On a Proposed Statistical Scale

AT a lecture last Friday evening, at the Royal Institution, I spoke on a subject which happens to lie at the meeting-point of many special sciences, and therefore, as I am desirous of having it well discussed, and from many points of view, it seems to me best to state it afresh in your columns for that purpose. It refers to the *definition* of the estimated *degree of development* of any quality whatever, without reference to external standards of measurement. The scale I propose depends on two processes; the one is securely based on the law of statistical constancy, the other is doubtfully based on the law of frequency of error. (1) At present we are accustomed to deal with averages and the like, which can only be obtained by measuring *every* individual by a *detached standard scale*, and going through an arithmetical process afterwards. Now I want to deal with cases for which no external standard exists, and I propose to proceed in quite another way, on the principle that *intercomparison* suffices to define. We have only to range our group in a long series, beginning with the biggest and ending with the smallest; and then we know by the law of statistical constancy that the individual who occupies the half-way point, or any other fractional position of the entire length, will be of the same size as the individual who occupies a similar position in any other statistical group of similar objects. We state his size with statistical precision by saying that his place is so and so in a series. We appeal to a standard which lies dormant in every group, and which a statistician can evoke, for temporary purposes of comparison, whenever he will. (2) What places in the series shall we select for our graduations? Equal fractions of its length will never do—I mean such as one-tenth, two-tenths, &c. —because of the great inequality of the variation in different parts of the series, being insensible between those whose position is near its middle and great between those at either end. I propose to use a scale founded on the law of Frequency of Error, which gives a scale of equal parts wherever that law applies, and I use the "probable error" for the unit of the scale. Thus, in a row of a hundred individuals the graduations of $+2^\circ$, $+1^\circ$, $0^\circ$, $-1^\circ$, $-2^\circ$, respectively would be at the following places, in percentages of the length of the series:—2, 9, 25, 50, 75, 91, 98. We know that the law of Frequency of Error applies very closely to the linear measurements of the human form. Now suppose that I want to get the average height and "probable error" of a crowd of savages. Measuring them individually is out of the question; but it is not difficult to range them—roughly for the most part, but more carefully near the middle and one of the quarter points of the series. Then I pick out two men, and two only—the one as near the middle as may be, and the other near the quarter point, and I measure them at leisure. The height of the first man is the average of the whole series, and the difference between him and the other man gives the probable error. The question I put is, whether any more convenient subdivision of a series can be suggested for *universal use* than that above mentioned. Its merits are, that it applies very fitly to linear measurements of all natural groups; also to errors of observation, which are akin to many of the moral qualities, for the measurement of which the scale is especially needed. It would not apply to weight, but is less out of relation to it than most persons might think, because weights do *not* vary as the cubes of the heights. Tall men are often thin, and short ones are fat, and the curious fact seems thoroughly verified that the general relation between height and weight is *strictly* as the *squares*. (See Gould's "Sanitary Memoirs of the War of the Rebellion," Cambridge, U.S., 1869, p. 408—410.) If we arrange a series and graduate it according to equal differences of the squares of the heights of the men, we are not so far astray as if we had dealt with the cubes. But I cannot imagine any quality, unless possibly music and memory, to vary so rapidly towards the large end of the series as the latter division would show. To sum up: subdivision in *equal* parts is of no use practically, and is therefore out of the question; the law of error will do very accurately for many large groups of cases; the law of error modified by being brought into relation to bulk will rarely, if ever, be right for other qualities. It therefore seems to me reasonable to adopt the law of error series, as the best compromise, and to accept it as "the common statistical scale." If, for example, I estimate a soldier's energy at $+2^\circ$ (S.S.), I state what everybody who cared to inquire into the subject would construe in exactly the same sense as I used the phrase, and he would also be inclined to believe, until better informed, that the difference between such a man's energy and that of a man of $+0^\circ$ (S.S.) was twice as great as between him and a man of $+1^\circ$ (S.S.).

Lastly, how can we best find individuals who represent the $0^\circ$, $\pm 1^\circ$, &c., of any and every quality, that they may be studied and their abilities illustrated and described, so as to serve as permanent standards of reference? These would gradually give us means of finding the equivalent of the S.S. graduation in the natural scale—as we might learn to say, $+4^\circ$ (S.S.) of energy $= +3^\circ\!\cdot\!5$ in the natural scale. Those who have to deal with bodies of men, whether as examiners, instructors, masters, overseers, or officers, could best tell. How about the ordinary subjects of competitive examination? Is there any optical observation made under (sensibly) identical circumstances and with (sensibly) identical instruments, of which the probable error of each observer is known? If one could only get two or three hundred nautical observers together, and make them take sextant angles of the same objects, and learn the probable errors of each, we should have data to give us once for all the values of the S.S. as regards ability to observe, in terms of absolute values. Can no drawing-master give accurate descriptions of the delicacy of touch of his pupils, corresponding to the graduations of the S.S. scale? How about mechanical manipulation among operatives? How about music and memory? Each separate quality requires and deserves a monograph, which, once thoroughly well done, would become a most valuable standard of comparison and check upon the S.S. scale, which it must be remembered is securely based on no ground except that of statistical constancy, but which, when it *proves* to be a scale of equal parts, is doubly acceptable.

I will not go on writing now, being rather desirous of raising discussion and learning more, than of saying all my say.

42, Rutland Gate, S.W. FRANCIS GALTON

## Simultaneous Meteorological Observations

WITH reference to the scheme of international simultaneous observations proposed by the War Department of the United States and adopted by the Meteorological Congress at Vienna in September last, a provisional arrangement was entered into at Vienna, between General Myer and myself, at his desire, by which the Scottish Meteorological Society was to assist the American Government in carrying out the proposed scheme by an exchange of meteorological observations between the two bodies. At a meeting of the Council of this Society on February 9, a letter was read from General Myer, dated January 27, 1874, formally requesting the co-operation of this Society in carrying out the international scheme, which letter being identical with the one on the same subject published in NATURE (vol. ix. p. 300), it is unnecessary to subjoin.

A considerable number of observers have been already obtained in connection with the scheme, and copies of the American *Monthly Weather Review* and *Daily Meteorological Record* have, along with the special schedules for the observations, been sent to them, as an acknowledgment on the part of the American Government for their assistance in the work. The Council are ready to receive the assistance of others of their own observers, and of any other observers who may be willing to co-operate in this cosmopolitan scheme, from which cosmopolitan benefits may be confidently looked for.

ALEXANDER BUCHAN

Scottish Meteorological Society, Edinburgh, March 2

## The Limits of the Gulf-stream

MUCH discussion has recently taken place respecting the limits of the Gulf-stream, and the Admiralty Chart of the North Atlantic, published last year, is supposed to embody all that is known of its boundaries. My observations, however, which have extended over a series of years, differ so widely from it that I am induced to send you an abstract chart of them.

In December 1872 I found the stream wedged in to a distance of fifteen miles off Cape Hatteras, and following the coast-line at that distance to Roanoke Sound. On arriving in Norfolk I found that the reports of several ships corroborated my observations.

The remarkable bend east of George's Shoals is confirmed by H.M.S. *Gannet*, and also by the Nantucket fishermen and pilots.

Maury, in his "Physical Geography of the Sea," makes the stream, in summer, wash the southern shores of Newfoundland, but in no month of the year have I found it so far north as the red line in the accompanying chart. I am of opinion that if it once passed over the bank every codfish would be destroyed. The highest temperature recorded by me in September on this line is 56°.

At the points of sudden change I have seen the ripples at the distance of a mile previous to entering them. Those which are recorded may be relied on to a mile, as I have discarded those made from dead reckoning. In every case the deep blue colour of the sea, the presence of sun-fish, Portuguese men-of-war, and numerous *débris*, confirmed the observations made with the thermometer, and I may add, what is of more importance to seamen, the strong easterly set.

The southern boundary of the stream is taken from the observations of five years. As summer advances it becomes more difficult, when east of Bermuda, to detect the line of demarcation, for the rays of the sun heat the water almost to Gulf-stream temperature right down to the limit of the trade-wind. From the data which I have been able to collect, as well as from personal observation, the limits of icebergs in the Admiralty Chart appear to be equally erroneous. To me it appears impossible that bergs could drift square across the heated waters of the Gulf-stream to lat. 39° N. almost in the teeth of the prevailing summer winds, and a strong north-easterly set of two miles per hour. The Admiralty Chart gives the current a higher velocity.

The most southern iceberg ever seen by a Cunard steamer (and there cannot be a higher authority) was in lat. 43° 10′ N., long. 49° 40′ W., and the most eastern, which has come under my observation, by the *Grace Gibson*, on June 11, 1868, which ship passed four between lat. 43° 15′ N. and 43° 20′ N. and long. 41° 20′

W. to 42° 10′ W. It certainly must appear singular to geographers that the limits of the best-known stream in the world should be so ill-defined; but the temperature of the sea at the places marked in the chart cannot suddenly change 12° from any other cause than the irruption of the Gulf-stream or the ordinary waters of the ocean. Had it occurred in a single season only, the correctness of the observations might have been impugned; but extending, as they do, over several years, their accuracy cannot be challenged.

It is the opinion of many that the Gulf-stream is extending its boundaries northward, and ameliorating the climate of the British islands. Such an assumption is not an impossibility, although there are no changes of volume or velocity at its outlet into the Atlantic. There are, however, grounds for believing that the Labrador current does not run with its former force, as icebergs are seldom seen south of the parallel of 43° 30′ north latitude. Observation can alone confirm this theory, but whether correct or not it in nowise affects the accuracy of my data.

WM. W. KIDDLE

U.S. White Star Mail Steamship *Oceanic*, Feb. 2

[We have received a chart from Mr. Kiddle; but it is too large for insertion in NATURE.]

### A Lecture Experiment

MR. TAIT's letter in NATURE of February 26 calls to mind an effective lecture illustration I have used in my classes to illustrate a fog or cloud produced by cooling air containing moisture. Instead of using an air-pump as described in "Heat, a mode of Motion," take a flask of one or two litres capacity, rinse it out with distilled water, and attach to the neck a cork and glass tube of about twenty or thirty centimetres in length. Place the glass tube in the mouth and exhaust, when a dense cloud will be formed; then on blowing into the flask the cloud disappears. The cloud may be produced and dissolved as often as wished, and if a beam from the oxy-hydrogen light be sent through the flask, the experiment becomes very effective.

Midland Institute, Birmingham C. J. WOODWARD

### The "Treasury of Botany"

IT might be inferred from your notice of the new edition of the "Treasury of Botany" (NATURE, vol. ix. p. 300) that the stereotyped pages of the original text of that work—of which you are pleased to speak in terms of commendation—had been reprinted without alteration. Will you allow me space to state that this is by no means the case (as indeed is stated in the preface), but that a large number of corrections have been made, as may be detected by a keen eye in consequence of the slight difference which is observable in the type where the alteration has extended over two or three lines or more. Hence it is not to the Supplement alone that the reader must look for such of the "additions to botanical knowledge made during the last eight years" as it has been found practicable to include in the revised edition.

THOS. MOORE

[WE are glad of the opportunity afforded by the foregoing letter of repeating our opinion, already expressed, that in the department of botanical nomenclature and classification, the new edition of the "Treasury of Botany" is an altogether admirable and indispensable work. It is in this department only, or almost exclusively, that the corrections alluded to by Mr. Moore—and to which we perhaps ought to have called special attention—have been made, at least as far as we have been able to detect. We regret that we cannot withdraw from our statement that the same care has not been taken with the histological and physiological section. We might quote a number of instances in support of this assertion—a very ungracious task in speaking of a work so excellent in other respects—but will only refer to a single one. Notwithstanding that a very good and useful epitome of the more important properties of "Cellulose" is given in the Supplement, the statement is allowed to stand in the article in the body of the work, that "its composition, according to the latest analysis, is $C_{24}H_{20}O_{10}$" a formula which does not, and never did, even under the old notation, represent anything near its composition.
—A. W. B.]

### The Moons of Uranus

IN your "Notes," this week, it is stated that since Mr. Lassell's observations at Malta, no one has seen the four moons of Uranus, until the re-discovery of the two small ones lately with the new Washington telescope.

In 1869-70, the planet was observed with the Melbourne reflector; the observations were specially directed to the disc, but at the same time the positions of the four satellites were noted on successive nights and thus identified.

I speak from memory, but have no doubt that the observations are to be found in the Melbourne records. The statement "have actually been measured by Prof. Newcomb," probably refers to position, angle, and distance.

March 1 L. S.

## MEN OF SCIENCE, THEIR NATURE AND THEIR NURTURE*

THE lecturer spoke of the qualities by which the English men of science of the present day were characterised; he showed the possibility of defining and measuring the amount of any of those qualities, and concluded by summarising the opinions of the scientific men on the merits and demerits of their own education, and gave his interpretation of what, according to their own showing, they would have preferred. His data were obtained from a large collection of autobiographical notes, most obligingly communicated to him, in response to his requests, from the larger part of the leading members of the scientific world. He had addressed 180, who, being Fellows of the Royal Society, had, in addition, gained medals or filled posts of recognised scientific position; 115 answers had already been received, of which 80 or 90 were full and minute replies to his long and varied series of questions. He dealt with only a small part of his deductions from this valuable material, referring to a forthcoming work for the rest.

Regarding the chief qualities in the order of their prevalence among the scientific men, they were—(1) Energy both of body and mind; (2) Good health; (3) Great independence of character; (4) Tenacity of purpose; (5) Practical business habits; and (6) What was usually the salt of the whole, strong innate tastes for science generally or some branch of it. He illustrated his remarks by reading many anonymous extracts from the returns, and explained in what way a notable deficiency in any of the above-mentioned qualities would tend to disqualify a man from succeeding in science.

As to the measurement of qualities, it was argued that the law of constancy in vital statistics might be taken for granted, being evidenced by the experience of insurance offices against fire, death, shipwreck, and other contingencies, always with the proviso that the facts are gathered with discretion, on well-known general principles. Hence we may say with assurance, that although two common nuts may differ, yet the contents of different packets, each containing 1,000 nuts, will be scarcely distinguishable, for the same number of nuts of different sizes will be found in each. Let the contents of the several packets be each arranged in a long row, in order of size, beginning with the biggest nut and ending with the smallest, and place the rows rank behind rank; then by the law of statistical constancy the nuts in the same *files* will in all cases be closely alike (except the outside ones, where more irregularity prevails). Again, if we incorporate two rows into one of double length, still preserving the arrangement as to regular gradation in size, the centre nuts of the two original series will still be found at or near the centre of the compound series, the nuts in quarter positions will still be in quarter positions, and so on. Hence, whatever be the length of the series the *relative* position in it of the nut will be a *strict criterion* of its size. This is of course equally true of all groups of qualities or characters

* Lecture on Friday evening, Feb. 27, at the Royal Institution, by Franci Galton, F.R.S.

whatever, in which the law of statistical constancy prevails, the series, in each case, being arranged according to gradations of the quality in question. Each individual is measured against his neighbour, and it is quite unnecessary to have recourse to any external standard. As regards a scale of equal parts, the lecturer made use of a converse application of the law of "frequency of error," which he illustrated by many experiments, and which showed that in a row (say as before) of nuts, if we took those which occupied the three quarterly divisions (1st quarter, centre, 3rd quarter) as the three elementary graduations of size, a range of successive graduations would be obtained by the following series, in which the places of the nuts are supposed to be reckoned from the end of the row where the large nuts are situated, and to be given in per-thousandths of the entire length of the row. It might be called the "Common Statistical Scale" (S. S.). The place of $+ 4^\circ$ would be at 4 thousandths from large end; $+ 3^\circ$, at 21 thousandths; $+ 2^\circ$ at 89; $+ 1$, at 250; $0^\circ$ at 500; $- 1^\circ$ at 750; $- 2^\circ$ at 911; $- 3^\circ$ at 979; and $- 4^\circ$ at 996, or 4 thousandths from the small end of the row. Thus if we say that the size of a nut is $+ 2^\circ$ S. S., we absolutely define it. Anybody can procure such a nut independently by getting a quart of nuts and arranging them. Also we know that the difference between a nut of $+ 4^\circ$ S. S. and $+ 1^\circ$ S.S. is $3^\circ$, and therefore three times as great as between one of $+ 2^\circ$ S. S. and the latter. It cannot be affirmed that this is a precise scale of equal parts for all qualities, but it is found to hold surprisingly well in a great variety of vital statistics; perhaps, too, the mere thickness of tissues may be a chief element in the physical basis of life. This scale appears, at all events, more likely to be nearly approximative to one of equal parts, for qualities generally, than any other that can be specified, and it certainly affords definite standards subject to the law of statistical constancy. The habit should therefore be encouraged in biographies, of giving copious illustrations which tend to rank a man among his contemporaries, in respect to every quality that is discussed, in order to give data for appraising those qualities in terms of the Statistical Scale. By the general use of a system of measurement like the above, social and political science would be greatly raised in precision.

Regarding education, the lecturer disavowed speaking of what might be suitable for boys generally, but he summarised the replies of the scientific men with reference to their own special experience, and notwithstanding the diversity of branches of science, he found unanimity in their replies. They commonly expressed a hatred of grammar and classics, the old-fashioned system of education being utterly distasteful to them. The following seems the programme they themselves would have most liked:— 1. Mathematics, rigorously taught up to their capacity, and copiously illustrated and applied, so as to throw as much interest into its pursuit as possible. 2. Logic. 3. Some branch of science (observation, theory, and experiment), some boys taking one branch and some another, to insure variety of interests under the same roof. 4. Accurate drawing of objects connected with that branch of science. 5. Mechanical handiwork. All these to be rigorously taught. The following not to be taught rigorously: reading good books (not trashy ones) in literature, history, and art. A moderate knowledge of the more useful languages taught in the easiest way, probably by going abroad in vacations. It is abundantly evident that the leading men of science have not been made by much or regular teaching. They craved for variety. Those who had it, praised it; and those who had it not, concurred in regretting it. There were none who had the old-fashioned high-and-dry education who were satisfied with it. Those who came from the greater schools usually did nothing there, and have abused the system heartily.

## *INFLUENCE OF GEOLOGICAL CHANGES ON THE EARTH'S ROTATION*

At the annual meeting of the Geological Society of Glasgow, on Feb. 12, the president, Sir William Thomson, F.R.S., gave an address on the above subject, of which the following is an abstract:—

He first briefly considered the rotation of rigid bodies in general, defining a principal axis of rotation as one for which the centrifugal forces balance while the body rotates around it. He then took the case of the earth; and, having pointed out the position of its present axis, showed that if from any cause it were made to revolve round any other, that would be an "instantaneous axis," changing every instant, and travelling through the solid, from west to east, in a period of 296 days round the principal axis It would shift continually in the figure, owing to the varying centrifugal force of two opposite portions of the body. This would produce, by centrifugal force, a tide of peculiar distribution over the ocean, having 296 days for period. An inclination of the axis of instantaneous rotation to principal axis of $1''$, or 100 ft. at the earth's surface, would produce rise and fall of water in $45^\circ$ latitude, where the effect is greatest, amounting to ·17 of a foot above and below mean level.

He noticed, in passing, the application of these dynamical principles to the attraction which the sun and moon exercise on the protuberant parts of the earth, tending to bring the plane of the earth's equator into coincidence with the ecliptic. This causes an incessant change, to a certain limited extent, in the position of the axis of rotation, thereby occasioning what is known as the "precession of the equinoxes." Having illustrated these remarks by some interesting experiments, Sir William Thomson proceeded to consider more particularly the circumstances according to which the axis of the earth might become changed through geological influences, and the consequences of any such change. The possibility of such a change had been adduced to account for the great differences in climate which can be shown to have obtained at different periods in the same portion of the earth's surface. In the British Isles, for example, and in many other countries, there is clear evidence that at a comparatively recent period a very cold climate—much colder than at present—prevailed; while in the same places the remains of plants and animals belonging to several preceding eras indicate a high temperature and a comparatively tropical climate. The question arose, can changes in the earth's axis account for these changes of climate? In the present condition of the earth, any change in the axis of rotation could not be permanent, because the instantaneous axis would travel round the principal axis of the solid in a period of 296 days, as already stated. Maxwell had pointed out that this shifting of the instantaneous axis in the solid would constitute in its period a periodic variation everywhere of "latitude," ranging above and below the mean value, to an extent equal to the angular deviation of the instantaneous axis of rotation from the principal axis; and, by comparing observations of the altitude of the Pole-star during three years at Greenwich, had concluded that there may possibly be as much as $\frac{1}{2}''$ of such deviation, but not more.

In very early geologic ages, if we suppose the earth to have been plastic, the yielding of the surface might have made the new axis a principal axis. But certain it is that the earth at present is so rigid that no such change is possible. The precession of the equinoxes shows that the earth at present moves as a rigid body; and during the whole period of geologic history, or while it has been inhabited by plants and animals, it has been practically rigid. Changes of climate, then, have not been produced by changes of the axis of the earth. The learned professor then inquired what influences great subsidences or great elevations in different parts of the earth might have on the axis of rotation. No doubt the removal of a large quantity of solid matter from one part of the globe to another would sensibly alter the principal axis, as well as the axis of rotation, which so nearly coincides with it; but it could be shown that it would produce in the latter only about 1-300th part of the change produced in the former. We know too little of the changes in the interior of the earth accompanying such changes on its surface to be able to state results with certainty. But he estimated that an elevation, for example, of 600 feet on a tract of the earth's surface 1,000 miles square and 10 miles in thickness, would only alter the position of the principal axis by *one-third of a second*, or 34 feet. He called attention to the effect of tidal friction and subterranean viscosity in reducing any such deviation, and pointed out that it must be exceedingly slow; using for evidence the observationally proved slowness of the diminution of the earth's rotational velocity, and of the inclination of its equator to the ecliptic. It therefore seemed probable that geological changes had not produced any perceptible change in the principal axis or in the axis of rotation within the period of geological history.

## *OBSERVATIONS OF MAXIMUM AND MINIMUM SEA-TEMPERATURES BY CONTINUOUS IMMERSION*

WHEN the Scotch Meteorological Society was instituted, now nearly twenty years ago, observations on sea-temperature were set on foot at the suggestion of the late Prof. Fleming, and have since been continued. These observations were made by the immersion of thermometers with small cisterns attached, and were taken at the surface and at a depth of 6 feet. Besides these, special observations were made for me on the temperature of the flood and ebb tide at depths extending to 50 feet in the Pentland Frith,* and hourly observations continued at intervals during four years ending in 1863 by Capt. Thomas, R.N., at depths extending to 60 feet.† Such occasional observations seemed to me to be insufficient to show properly the changes in temperature to which the sea is subject, and in August 1872 I suggested to my friend, Prof. Wyville Thomson, the propriety of ascertaining, on his exploring voyage, maximum and minimum temperatures by means of thermometers constantly immersed in the sea. For this purpose a thin malleable iron plate of an oval shape, as shown in Fig. 1, is fixed to the outside skin of the ship so as to form a small cell into which the sea-water finds ready ingress through numerous perforations. This cell, which need not project more than two inches, so as not to cause any appreciable obstruction to the speed of the vessel, should extend so far under the smooth water level as to prevent its lower end from rising above the trough of the sea, or an upright pipe might be placed within the vessel. In sailing ships there might be a cell on each side so as to secure constant immersion while the ship "is on a wind." In this cell a frame carrying a maximum and minimum thermometer slides in checks so as to be capable of being raised above water to the level of the cabin or the deck, where there should be a porthole to admit of the instruments being read and the indices being readjusted.

An arrangement similar in principle to that described was made in the *Challenger* exploring vessel before she left on her voyage.

In this way, during the whole of an over-sea voyage, regular observations of maxima and minima may be obtained as often as may be desired. This arrangement is peculiarly suitable to floating lights, and the Scotch Meteorological Society have been in correspondence with the Mersey Board in order to establish observations at the North-West Lightship.

The Marquis of Tweeddale in 1872 proposed that the Scotch Meteorological Society should enter upon the investigation of the migrations of fishes, and particularly those of the herring, in connection with sea-temperatures and weather generally, and his Lordship informed me that in his opinion it was likely that the herrings followed belts of water of a higher temperature than that of the sea generally.

In carrying out his Lordship's suggestion the Society has been favoured through the courtesy of the Fishery Board with returns of the daily catch of herrings and of the weather from the different fishing districts of Scotland for the last two years; and already two elaborate reports on the subject have been drawn up by Mr. Buchan, the Secretary, and published, which give good ground to hope that some positive results of considerable importance will be obtained.

Fig. 1.

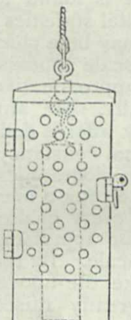


Fig. 3.

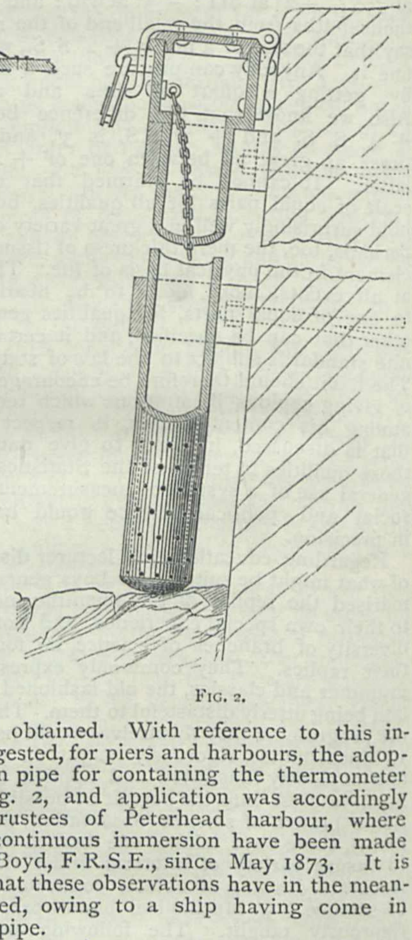


Fig. 2.

With reference to this investigation, I suggested, for piers and harbours, the adoption of a cast-iron pipe for containing the thermometer as shown in Fig. 2, and application was accordingly made to the Trustees of Peterhead harbour, where observations by continuous immersion have been made by Mr. William Boyd, F.R.S.E., since May 1873. It is to be regretted that these observations have in the meantime been stopped, owing to a ship having come in contact with the pipe.

In addition to observations near the surface at floating lights, it would be extremely desirable to have thermometers immersed at greater depths, and for this purpose a copper vessel weighted below should be used, as represented in Fig. 3, with perforations in the upper part and a cistern about 4 in. deep in the lower part. The Scotch Meteorological Society, at its meeting on February 9 last, authorized an application to the different lighthouse authorities for sanctioning these deep-water observations as well as those of the surface and of the air.

THOMAS STEVENSON.

* "Edin. Phil. Jour." Nov. 25, 1857.
† "Jour. Scot. Met. Soc." vol. i., p. 256.

## OZONE*

### I.

TOWARDS the end of the last century, Van Marum, while experimenting with his powerful electrical machine, observed that oxygen gas through which electrical sparks had been passed acquired a peculiar odour and the property of attacking mercury. This subject attracted no further attention for upwards of half a century after the publication of Van Marum's observations.

The discovery of ozone was announced by Schönbein in a memoir which he presented in 1840 to the Academy of Munich. In this important communication he states that in the electrolysis of water, an odorous substance accompanies the oxygen evolved at the positive pole, that this substance may be preserved for a long time in well-closed vessels, and that its production is influenced by the nature of the metal which serves as the pole, by the chemical properties of the electrolytic fluid, and by the temperature of that fluid, as well as of the electrode. The same body he found to be produced by holding a strip of platinum or gold near the knob of the prime conductor of an electrical machine in good order. With great sagacity he recognised the identity of the peculiar odour which accompanies a flash of lightning with that of the new substance. In this memoir Schönbein supposes the odorous body, for which, in a note at

FIG. 2.

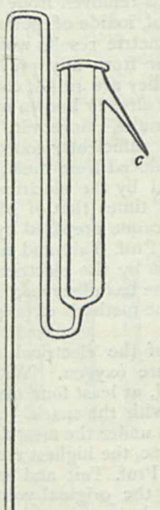
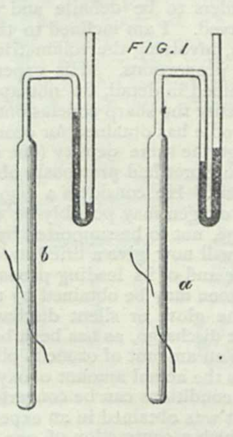



FIG. 1




the end, he proposes the name of ozone, to be a new electronegative element belonging to the same class as chlorine and bromine; but in a paper published a little later he hints that ozone may be one of the constituents of nitrogen.

Schönbein soon afterwards discovered that ozone is formed when phosphorus oxidises slowly in moist air or oxygen.

In the following year, he returned to the consideration of the subject, and partly from his own observations, partly from experiments communicated to him by De la Rive and Marignac, he abandoned his former view of the nature of ozone, and concluded that it is an oxide of hydrogen different from the peroxide of hydrogen of Thénard.

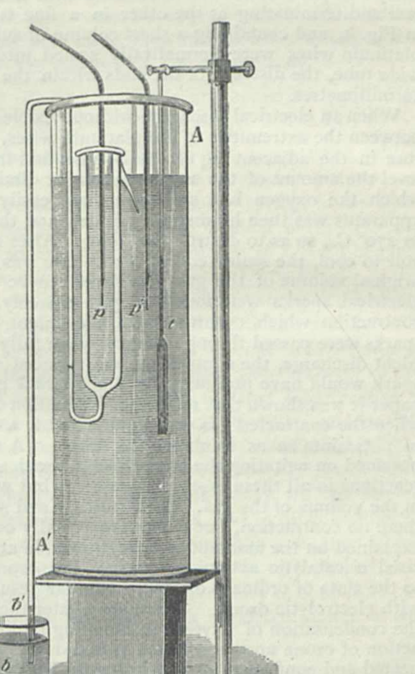
Many of the properties of ozone described by Schönbein were soon afterwards verified by Marignac, who found, as Schönbein had already stated, that it is only in the presence of moisture that air or oxygen when passed over phosphorus produces ozone, and that no ozone can be formed from air, even if moist, which has been deprived of its oxygen. He also confirmed the observations of Schönbein that the peculiar properties of ozone disappear when it is heated to a temperature between 300° C. and 400° C., and that it is not absorbed by water or sulphuric acid.

* An Address delivered before the Royal Society of Edinburgh on December 22, 1873, by Dr. Andrews, LL.D., F.R.S., Honorary Fellow of the Royal Society of Edinburgh.

In a subsequent investigation (1845) which Marignac conducted with De la Rive, the important fact was established that ozone is formed by the passage of electrical sparks through pure and dry oxygen gas. Frémy and Becquerel also showed that pure oxygen contained in a tube inverted over a solution of iodide of potassium is entirely absorbed by that liquid, if electrical sparks are passed for a sufficiently long time through the gas.

The last hypothesis of Schönbein, according to which ozone is an oxide of hydrogen, was manifestly inconsistent with the production of that body by the passage of electrical sparks through pure and dry oxygen. On the other hand, it received support from some experimental inquiries which appeared about this time, and particularly from an elaborate investigation which was conducted by Baumert in the laboratory of the University of Heidelberg, and published in *Poggendorff's Annalen* for 1853. Baumert maintained that water is always formed when dry ozone, prepared by electrolysis, is destroyed or decomposed by heat, and further endeavoured to establish its composition by determining the increase of weight of a solution of iodide of potassium when it is decomposed by ozone. He inferred, as the result of his researches, that two distinct bodies had been confounded

FIG. 3




under the name of ozone; (1) allotropic oxygen, formed by the passage of the electrical spark through oxygen; and (2) a teroxide of hydrogen, produced in the electrolysis of water. The experiments and conclusions of Baumert attracted a great deal of attention at the time they were published, and received very general assent.

Having repeated, soon after it was announced, the experiment of Baumert, in which ozone prepared by electrolysis was destroyed by heat, and having failed to obtain the slightest trace of water in numerous trials, I deemed it important to undertake a careful investigation of the subject, the results of which were communicated in 1853 to the Royal Society of London. By employing an acidulated solution of iodide of potassium, I found that its increase of weight, when decomposed by ozone, exactly agreed with the weight of the ozone calculated as allotropic oxygen from the iodine set free. The numbers deduced from five careful experiments were 0·1179 grammes for the increase in weight of the solution, and 0·1178 grammes for the calculated weight of the oxygen. As regards the supposed formation of water in the destruction of ozone by heat, it may be sufficient to mention the results of two experiments performed with great care, in one of which 6·8 litres of electrolytic oxygen containing

27 milligrammes of ozone, and in the other 9·6 litres of the same gas containing 38 milligrammes of ozone, were exposed to the action of heat, so as to destroy all ozone reactions, when not a trace of water was obtained; the increase in weight of the desiccating apparatus being in the first case only one-third, and in the second one-half, of a milligramme. If Baumert's experiments had been correct, 24 milligrammes of water should have been formed in these experiments. The general conclusions at which I arrived were: "that no *gaseous* compound, having the composition of a peroxide of hydrogen, is formed during the electrolysis of water, and that *ozone from whatever source derived is one and the same body, having identical properties and the same constitution, and is not a compound body, but oxygen in an altered or allotropic condition.*" ("Phil. Transactions" for 1856, p. 13.)

The next step in the investigation of this singular body was the discovery that oxygen gas in changing into ozone diminishes in volume, or becomes condensed, recovering its original volume when the ozone is changed back into oxygen by the action of heat or otherwise. This relation between ordinary oxygen and ozone was first announced in 1860 by Prof. Tait and myself in a communication to the Royal Society of London. Oxygen gas in a dry and pure state was introduced into a tube sealed at one end and terminating at the other in a fine tube bent as shown in Fig. 1, and containing a short column of sulphuric acid. Two platinum wires were hermetically sealed into the sides of the wide tube, the distance of the ends within the tube being about 20 millimetres.

When an electrical discharge without visible sparks was passed between the extremities of the platinum wires, the sulphuric acid rose in the adjacent leg of the U-tube, and from the change of level the amount of the condensation, or diminution of volume, which the oxygen had undergone was easily calculated. The apparatus was then hermetically sealed and the reservoir heated to 270° C., so as to destroy the ozone. After allowing the reservoir to cool, the sealed end of the U-tube was opened, when the original volume of the gas was found to be restored. Strong electrical sparks were found to give scarcely one-fourth of the contraction which occurred with the silent discharge, and if sparks were passed through the gas when fully contracted by the silent discharge, the contraction was reduced to that which the spark would have produced in the original gas. In the same paper it was shown that no further diminution of volume occurred when the contracted gas was agitated with a solution of iodide of potassium so as to absorb the ozone. A similar result was obtained on agitating the contracted gas with iodine. The ozone reactions in all these cases disappeared, but without any change in the volume of the gas. With mercury and silver, not only was there no contraction, but expansion actually occurred, which was explained on the assumption that the oxide at first formed exercised a catalytic action on part of the ozone and restored it to the state of ordinary oxygen. Similar results were obtained with electrolytic ozone. Three years later these experiments on the condensation of oxygen in changing into ozone, and on the action of ozone upon a solution of iodide of potassium were repeated and confirmed by Von Babo and by Von Babo and Claus.

We did not attempt to give any absolute explanation of these singular facts; but discussed them under different aspects. We showed that on the allotropic view of the constitution of ozone its density must be enormously great; unless it was assumed that "when ozone comes into contact with such substances as iodine, or a solution of iodide of potassium, one portion of it, retaining the gaseous form, is changed back into common oxygen, while the remainder enters into combination, and that these are so related to one another that the expansion due to the former is exactly equal to the contraction arising from the latter." On this assumption, which however we did not consider probable, we remarked that "our experiments may be reconciled with the allotropic view, and an ordinary density, but still one greater than that of oxygen." A similar explanation of our experiments but connected with a peculiar view of the molecular constitution of oxygen was proposed in 1861 by Dr. Odling. "If we consider," he remarks, "ozone to be a compound of oxygen with oxygen and the contraction to be consequent upon their combination, then if one portion of this combined or concentrated oxygen were absorbed by the reagent, the other portion would be set free, and by its liberation might expand to the volume of the whole; thus, if we suppose three volumes of oxygen to be condensed by their mutual combination into two volumes, then on absorbing one-third of this combined oxygen by mercury, the remaining two-thirds would be set free and consequently expand to their normal bulk, or two volumes—

$$\overset{-}{O}\,\overset{+}{O}\,\overset{-}{O} + \overset{+}{Hg^2} = \overset{+}{Hg^2}\overset{-}{O} + \overset{+}{O}\,\overset{-}{O}."$$

Soret, experimenting in 1866 upon the mixture of oxygen and ozone obtained by electrolysis, made the important discovery, that if this mixture is brought into contact with oil of turpentine, or oil of cinnamon, a diminution of volume takes place, equal in amount to twice the augmentation of volume which the same mixture would sustain if the ozone were converted by heat into ordinary oxygen. In other words the volume of ozone, measured by its absorption by the essential oil, is twice as great as the difference between the volume of the same ozone and oxygen. Hence Soret concluded that the density of ozone is one and a half times that of oxygen gas.

The latest investigations on this subject are due to Meissner and Brodie. The former has fully confirmed my early experiments, according to which the increase in weight of an acid solution of iodide of potassium, when electrolytic ozone is passed through it, corresponds exactly to the weight of oxygen absorbed, as calculated from the liberated iodine. Meissner has also found, as I had long before stated, that when a neutral solution of iodide of potassium is employed, the results are variable and untrustworthy.

Brodie has examined the action of ozone on a variety of liquids, and has confirmed the results of Prof. Tait and myself that no diminution of volume occurs when ozone is removed from a mixture of ozone and oxygen by a solution of iodide of potassium. With other liquids he has obtained volumetric results which he considers to be definite and which differ from any previously observed. I am inclined to think that they are rather complex cases, involving the volumetrical changes already known in variable proportions. His experimental results, moreover, when examined in detail, do not appear to be sufficiently concordant to justify the sharp conclusions he has deduced from them.

Brodie has obtained for ozone prepared by the electrical discharge the same density (one and a half times that of oxygen) which Soret had previously obtained for ozone prepared by electrolysis. He considers a suggestion of Prof. Tait and myself, that oxygen may possibly be decomposed by the electrical discharge, not to be supported by the facts he has observed.

I will now give a brief statement of the methods of preparing ozone and of its leading properties.

Ozone may be obtained by the action of the electrical spark, or the glow or silent discharge on pure oxygen. With the silent discharge, as has been before stated, at least four times as large an amount of ozone is obtained as with the spark. As regards the actual amount of oxygen which, under the most favourable conditions can be converted into ozone, the highest recorded result was obtained in an experiment by Prof. Tait and myself, in which a contraction of one-twelfth of the original volume of the oxygen, or 8·3 per cent., occurred; but we were unable in other trials to produce again so great a diminution of volume. The greatest contraction attained in the experiments of Von Babo and Claus amounted to 5·74, and in those of Brodie to 6·52 per cent. The doubt which existed as to the accuracy of our solitary experiment I have lately been able to remove, and by a slight modification in the form of the apparatus I have succeeded in obtaining greater contractions than any hitherto recorded. In one of the first trials the diminution of volume amounted to more than 10 per cent., and there can be little doubt that with care even greater contractions than this may be attained.

As the method referred to enables the contraction of oxygen in changing into ozone to be exhibited as a class experiment, I will describe it in some detail. The excellent induction tube of Siemens, in which the electrical discharge from an induction coil acts upon air or oxygen, as it flows between two thin tubes of glass, whose surfaces are at a distance of a few millimetres from one another, has hitherto been employed to obtain a continuous stream of ozone in a more or less concentrated state. But this apparatus can easily be modified so as to show the contraction which takes place when oxygen is converted into ozone. Fig. 2 exhibits the modification I have given for this purpose to the ordinary form of Siemens' tube. At *c* it terminates in a capillary tube, the end of which is hermetically sealed, after a stream of pure and dry oxygen gas has been passed through the apparatus for a sufficient time to displace the air. In exact experiments the other end (*b*) is at the same time sealed and afterwards opened under sulphuric acid. For class purposes it will be found sufficient to immerse it quickly under the acid, contained in the beaker (*a*), as shown in Fig. 3, where the induction-tube is seen immersed to within 12 millimetres of its upper surface in water contained in an *insulated* cylindrical vessel (A A'). The inner cavity of the induction-tube is also filled with water to about the same level. By means of wires covered with caoutchouc, except at the lower ends (*pp'*), the discharge from an induction-coil, capable of giving 10 millimetre sparks in air, can be passed through the apparatus. The water in A A' is maintained as steadily as possible at the temperature of the apartment, and any slight changes in the course of the experiment are noted by means of a delicate thermometer (*t*). The variations of the barometer are also carefully observed. In very exact experiments the surfaces of the induction-tube should be covered with tinfoil, and the cylindrical vessel filled with ice. Before commencing the observation, it will be found convenient, if the temperature has not already effected the adjustment, to expel a little oxygen from the induction-tube, so that the level of the acid may stand somewhere about *b'*. On passing the electrical discharge, the acid will at first be depressed a few millimetres, from the repulsive action of the particles of the electrified gas, but will afterwards steadily rise, and for some time with such rapidity that the ascent of the acid column can be easily followed by the eye. When the current is interrupted, a sudden rise of the acid column will occur equal to the depression which took place on first making connection with the induction coil, after which the new level of the acid may be read.

Another method of obtaining ozone is by the electrolysis of water and of certain acid and saline solutions. The most convenient liquid for this purpose is a mixture of one part of sulphuric acid with six or eight parts of water, and the lower the temperature at which the electrolyte is maintained during the process the greater is the amount of ozone. The simplest and most efficacious arrangement for obtaining ozone by this method is one I have used for many years and exhibited in my lectures. It consists

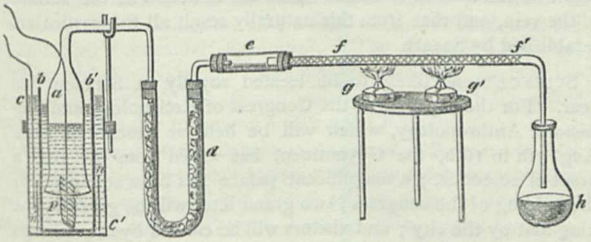



FIG. .

of a bell-jar (Fig. 4, *a*), or glass cylindrical vessel, open below, and contracted to a neck above, which is suspended in a round cell (*b b'*) of porous earthenware, leaving a clear space of two inches between its lower edge and the bottom of the porous cell. The whole is placed in a glass jar (*c c'*) of somewhat larger dimensions than the cell; a bundle of platinum wires (*p*) suspended below the bell-jar serves as the positive pole, and a broad ribbon of platinum (*n n'*) placed between the outer glass jar and the porous cell as the negative pole of a voltaic arrangement of three or four couples. A delivery tube hermetically united to the neck of the bell-jar conveys the mixture of oxygen and ozone disengaged at the positive pole to a sulphuric acid drying tube (*d*). From the desiccating tube the gas passes through the connecting tube (*e*) and thence to other tubes, for the purpose of illustrating the properties of ozone. Thus, in the figure, it is represented as traversing a tube of hard glass (*ff'*) covered with fine wire gauze, and terminating near the surface of mercury contained in the flask (*h*). So long as the gas is heated strongly as it passes through the tubes (*ff'*) by the spirit lamps (*gg'*), not the slightest change is produced upon the mercury; but when the lamps are removed, and the tube allowed to cool, the mercury is rapidly attacked. I ought, perhaps, to mention that all the junctions are made with dry and tightly fitting corks, care being taken that the ends of the connecting tubes project a little beyond the corks. With these precautions the loss of ozone, from its action on the corks, is altogether insignificant.

Ozone can also be obtained by the slow oxidation of phosphorus, and of certain ethers and essential oils in presence of moisture.

(*To be continued.*)

## *NOTES*

ONE of the last and one of the best acts of the late Government was to grant a pension of 150*l.* a year on the Civil List to Prof. Sharpey. Dr. Sharpey has done as much as any living teacher for the advancement of physiological knowledge, while his personal worth has secured for him universal respect and esteem.

AT the last monthly meeting of the Russian Imperial Geographical Society M. Venioukoff, the secretary, before proceeding with the business of the evening, said the Society owed a duty which must first be fulfilled, and that was to render homage to the memory of Dr. Livingstone, the importance of whose discoveries and the perseverance of whose labours had placed him in the rank of the most remarkable travellers of all times and of all nations. His biography belonged to the annals of geographical science. M. Venioukoff then read a memoir of Livingstone, which concluded as follows:—"Let England, which may be proud of having given birth to Livingstone, and of having supported him in his labours, learn that among us the merit of her great men can be appreciated." The whole assembly, which was very large, then rose in order to pay a last tribute of respect to the memory of Dr. Livingstone.

THE University of St. Andrew's has conferred upon Mr. J. Gwyn Jeffreys, F.R.S., the honorary degree of LL.D.

WE would draw special attention to the programme, which has just been issued, of a new course of twelve lectures on Zoology, to be delivered during the ensuing spring, in the Zoological Gardens, Regent's Park; the Council of the Society having determined to appropriate the interest of a small bequest which they hold for scientific purposes—the Davis Fund—to the subject. Mr. P. L. Sclater, F.R.S., the Secretary to the Society, will deliver the Introductory Address on April 14; and he will follow it by four lectures *On the Geographical Distribution of Mammals.* After these Mr. A. H. Garrod, the Prosector to the Society, will give five lectures *On the General Classification of the Vertebrata;* and Dr. Carpenter, F.R.S., will conclude the course by giving two *On the Aquarium and its Inhabitants.* The lectures will be delivered on the Tuesdays and Fridays in April and May, at 5 o'clock in the afternoon; they will be free to Fellows of the Society and their friends, and to other visitors to the Gardens. The subjects will be treated in a manner which will make them of general interest, and it is to be hoped that ladies will avail themselves of the opportunity thus afforded, of obtaining information on this too much neglected branch of the great science of Biology.

MR. PHILIP BARNES, who died on Feb. 24, at the age of 82, was one of the oldest Fellows of the Linnean Society. He was a native of Norwich, and a cousin of the Sowerbys. Thirty-four years ago he founded the Royal Botanic Gardens in the Regent's Park, and was the oldest Fellow and father of the Society. A portrait of Mr. Barnes was in the last International Exhibition, and a bust in that of the year before. He was father of Robert Barnes, M.D., and of the late Philip Edward Barnes, the former known in the scientific world by his professional discoveries and writings, and the latter the author of a work on the Belgian Constitution.

THE death, from heart-disease, of Prof. J. F. Holton is announced as having taken place in Everett, Massachusetts, U.S., on the 25th of January. Prof. Holton was well known as a botanist, having devoted many years to the study of the science. He visited South America with special reference to prosecuting his researches in this direction, and studying the relation between the physical geography and the vegetation of the Andes. His somewhat extended sojourn in that country enabled him to collect materials for a work, which was published after his return by Harper and Brothers, and is frequently quoted by botanists.

MR. WILLIAM DUNVILLE has presented a valuable endowment in trust for ever to the Queen's College, at Belfast. The endowment consists of two studentships, one for the encouragement of the mathematical and physical and the other for that of natural sciences. They are intended by the donor to enable distinguished students who attained graduation to pursue their collegiate studies further. The studentships are tenable for two years, and are of the value of 45*l.* for the first, and 100*l.* for the second year.

WE hear from Cambridge, Massachusetts, that the chair of Zoology held by Professor Agassiz during his lifetime is most probably to be discontinued, and that the teaching he was accustomed to give will, for some time at least, be carried on by Prof. McCrady and Prof. Shaler. Mr. Alexander Agassiz is to be Curator of the Museum, which post being very onerous, prevents him from accepting any professorial work. The new Zoological School at Penikese is also to be under his charge, and we hope that that promising institution will be kept up with vigour notwithstanding the great loss it has sustained in the death of its illustrious founder.

WE learn from the *Lancet* that a memorial to Agassiz is in contemplation. At Boston a meeting for the purpose was addressed by Profs. Rogers and Wendell Holmes, after which it was resolved to make the Museum of Zoology at Cambridge—the work of Agassiz's best years—a memorial monument. For this it was proposed to raise the sum of 300,000 dols. to complete its endowment. 65,000 dols. were subscribed before the proceedings closed.

THE first part of a new Russian work by M. Prijevalsky, entitled "Mongolia and the country of the Tanguts," may be expected before the end of the year. It will contain an account of the author's travels in Central Asia, together with a description of the Zoological and Botanical results he has arrived at. In all, 64 species of mammalia, and 292 species of birds were obtained, including among the most remarkable of the former, the Wild Yak, the Orongo Antelope and *Ovis polii*; of the latter *Gyps nivicula* and a new species of *Pterorhinus*. The botanical collection includes, according to the botanist Maczimovitch, a great many new and rare specimens. In the mountains of Kansu about 500 different plants were obtained, including the seeds of the medicinal rhubarb.

THE Cambridge Syndicate appointed to organise courses of lectures or classes with the necessary examinations in a limited number of centres of population have received applications from several places to supply teachers during the ensuing winter. Among the subjects suggested for choice are Political Economy, Mental and Moral Science, History, English Literature, Physiology, Physical Geography, Geology, Astronomy, Mechanics, various branches of Physical Science, and other subjects of a kindred character to these. The remuneration offered varies from 125*l.* to 200*l.* for the term of three months, there being two such terms to be provided for between October and May. The pupils are chiefly from among young men and women of the middle and working classes. The Syndicate request any gentleman willing to take part in such work to send his name and the statement of subjects he would be willing to give instruction in to Mr. Stuart, M.A., Trinity College, the secretary.

THE Council of the Senate of Cambridge University recommend that a Demonstrator of Experimental Physics be appointed at an annual stipend of 150*l.* The duties of such person shall consist of assisting the Professor in giving class instruction and making experiments. He is to be appointed by the Professor, with the consent of the Vice-Chancellor. A discussion of this report takes place to-day.

M. J. PLATEAU has recently published, in two volumes, a work entitled "Statique expérimentale et théorique des liquides soumis aux seules forces moléculaires" (London: Trübner). M. Plateau has effected the realisation, on a large scale, of a part of the figures of equilibrium, indefinite in number, which would affect liquids if gravity did not act upon them; he has thus furnished the experimental verification of a series of results obtained by geometers in respect to surfaces whose mean curvature is constant, such surfaces as those of figures of equilibrium. The work referred to contains an account of the author's researches on the forms and phenomena presented by liquids in the condition named, as well as the consequences which result therefrom. The following are two examples of these consequences:—1. The froth which is formed on champagne and other liquids is evidently an assemblage of laminæ, which enclose in their interstices small portions of gas. One might naturally expect that in this assemblage all would be ruled by chance, but it is nothing of the kind; the small laminæ never unite but three and three, and make with each other, at the small liquid edge which unites them, equal angles of 120°. Moreover, the liquid edges throughout unite four and four, and thus form between them, at the point where they meet, equal angles, angles whose cosine is $-\frac{1}{3}$. 2. The beautiful observations of Savart have taught us that a vein of liquid pierced by a circular orifice is gradually converted, during the passage of the liquid composing it, into a series of isolated masses. The illustrious French physicist, to account for this phenomenon, has tried to prove that the very act of flowing gives rise, in the orifice, to pulsations which produce in the vein successive protuberances, and this hypothesis has been adopted by most of the students who have inquired into the matter. M. Plateau shows that this ingenious notion is quite insufficient to account for the facts, that the conversion into isolated masses is a result of the molecular forces which are in action at the surface of the vein, and that from this naturally result all the particulars established by Savart.

SCIENCE seems likely to be treated royally in Sweden this year. For the expenses of the Congress of Archæology and Prehistoric Anthropology, which will be held at Stockholm from Aug. 7th to 16th, the Government has asked from the Diet a grant of 20,000 fr.; a magnificent palace has been set apart for the holding of the congress; two grand fêtes will be given by the king and by the city; and visitors will be carried by the railways at half-fares. The programme includes papers and discussions on the stone age, bronze age, and iron age, and on prehistoric archæology; and excursions will be made to places of archæological interest and remains of prehistoric man in the neighbourhood. The "Congrès d'archéologie slave" will also be held at Kiew, from Aug. 14 to Sept. 3. Altogether, students of prehistoric man will have a good time of it in North Europe this summer.

THE appointments to the Bureau des longitudes at Paris for 1875 are—M. Puiseux as president, M. Faye as vice-president, and M. Yvon-Villarceau as treasurer and secretary.

THE French Academy is publishing a large 4to volume of 300 pages, containing all the reports and maps relating to the next Transit of Venus. A copy has been presented to each member, and the book is to be had at M. Firmin Didot's, the publisher to the French Institute.

SOME carpenters are at present engaged in building in the Jardin de Luxembourg at Paris a photographic studio, for the use of the photographers who are to be sent out with the Transit expedition. The observations are soon to begin, and will be under the direction of M. Fizeau, member of the French Institute; but that gentleman will not leave Paris to follow the operations.

THE young King of Siam having come of age on October 10 last, great feasts were given to his subjects at Bangkok, the chief town of his dominion. Amongst other attractions was the ascent of a small mounted balloon, which had been constructed in Paris and had arrived by steam a few days previously.

Liberal offers were made to procure an aëronaut, but were of no avail, nobody amongst the Siamese presuming to ascend. Consequently his Majesty ordered a slave, selected from amongst the less heavy of his household, to be sent up in the car. In order to encourage the poor aëronaut, so frightened for his life, he was promised to be rewarded with his enfranchisement. The ascent took place and elicited much enthusiasm from the bystanders; but, unhappily, nothing was heard from the poor fellow or of the craft.

THE Universal Exhibition to be held in the Champs Élysées Palace in 1875 is merely a private enterprise; the French Government having no intention to interfere except in giving its authorisation. No charge will be made on the national Exchequer, but it is rumoured and hoped that the Municipal Council of Paris will grant a considerable sum of money.

MR. G. J. SYMONS writes to yesterday's *Times* suggesting various methods, all good, and we think practicable, of distributing daily, or even at certain intervals during each day, the accurate time throughout London. This is an advantage possessed for long by many provincial towns; though London in this, as in many other respects, is far more "provincial" than many a second-rate provincial town. We are glad to see, however, from Mr. W. Abbott's letter in the same paper, that the want complained of by Mr. Symons will soon, to some extent, be remedied; as one of the objects of the British Telegraph Manufactory (Limited), which has just taken over all the inventions of Sir Charles Wheatstone, is to establish a large electrical driving clock in a central position of the metropolis.

THE Commissioners of the Fairmount Park, Philadelphia, U.S., are making great efforts in the way of bringing together, in the form of a zoological garden, a complete collection of animals of North America, with a view of their exhibition at the approaching Centennial Exhibition. The Commissioners are also expecting considerable consignments from other parts of the world, as South Africa, South America, &c., and the whole enterprise bids fair to assume a very great magnitude.

AT a meeting of the California Academy of Sciences in November last, photographs of strange but beautiful hieroglyphics, cut in wood, and found on Easter Island, were received from Mr. Thomas Croft, of Papeeti, Tahiti. From vague traditions among the natives, they were supposed to represent the written language of some prehistoric nation. The stone idols found on the island exhibit a refined form of art, and other relics found there go to prove that the present population has gradually degenerated from a previous one. In the letter accompanying the hieroglyphics, Mr. Croft stated from the best information he could obtain, that none except the priests and a chosen few could decipher these strange characters. A letter was read from this gentleman at the last meeting, in which he stated that he had found a native of the island who could read them, and who was going to teach Mr. Croft the language, so that he will shortly be able to translate them. Mr. Croft thinks that he has discovered the relics of a great Malayan empire, which extended its power over that part of the ocean at some former period of the island's history.

"THE Treasury of Languages, a Rudimentary Dictionary of Universal Philology" (London: Hall and Co.), is an attempt at making an exhaustive alphabetical list, with brief explanations, of all the known languages and dialects of the world. It contains, besides, explanations of terms used in the science of language. The volume contains 300 pages, with an average of fifteen names on each page; this will convey some idea of the variety of tongues on the face of the earth. The author, who is nameless, but who, we are told, is a "literary amateur," moreover intimates that he has received additional material sufficient to make a second volume. What a bewildering field is before the student of languages, to whom the present work is calculated to be extremely useful.

WE have received a second and richly illustrated edition of Mr. Hartwig's "Polar World" (Longmans). The record of Arctic discovery has been succinctly brought up to the present time, and the work is well calculated to convey to the general reader a vivid, and on the whole correct, idea of man and nature in the Arctic and Antarctic regions of the globe.

PART I. of Vol. V. of the "Natural History Transactions of Northumberland and Durham" (Williams and Norgate) has come to hand. It contains the usual Annual Address of the President, Mr. H. B. Brady, F.L.S., who recounts the excursions of 1872, and touches on one or two important questions of the day, with clearness, vigour, and brightness. The following are the titles of the papers in this part:—"Note on the recent occurrence in Northumberland and Durham, of the Camberwell Beauty Butterfly," by T. J. Bold, who also contributes papers on "The Museum Collection of British Insects," and "The Occurrence of Lepidoptera in Northumberland and Durham in 1872;" "Note on Bones dredged from the bed of the river Weir in 1872," by Dr. D. Embleton; "Meteorological Report for 1872," by the Rev. R. F. Wheeler and the Rev. Dr. R. E. Hooppell; "First Instalment of a Catalogue of the more remarkable Trees of Northumberland and Durham," by Mr. G. C. Atkinson, who has devised a "hypsometer," a simple but useful instrument for ascertaining the height of trees; "Note on Cinerary Urns found at Humbledon Hill, near Sunderland."

PART III. of Vol. III. of "Proceedings and Transactions of the Novia Scotian Institute of Natural Science," has been sent us. Besides a summary of the Proceedings of the Society, it contains twelve papers of varying value on scientific subjects, eight of these being by three of the members; this Society, like many others at home apparently, having many names on its roll but few working members. Three papers are by the Rev. Dr. Honeyman, F.G.S., Director of the Provincial Museum:—"On the Geology of Nova Scotia and Cape Breton," "On the Metamorphism of Rocks in Nova Scotia and Cape Breton," and "The History of a Boulder." Of the other papers we may mention two by Dr. J. B. Gilpin on "The Eagles of Nova Scotia," and "The Stone Age of Nova Scotia;" "The Great American Desert," by Mr. H. S. Poole; and "The Vegetation of the Bermudas," by Mr. J. M. Jones, F.L.S. Appended is a brief note on the visit of the *Challenger* to Halifax.

THE "Report of the Birmingham School Natural History Society for the year 1873," is on the whole satisfactory. All the sections seem to be in good working order, their meetings fairly attended, and some profitable field-work is being done. The papers, abstracts of which are published in the report, are creditable to the young gentlemen who wrote them.

WE have received a large sheet containing Statistical Tables relating to the Colony of Victoria, compiled from official records in the Registrar-General's Office, Melbourne, by Mr. W. H. Archer, Registrar-General. The tables contain a vast amount of information, well and compactly arranged, concerning the population, industry, education, &c., of the colony. The sheet contains also the usual meteorological statistics for the twelve months of the year, and extending over a period varying from six to fourteen years.

THE additions to the Gardens of the Zoological Society during the past week include a Common Rhea (*Rhea Americana*) from S. America, presented by Mr. A. Maxwell; a Black-tailed Godwit (*Limosa melanura*), British, presented by Mr. H. Stacy Marks; a Red-faced Deer (*Cervus œnops*) and two Falcated Teal (*Querquedula falcata*) from China, purchased; a Chinese Water Deer (*Hydropotes inermis*), a Reeves' Muntjac (*Cervulus reevesi*), and a Japanese Teal (*Querquedula formosa*) from China; a Collared Peccary (*Dicotyles tajuça*) from S. America, deposited.

## SCIENTIFIC SERIALS

*American Journal of Sciences and Arts*, January 1874.—This number commences with an account, by Mr. H. Gillman, of some Indian mounds and skulls in Michigan. The numerous tibiæ unearthed showed the compression or flattening which characterises platycnemic men; and the race, from Detroit River to St. Clair and Lake Huron, seems to have been marked with platycnemism to an extreme hitherto unobserved in any other part of America, or perhaps any other country in the world. The writer thinks the type of bone will be found predominant in the entire region of the great lakes.—Mr. Hilgard follows with a note on silt analyses of Mississippi soils and sub-soils (the author having used his "churn elutriator"); and Mr. Longbridge discusses the distribution of soil ingredients among the sediments obtained in silt analysis, and the influence of strength of acid and time of digestion in the extraction of soils.—Mr. Lesquereux communicates the remarkable discovery that traces of land vegetation exist in the Lower Silurian of America; branches or small stems of a species referable to *Sigillaria* having been found by the Rev. H. Herzer in clay beds of the Cincinnati group. The only records hitherto had of vegetable remains from the Silurian of North America are some fragments of stems and rhizomes of *Psilophyton* observed by Dawson in the Gaspé group of Canada; the only link of connection of the Devonian flora with that of the Silurian period. In Europe, too, the first remains of land plants have been found in the Lower Devonian; and as yet only a single specimen of *Sigillaria*. The same writer, in another note, argues against the view, recently advanced, that the lignite beds of the Rocky Mountains have been formed by the heaping up of drifted materials. We also find notes on the geology of Western Texas (Jenney), on the results of recent dredging expeditions on the coast of New England (Verrill), on fossil woods of British Columbia (Dawson), on a combination of silver chloride with mercuric iodide (Lea), &c.—An appendix contains a paper (with two plates) by Prof. Marsh, treating of the structure and affinities of the Brontotheridæ.

*Poggendorff's Annalen der Physik und Chemie*, No. 11, 1873.—This number contains the concluding part of M. Kundt's paper on the vibrations of square air plates.—Dr. Schüngel describes some experiments made with reference to change in the pitch of sounds through a movement of translation of the sounding body. He arranged an apparatus in which a tuning fork, mounted, with its case, on a little waggon, was rapidly drawn along (by a cord passing round a drum) towards the observer, who stood beside another fork making a slightly greater number of vibrations than the moved one. In this way a different number of beats was obtained; less than that produced when both forks were at rest. The pressure of a key, giving rise to this motion (through electro-magnets, &c.), caused a telegraphic strip of paper to be at the same time impressed, showing a continuous line; and a second pendulum, closing a current at each swing, produced a series of points on the same strip. By this means could be measured the time in which a certain number of successive beats was heard, and the rate of motion of the travelling fork. The author points out how the method may be employed for determining the velocity of sound, and commends it to the attention of physicists for further development.—M. Zöllner replies, at some length, to the considerations urged by M. Reye against his explanation of the sun-spots and protuberances; and M. Behrens communicates a note on porcelain and allied products.—A mercury air-pump, of improved construction, is described by M. Mitscherlich; and a variation-barometer by M. Kohlrausch; the latter instrument being formed with the vacuous metallic ring of a Bourdon aneroid.—M. Herwig makes a calculation of the number and weight of ether-molecules contained in electrical conductors.—Among the extracted matter, we note several important papers; one by Dr. Heinrich Streintz (Vienna Acad.), on the changes in elasticity and length of a wire traversed by a galvanic current; one by M. Plateau (Belgian Acad.) on the measurement of physical sensations, and the law which connects the intensity of these with that of the exciting cause; and one by M. Helmholtz (Berlin Acad.) on galvanic polarisation in gasless liquids.

*Astronomische Nachrichten*, No. 1,974.—In this number Prof. Spoerer writes a very interesting account of his sun-spot and prominence observations, from which he concludes that faculæ occupy the same places where protuberances arise or where the points of the "flaming chromosphere" are situate; and further, that protuberances are in most cases connected with spots, and are very conspicuous before and at the commencement of a group of spots. In many cases, he says, it is possible to calculate when a spot will appear, from the observation of a flaming protuberance, and that the spots are produced by the substances thrown up becoming cooled and producing a cloud of products of condensation.—Dr. Hugo Goricke contributes a number of observations of position of the minor planets Asia, Flora, Thetis, and Hera.

*Astronomische Nachrichten*, No. 1,975.—In this number Prof. Schmidt gives an account, in full, of his observations on Sun-spots, the number of groups being given for each day in 1873, the maximum number on any one day being 9, and the minimum 1. There is no day on which the sun was free from spots. Prof. Schmidt says that clouds have prevented observations on 12 days; we, in this country, should be content with missing 120 days. Prof. Schmidt also gives the maxima and minima of a number of variable stars, and we regret that want of space prevents our reproducing his results, which are worthy of perusal by those interested in the matter.

*Der Naturforscher*, Jan. 1874. In this number we may first note an account of some observations by M. Hann, at Hong Kong and in Ceylon, as to the decrease of temperature with the height. It appears that the yearly average of decrease is much the same in the tropics as in central Europe. During the regular monsoons, the decrease is much more gradual on the windward side of a mountain than on the lee. The quick decrease in time of rain is due, in part, to increase in quantity of rain with the height, and greater cooling in consequence.—From experiments on alcoholic fermentation, by M. Brefeld, it is concluded that alcohol yeast always requires free oxygen for its growth; it cannot grow on oxygen from a compound like sugar; further, that living, but non-growing, yeast-cells (free oxygen being excluded) may yet excite fermentation in sugar solution. As showing the affinity of the yeast-cell for free oxygen, the author states that it may grow in $CO_2$ containing less than $\frac{1}{1000}$ of its volume of such gas, and will fully absorb it.—We also find a note of some experiments on butyric fermentation, by M. Paschutin; and in the botanical department there are several interesting notes.—On the reaction of plant protoplasm to mechanical injuries, by M. Hanstein; the cause of periodical motions in leaves, by M. Batalin, stated to be, chiefly, unequal growth, preponderating at one side or the other, through varying conditions of light, temperature, and turgescence; on the morphological differentiation of the lower plants, by M. Pfingsheim, and others.—In a suggestive mineralogical paper, M. Hirschwald theorises on the cohesion-relations in drops and in crystals.—Physics is represented by several extracted notes—on evaporation, on phenomena of polarisation produced through dispersion of light, on relations between capillary and electric phenomena, on intermittance of the electric current, &c., most of which have already been noticed elsewhere in our columns; and in physiology there is an account of a valuable investigation by M. Forster, as to the significance of ash-constituents in food.

## SOCIETIES AND ACADEMIES

### LONDON

**Royal Society**, Feb. 12.—"On the influence of Ethyl Alcohol on the Bodily Temperature, the Pulse, and the Respirations of a healthy man." By E. A. Parkes, M.D., F.R.S., Professor of Hygiene, Army Medical School.

The author made a large number of experiments on a strong healthy soldier, T.R., aged twenty-five, height 5 ft. 8¾ in., weight (naked) 67·46 kilogrammes, or 148 lbs.

The course of the experiments was as follows:—His breakfast was taken at 6.30, was finished every day by 7 A.M.; he took for breakfast 8 ounces of bread, ½ ounce of butter, and 17 fluid ounces of tea with sugar, and with 3 ounces of milk. Immediately after breakfast he went to bed again, and did not get out of the recumbent position for any purpose until 2 o'clock. He then dined on 12 ounces of beefsteak, 4 ounces of bread, and 8 ounces of water.

After dinner he took exercise and smoked, had tea (same food as at breakfast) at 6, and a glass of water at 9 P.M., when he went to bed. He took daily precisely the same diet and quantity of water.

Thermometers (tested for accuracy and exactly corresponding) were placed in the axilla and rectum at 6 o'clock, and, except at breakfast, they were removed only for the purpose of being read at first every 30, and then every 15 minutes, and were at once replaced, until 2 o'clock; after which time the temperatures were only taken every two hours.

After several days' preliminary examination (during which time he took no alcohol) the experiments were commenced and carried on for six days without alcohol; then during five days undiluted brandy containing 50 per cent. of absolute alcohol was given once daily, viz. at 11 A.M., four hours after breakfast.

On the first day one fluid ounce of brandy (= ½ ounce of alcohol) was given; on the second day two ounces, on the third day four ounces, on the fourth day six ounces (= 3 ounces of alcohol), and on the fifth day also six ounces.

The following were the conclusions arrived at:—

1. The change in the temperature of the axilla and rectum produced by brandy was very slight. It was never increased, but was probably slightly lowered; but the result is not quite certain; and if any lowering occurred, it did not exceed 0°·35 Fahr., and may not have been more than 0°·07 Fahr.

2. The pulse, which was lessened in number by long rest in a recumbent position, was increased in frequency by a single dose of brandy for three hours, but subsequently fell in number, so that the daily work done by the heart was the same on the water and the brandy days. What occurred was accelerated work for a certain time, and compensation for this by lessened work afterwards. That brandy increases the force as well as the number of the pulse, was shown by sphygmographic tracings in the papers already communicated to the Royal Society; and in order not to disturb the state of rest, no sphygmographic observations were taken in this case.

3. The respirations appeared to be slightly lessened by brandy; but the evidence is not very strong.

The author made another series of experiments to determine the effect of alcohol after sixteen hours' fasting.

The following conclusions may be drawn from the observations formerly recorded ("Proceedings of the Royal Society," Nos. 120, 123, and 136), and from those now laid before the Royal Society:—

1. When alcohol in dietetic doses (=2 fluid ounces, or 57 cub. centims., of absolute alcohol) was given to a healthy man fasting and at rest, a decided though slight lowering of bodily temperature (as judged of by the heat of the rectum) was caused. The amount of lowering was under half a degree of Fahrenheit; and sometimes even this amount was not perceptible, being probably counteracted by the opposing influence of the heat-producing changes in the body, which cause slight variations of temperature independent of food and movement. The greatest effect was produced about from one to two hours after the alcohol was taken, and the effect was evidently passing off in three hours.

2. When alcohol in dietetic doses was given to a healthy man at rest, and in whom the process of digestion was completed, and whose temperature, raised by the food, was again commencing to fall, a lessening of temperature was also proved, but its amount was not so great; it could not have been more than 0°·35 Fahr., and may have been only 0·07 Fahr.

3. When alcohol was given with food with either usual or increased exercise, no effect on temperature was perceptible, even though the alcohol was given in large quantities, viz. from 4 to 8 fluid ounces of absolute alcohol (114 to 227 cub. centims.) in twenty-four hours. It is to be presumed that the amount of heat generated from the food and movement concealed the effect of the alcohol, which would require a more delicate method for detection.

4. In no case did alcohol raise the temperature.

5. The effect of alcohol on the pulse was uniform in the four men experimented upon. The contractions of the heart were more frequent during complete rest, from five to ten beats per minute for some time; and when exercise was taken the increase was greater. The mean pulse of the twenty-four hours was, however, not increased unless the amount of alcohol was large and repeated. In other words, the heart's beats were less frequent than natural when the effect of the alcohol had passed off. The pulse became both fuller and softer to the touch; and this relaxation of the radial artery was shown also by the sphygmograph. That the smaller vessels were relaxed was shown by the redness of the surface and by the evident ease with which the blood traversed the capillaries, as shown by the sphygmographic tracings.

6. The respirations were not increased in number by alcohol; they were indeed lessened, and were deeper in some of the experiments; but the effect was not very marked.

Feb. 26.—"The Winds of Northern India, in relation to the Temperature and Vapour-constituent of the Atmosphere," by Henry F. Blanford, F.G.S., Meteorological Reporter to the Government of Bengal.

Geological Society, Feb. 20.—His Grace the Duke of Argyll, K.T., F.R.S., president, in the chair. In handing the Wollaston Gold Medal to the foreign secretary, Mr. W. W. Smyth, for transmission to Prof. Heer, of Zurich, the president referred to the fact that last year the council had awarded the balance of the proceeds of the Murchison Geological Fund to Prof. Heer, and remarked that it gave him much pleasure that the Wollaston Medal, the highest honour which the Society had it in its power to confer, should be so worthily bestowed. He alluded briefly to the labours of Prof. Heer in the difficult departments of Fossil Botany and Entomology, and to the admirable works in which he had given to the world the results of his indefatigable researches.

Mr. W. W. Smyth, in reply, said:—"My Lord President, it is with a great pleasure that I undertake the transmission to Prof. Heer of this new testimony of the importance attached by this Society to his long-continued labours. I have received from our valued foreign member a letter stating that my announcement of the award had found him extended on the bed of sickness, and begging me to assure the Society that, but for this misfortune, nothing would have given him greater pleasure than to have been present at this meeting, and to have thanked the Society personally for the high honour which has now been awarded to him."

The President then presented the balance of the proceeds of the Wollaston Donation Fund to the foreign secretary for transmission to Dr. H. Nyst, of Brussels, remarking that this distinction had been well earned by Dr. Nyst by his admirable researches upon the Molluscan and other fossil remains of his native country.—Mr. W. W. Smyth briefly thanked the president on behalf of Dr. Nyst.

The president next presented the Murchison Medal to Dr. J. J. Bigsby, F.R.S., and remarked in so doing that there was a peculiar fitness in this award, which would have met the approval of the distinguished geologist in accordance with whose last wishes this medal was given. It was awarded to Dr. Bigsby in recognition of his long and valuable labours in that department of geology and palæontology with which the name of Murchison is more particularly connected.—Dr. Bigsby replied, thanking the Society for the honour conferred upon him, and the president for the terms in which he had spoken of his labours.

The president then handed half the balance of the proceeds of the Murchison Geological Fund to R. Etheridge, F.R.S., for transmission to Ralph Tate, F.G.S., expressing a hope that it would be regarded by him as a testimony of the value set by the Society upon his palæontological researches, especially on the Fauna of the Lias, and that it would enable him to enlarge the sphere of his investigations.—Mr. Etheridge, in reply, read the following letter of acknowledgment from Mr. Tate:—

"My Lord President and Gentlemen, To say that I am unworthy of the honour that you have awarded me by the bestowal of the 'Balance of the Proceeds of the Murchison Fund,' would be to call into question your judgment, and would render nugatory its value to me. The encouragement that such an award conveys is ample recompense for labour bestowed in palæontological research, and is a real incentive to more diligent work. It is in this spirit that I accept the award, and tender my warmest thanks to you for the distinction it confers. It is now twelve years since I was led to select for special study the geological history of the Lias, which appeared to me not to have received that attention at home that it had upon the Continent, and which it claimed by offering the earliest phase of Mesozoic life, and presenting a number of physical problems that seemed upon the threshold of the inquiry to reward even the casual observer with a rich harvest. I have published from time to time fragments relating to the stratigraphy and palæontology of this period, but I hope soon, in conjunction with my friend Mr. J. F. Blake, F.G.S., to submit, in a work entitled 'The Yorkshire Lias,' a comprehensive review of the chief characteristics of the period, embracing the remarkable variation of mineral conditions, and the particular distribution of organic life, as indicative of peculiarities of depth of ocean, the direction and proximity of land, &c. Despite all these efforts, the ambition to acquire the position of an expositor of the life of this interesting group of strata urges me to the completion of a *Prodromus* or *Thesaurus Liassicus*, the materials for which have been accumulated during several years; but from the great labour demanded to bring into harmony the nomenclature of the fossils, without which the compilation can have no real value, some time must elapse before the results can be submitted to you.—Faithfully yours, Ralph Tate."

The President then presented to Mr. Alfred Bell the other half of the balance of the proceeds of the Murchison Geological Fund, and stated that this was awarded to him in recognition of his valuable researches upon the fossils of the newer Tertiary beds of this country, and to assist him in the completion of his work upon the Crag deposits of the eastern counties. Mr. Bell, in reply, said that he was most grateful for this token of the Society's appreciation of the value of his labours, and stated that up to the present time he had been enabled to distinguish about 3,000 fossil species from the newer Tertiaries of Britain, and that he hoped yet to add very largely to their number.

The President then proceeded to read his Anniversary Address, in which he stated that the pressure of his official duties during the period of his presidency had prevented his keeping himself thoroughly acquainted with the recent progress of geological research, and he therefore proposed in his present address to advert rather to those questions in geology which seemed to him still to require an answer. He referred to the relations between geology and cosmogony, to the effects and causes of volcanic and earthquake action, and finally to the great questions which are still unsettled as to the origin of life and the sequence of organic beings on the face of the earth. The address was prefaced by some obituary notices of Fellows and Foreign Members and Correspondents deceased during the past year, including Mr. J. Wickham Flower, Mr. J. Garth Marshall, Prof. Agassiz, and M. de Verneuil.

The Ballot for the Council and Officers was taken, and the following were duly elected for the ensuing year:—President—John Evans, F.R.S. Vice-Presidents—Robert Etheridge, F.R.S.; R. A. C. Godwin-Austen, F.R.S.; Sir Charles Lyell, Bart., F.R.S.; Joseph Prestwich, F.R.S. Secretaries—David Forbes, F.R.S.; Rev. T. Wiltshire, M.A. Foreign Secretary—Warington W. Smyth, F.R.S. Treasurer—J. Gwyn Jeffreys, F.R.S. Council—The Duke of Argyll, K.T., F.R.S.; H. Bauerman; Prof. G. Busk, F.R.S.; J. F. Campbell; Frederic Drew; Sir P. de M. G. Egerton, Bart., F.R.S.; R. Etheridge, F.R.S.; John Evans, F.R.S.; David Forbes, F.R.S.; Capt. Douglas Galton, F.R.S.; R. A. C. Godwin-Austen, F.R.S.; J. Gwyn Jeffreys, F.R.S.; Sir Charles Lyell, Bart., F.R.S.; C. J. A. Meyer; J. Carrick Moore, F.R.S.; Joseph Prestwich, F.R.S.; Prof. A. C. Ramsay, F.R.S.; Samuel Sharp, F.S.A.; Warington W. Smyth, F.R.S.; Prof. J. Tennant, F.C.S.; W. Whitaker, B.A.; Rev. T. Wiltshire, F.L.S.; Henry Woodward, F.R.S.

**Anthropological Institute**, Feb. 24.—Sir Duncan Gibb, Bart., M.D., in the chair.—Mr. Biddle Lloyd, C.E., F.G.S., read a paper on the Beothucs, a tribe of Red Indians, supposed to be extinct, which formerly inhabited Newfoundland. The author, after reviewing the various accounts related of the aborigines of the island from the time of Sebastian Cabot downwards, gave the results of the information he picked up from various sources during an exploratory cruise he made last summer round the coast of Newfoundland, respecting the strange tribe of Indians which inhabited the island up to a period which terminated about forty years ago, when, by reason of the cruelties practised on them by the English fishermen, and the warfare carried on against them by the Mic-mac Indians, they were reduced in number, and finally the few of them that were left, it is supposed, crossed over the straits of Belleisle, or at all events disappeared. Several singular circumstances in connection with the Beothucs, as they styled themselves, were noticed: namely, the curious shape of their birch-bark canoes, the fact that the dog was not domesticated by them, and their manner of hunting the Caribou by means of long lines of fencing put up to keep the herds of deer along certain tracks.—Mr. Lloyd also read notes on Indian remains found on the coast of Labrador. The Indian remains found on the coast of Labrador consisted of rudely-constructed buildings, of stone slabs, which were discovered on the sea-shore at the western entrance of the straits of Belleisle. They were described to the author as Indian graves, but there was no evidence to show that such was the use to which they had been applied. On the contrary, it seemed probable they were stone wigwams built by some Indian families for a summer residence. The author was fortunate enough to discover at L'Anse du Diable, which is a cave situated about 20 miles east of the locality where the so-called Indian graves were found, a few arrow-heads of quartzite and hyaline quartz on a sandy "barren" which stretched inland from the head of the cave. From circumstances connected with the cave, the author concluded that the locality had been chosen by some unknown tribe of Indians for the manufacture of their arrow-heads during an occupancy of some considerable time on the spot.—A paper was read by Dr. Sinclair Holden on a peculiar Neolithic implement from Antrim.

**Royal Horticultural Society**, Feb. 10.—Annual General Meeting.—Viscount Bury, president, in the chair.—The Report of the Council having been taken as read, it was moved by Mr. Haughton as an amendment to the motion for its adoption, and seconded by the Rev. C. P. Peach, that the meeting be adjourned to enable the opinion of the Court of Chancery to be taken as to the legal position of the Society. (The commissioners of the Annual International Exhibitions dispute the validity of the election of the Council chosen last year.) The amendment being put to the vote was lost by a majority of six, the numbers (including ladies' proxies) being, for, 225; against, 231. The report was then put and carried. The following vacancies were filled for the ensuing year:—President—Viscount Bury, K.C.M.G. Treasurer—Mr. Bonamy Dobree. Secretary—Mr. W. A. Lindsay. Members of Council (extraordinary vacancies)—Lieut.-Gen. Hon. Sir A. H. Gordon, K.C.B.; Mr. Joseph Robert Tritton; Mr. Burnley Hume; Mr. Henry Webb.

General Meeting, Feb. 18.—Henry Little in the chair.—The Rev. M. J. Berkeley commented on a plant shown by Mr. Bull, under the name of *Rapatea pandanoides*. It is a species of *Saxofridericia*. He also gave some account of Dr. Cunningham's microscopic examinations of air in Calcutta.

Scientific Committee.—A. Smee, F.R.S., in the chair.—A large number of subjects were brought before the Committee. Among the more important were—Mr. Grote: The Tea-bug of Assam, supposed by Prof. Westwood, from the figures, to belong to the Cimicideous family, Capsidæ, and nearly allied to a species which injures chrysanthemum-buds. Mr. A. Müller thought it much more likely to be some aphis, though it might be immature.—A communication was sent through Dr. Hooker on a new disease of the coffee plantations in India (Tellicherry). The leaves turn yellow, and the back is found to be covered with a rust-coloured dust. Further information was requested.—Prof. Thisselton Dyer exhibited specimens of the Balaniform gabsy gall of the oak with specimens of the Cynips which had been bred from them. These had been identified by the Rev. T. A. Marshall as *C. radicis*, Fab. He also read a note from Mr. Fenn, of Woodstock, as to the practical impossibility of making keeping wine from out-door ripened grapes without the addition of sugar—a point of interest in connection with the supposed deterioration of the English climate; also a note on the condition of an armour-plated ship which was being rapidly destroyed by dry-rot, and a photograph of the tree of the orange or Pearmain apple, with a drawing of the branch which had produced the russet sport exhibited to the Committee last November.

**Entomological Society**, Feb. 16.—Sir Sidney Smith Saunders, C.M.G., president, in the chair.—Mr. Weir exhibited a sample of wheat from Australia infested with a weevil, *Sitophilus oryzæ*; the cargo was so much damaged that about two tons were utterly useless. The weevil was accompanied by *Læmophlœus ferrugineus*. Some wheat from Japan was also infested with *Sitophilus granaria* and *Rhizopertha pusilia*.—Mr. Higgins exhibited a number of *Cetoniidæ* from the Philippine Islands, which had been described by Dr. Mohnike.—Mr. F. Smith read extracts from a letter from Mr. J. T. Moggridge of Mentone, on a small beetle, *Coluocera attæ*, Kraatz, found in the granaries of *Aphænogaster* (*Atta*) *structor*; and stating that *Platyarthrus* was also very common in the nests. He was much struck by the frequent occurrence of the nests of trap-door spiders in the very soil of the ants' nests; the spiders' tubes often running quite close to, and in the midst of, the galleries of the ants. As ants form a large portion of the food of trap-door spiders, this helped him to understand how it was that the spiders got a living without leaving their nests.—Some conversation took place on the ravages of the Colorado potato beetle (*Doryphora decemlineata*) in North America; a writer in the *Times* recommending the encouragement of small birds as the best security against the pest; but it was much doubted whether the small birds would care to meddle with the insect, as it was stated that when crushed it caused blisters on the skin, and that if a wound was touched severe inflammation and painful ulcers followed.

**Institution of Civil Engineers**, Feb. 10.—Mr. T. E. Harrison, president, in the chair.—The paper read was on the construction of Harbour and Marine Works with artificial blocks of large size, by Mr. Bindon Blood Stoney, M.A. The author described a new method of submarine construction, with blocks of masonry or concrete far exceeding in bulk anything hitherto attempted. The blocks were built in the open air on a quay or wharf, and after from two to three months' consolidation, they were lifted by a powerful pair of shear legs, erected on an iron barge or pontoon. When afloat, the blocks were conveyed to their destination in the foundations of a quay wall, breakwater, or similar structure, where each block occupied several feet in length of the permanent work, and reached from the bottom to a little above low-water level. The superstructure was afterwards built on the top of the blocks in the usual manner by tidal work. By this method the expenses of cofferdams, pumping, staging and similar temporary works were avoided, and economy and rapidity of execution were gained, as well as massiveness of construction, so essential for works exposed to the violence of the sea.

### EDINBURGH

**Royal Society**, Monday, March 2.—Sir Robert Christison, honorary vice-president, in the chair.—The following communications were read :—"On the Parallel Roads of Glen Roy, with a Notice of finding Fossil *Diatomaceæ* in the Deposits," by the Rev. Thomas Brown.—"On the Perception of Musical Sounds," by Dr. M'Kendrick.—"On the Establishment of the Elementary Principles of Quaternions on an Analytical Basis," by Mr. G. Plarr. Communicated by Prof. Tait.—"Preliminary Note on Spectra under exceedingly small Pressures," by Prof. Tait and Mr. J. Dewar.—"Laboratory Notes," by Prof. Tait (1) On Atmospheric Electricity; (2) On the Thermoelectric Position of Sodium.

### DUBLIN

**Royal Irish Academy**, Feb. 9.—Rev. J. H. Jellett, president, in the chair.—W. H. Baily, F.L.S., read a preliminary report on the plant-fossils of the Kiltorkan district. In this preliminary report Mr. Baily stated that the most frequent plant met with is *Palæopteris hibernica*, first noticed by the late Prof. E. Forbes, under the provisional name of Cyclopteris, afterwards referred to Adiantites by A. Brogniart, and now placed by Schimper in his genus Palæopteris, differing as it does from the former genus in the arrangement of its leaflets and from the latter in its mode of fructification. Some of the fronds met with were nearly five feet long and three wide. Two new species were described as *Sphenopteris hookeri* and *S. humphresianum*, both of which were comparatively rare.—A fine example of the stem of *Sagenaria bailyana* of Schimper was met with, the total length of which was 20 ft. 4 in., and at its lowest portion it was 6 in. in diameter; it branched at about 15 ft. from the base; and the upper portion of these branches corresponds with *Cyclostigma minuta* of Haughton. Cone-like bodies, somewhat resembling Lepidostrobus of the coal were met with. They are composed of elongated scales, terminating in long linear processes showing large and very distinct sporules.—These presumably belong to the Sagenaria but have never yet been found attached.—The report was referred to Council for publication.—Mr. G. Kinahan, of the Geological Survey, believed the report was a most valuable one, and that the researches of Mr. Baily had proved that many of Mr. Carruther's species were but portions of the same plant.—Prof. M'Nab read a report on some researches into the physiology of plants. These experiments were first a series to determine the amount of water transpired by leaves, and secondly the ascent of water in the stem. The plants selected for both series of experiments were the cherry-laurel, the common privet, and the common elm. It would be impossible to condense the large series of experiments made by the author. One series, to determine the amount of water transpired by leaves, made on August 7, 1873, showed that, with very nearly the same exposure and under the same conditions, the cherry-laurel lost, of water, 51·81 per cent. of the weight of the branch employed; the privet, 26·78; the elm, 65·61. Very many experiments were made to determine the actual rate at which fluid ascends in the stem. In Sach's experiment on this subject he fixed the rate to be 9 in. per hour. In Dr. M'Nab's first experiments he obtained a rate of 24 in. per hour. The present series of experiments were made on the same species of plants mentioned above. In the privet the rate was 6 in. per hour; in the elm the rate was 15·6 in. per hour. But in both plants the leaves and stem soon became placid, and the experiments were not completely satisfactory. In the cherry-laurel the rate in one experiment was 24 in. per hour; in a second, 13·2 in. per hour; and in a third, 18·6 in. per hour. The author also recorded a large series of experiments: 1. As to the rapidity of the ascent of fluid in stems when in (*a*) sun, (*b*) diffused daylight, and (*c*) darkness. 2. Rapidity of ascent in branches cut off in the dark. 3. Rapidity of ascent in branches with the cortical tissue removed. 4. Rapidity of ascent in stems deprived of their leaves. 5. Rapidity of absorption of lithium when applied at apex of the branch; and 6. Rapidity of ascent when fluid was taken up under pressure of mercury, intended to represent the root pressure of the plant.—This report was also referred to Council for publication.

### VIENNA

**Geological Institute**, December 3, 1873.—One of the most obscure questions in the geology of the Austrian empire has been the geological position of the Vienna and Carpathian sandstones which form a broad continuous zone on the northern flank of the Austrian Alps, and by far a broader one still on the northern and eastern flank of the Carpathians in Moravia, Silesia, Hungary, Galizia and Transylvania. Only in Silesia, by the investigations of the late Hohenegger, and in Northern Hungary, by those of M. C. Paul, a more satisfactory knowledge has been obtained on this subject. They agree that in both regions the Carpathian sandstones may be divided into several easily distinguishable groups which belong partly to the older tertiary, and partly to the cretaceous formations. Two very valuable memoirs on this subject were read; the first from M. F. Herbich, on the Carpathians in Eastern Transylvania, between the Gyimes and the Tömös Pass. The lowest member of the Carpathian sandstones is formed here by white or yellowish sandstones, which, higher up, pass into coarse conglomerates and belong to the middle neocomian formation; they are covered by a large series of dark-grey sandstones which contain characteristic fossils, and belong to the upper neocomian. The next member, developed near Zaizon, is a grey limestone with Caprotina Lonsdali, identical with the well-known Caprotina limestone of the Alps, and belonging also to the upper neocomian. Above the neocomian strata follow again different sandstones, which M. Herbich thinks to be identical with the Godula sandstones of Hohenegger, and therefore to belong to the Gault. The second memoir, by M. Ch. Paul, treats of the Carpathian sandstones in the eastern Bukowina. They are divided in five different stages, viz., (1) Lower Teschen slates; (2) Neocomian Aptychus limestones; (3) Ropianka beds; which were formerly thought by the author to belong the Eocene series, whilst now he considers them as probably Cretaceans. They are of very great importance, because they contain in Galicia and Bakowina, as well as in Hungary, exclusively the sources of petroleum. 4. Menilith schists, with nests of fossil fishes, which are generally thought to belong to the middle oligocene formation. 5. Magara sandstone, probably upper oligocene.—Dr. Neumayer on the character and the distribution of some Neocomian cephalopods. The author, referring to a former memoir, ("Jahrb. d. k. k. geol. Reichsaunstalt," 1871, p. 521), states that the European jurassic deposits form three different provinces, the Mediterranean, the middle European, and the Russian province. By very interesting observations on the faunas of these provinces, as well as on that of the neocomian period, he establishes some facts relating to the physical geography of the mesozoic period. First he states, that at the end of the jurassic time, the middle parts of Europe were laid dry, and whilst therefore the marine life in the middle European province ceased, it continued, and was differently developed in the Mediterranean (deposits of Stramberg, of Berrias, &c.) and in the Russian province. Afterwards, about the time of the Valenginien, the middle part of Europe was again submerged and now peopled partly from the northern and partly from the southern seas; that the immigration went really partly from the north, is proved by the very curious and close affinities between some of the middle European neocomian cephalopods and those of the upper jurassic strata of Russia.

**Academy of Natural Sciences**, Dec. 11, 1873.—M. Hoernes described the geological features of the island of Samothrace, from observations made in the spring of 1873.—Prof. Knoll presented a paper on the reflex effects produced on respiration, by introducing some volatile substances into the air passages under the larynx. When chloroform is inhaled through a tracheal canula (the mucous membrane of the nose being guarded against its action), there is acceleration and shallowing (*Verflachung*) of the respiratory movements, with low position of the diaphragm, and, sometimes, entire stoppage in the position of inspiration. Ether, benzine, and oil of mustard have a similar, though less, effect. Section of the vagi at the neck shows that these changes depend on reflex action of the vagi. The vapour of a strong solution of ammonia produces great change in the respiration, often lasting several minutes, and varying between a retarding and deepening effect, with long stoppage in position of expiration, and retardation and shallowing in position of inspiration. This also is due to reflex action through the vagi. Inhalation of pure carbonic acid through the tracheal canula produces, both when the vagi are cut and uncut, first, a moderate acceleration, then a considerable retardation of the respiratory movements. No phenomenon occurs which can be explained by a direct stimulation of the vagi by the $Co_2$.—Dr. Fitzinger communicated a paper on the species of the family of deers (*Cervi*) according to their natural relations. He enumerates twenty different species, four of which he has himself introduced, viz., *Strongyloceros*, *Elaphoceros*, *Doryceros*, and *Nanelaphus*. To Wagner's species *Macrotis* and *Furcifer*, he gives the names *Otelaphus* and *Creagrocerus*, the two former names having had a previous application in zoology. Dr. Schenck presented a note on the eggs of *Raja quadrimaculata* within the oviduct; describing the structure of the shell, and the development of the embryo.—Drs. Nowak and Kratschmer made a communication on phosphoric acid as a re-agent with alkaloids. They find that it gives, with several alkaloids, peculiar colour-reactions, in some of which characteristic reactions of smell are developed. In both respects it presents some advantages over the similarly-acting sulphuric acid. It is specially preferable to this in determination of atropia, for reasons which the authors give.

### PHILADELPHIA

Academy of Natural Sciences, Oct. 7, 1873.—Dr. Ruschenberger, president, in the chair.—"Law of Seed Germination in Swamp Plants." Mr. Thomas Meehan said that it was an error to suppose that Nature placed trees in places the best suited to their growth. Almost all of our swamp trees grew much better when they could get into dryer places, if in ordinary good land. He referred among others to *Magnolia glauca*, *Acer rubrum*, *Celtis occidentalis*, *Ilex opaca*, *Cupressus chamæcyparis*, *Cephalanthus occidentalis*, *Salix babylonica*, especially as, within his own repeated observations, growing better out of swamps than in them. Why it was that they grew in swamps was no enigma to those in the habit of raising forest trees from seed. It was found that seeds of these trees would only germinate in damp places, and, of course, in a state of nature the tree had to remain in the place where the seed germinated. He thought the principle taught that plants required water to grow well was true only in so far as a humid condition of the soil was concerned. Plants as a general thing, though they were of the class known especially as water plants, preferred to grow out of the water, except in those which grew almost entirely beneath the surface. As was well known, the *Taxodium distichum* in the southern swamps sent up "knees" from various points as the roots extended, often as large as old-fashioned bee-hives, and several feet above the surface.

Oct. 21.—Dr. Ruschenberger, president, in the chair.—"Stibiaferrite, a new Mineral from Santa Clara County, California," by E. Goldsmith.

Oct. 28.—Dr. Ruschenberger, president, in the chair.—The following paper was presented for publication:—"Descriptions of Mexican Ichneumonidæ," by C. T. Cresson.

Nov. 18.—Mr. Vaux, vice-president, in the chair.—The following papers were presented for publication:—"On the Homologies and origin of the Types of Molar Teeth in Mammalia Educabilia," by E. D. Cope; "Contribution to the Ichthyology of Alaska," by E. D. Cope. Prof. Cope remarked that he had observed in the Rocky Mountain region circles of stones arranged by human hands, in countries not now inhabited by the Indians. One of these is in South-western Wyoming near South Bitter Creek, inside the horseshoe of the Mammoth Buttes. The locality is a very barren one, and could hardly be regarded as a camping-ground. The circle consists of three uninterrupted concentric rings close together, the hole having a diameter of about 15 ft. The stones are of moderate size, composed of a dark silex, and evidently derived from the drift material brought down from the Uinta Mountains, which is found on the snmmits of the bad-land mesas. Five or six miles from this place was found a flint factory with numerous implements and cores. Two other circles were observed, in Colorado, about a hundred miles east of Long's Peak, and about five miles from a spring in a well-grassed country. The locality is unsuitable for a camp, in consequence of the remoteness of wood and water. The country is not inhabited by Indians, the nearest, a temporary camp, for travelling Cheyennes, Sioux, &c., being forty miles distant.

Nov. 25.—Dr. Ruschenberger, president, in the chair.—The following paper was presented for publication:—"Description of Seven New Species of Unionidæ of the United States," by Isaac Lea. The committees to which were referred the following papers:—"On the Homologies and Origin of the Types of Molar Teeth in Mammalia Educabilia," by Edward D. Cope; and "Contributions to the Ichthyology of Alaska," by Edward D. Cope," reported in favour of their publication in the *Journal*.—Disposition of the *Flexor perforans*, *Flexor longus hallucis*, and *Flexor accessorius* in *Paradoxurus musanga* Gray, by Dr. H. C. Chopman.

### PARIS

Academy of Sciences, Feb. 23.—M. Bertrand in the chair.—The following communications were made:—On the undulatory movement of a train of wagons due to a shock, by M. H. Resal.—On the acid waters which rise in the Cordilleras, by M. Boussingault.—Determination of vapour densities, by H. Sainte-Claire Deville. The author criticised the apparatus for the determination of vapour densities, recently devised by M. Croullebois.—M. Dumas communicated a note on a process invented by Dulong for taking vapour densities.—Observations concerning the last communication by M. Clausius, on the equation $\int \frac{dQ}{T} = 0$, by M. A. Ledieu.—M. Milne-Edwards gave news of l'Abbé A. David, now travelling in Western China, and presented, on the part of this naturalist, a note containing descriptions of several new birds.—Memoir on the swim-bladder from the point of view of station (*station*) and locomotion, by M. A. Moreau. The author described some experiments made upon a perch (*Perca fluvialis*).—Organogenesis compared with Androgenesis in its relations to natural affinities (*Class Œnotherinæ*), by M. A. Chatin.—On a new mode of ramification observed in plants of the family of the Umbelliferæ, by M. D. Clos.—Observations relative to a recent memoir by M. Helmholtz upon "Aërial Navigation," by M. W. de Fonvielle. On the lines which are doubly tangential, to the "*surface lieu*" of the centres of curvatures of a surface of the second order, by M. Laguerre.—On the permanent magnetism of steel, by M. E. Bouty.—Note on the distribution and determination of thallium, by Mr. T. L. Phipson.—On the presence of metallic silver in gallena, by the same author.—Anatomical researches on rickets of the vertebral column," by M. Ch. Robin.—Geological sketch of the Isle of Tros, by M. H. Gorceix.—On a new apparatus for registering the direction of clouds, by M. H. de Parville.—On three new human skeletons discovered in the caves of Menton, and on the disappearance of chipped flints and their replacement by sandstone and limestone instruments, by M. E. Rivière.—On pine-culture in Central France, by M. de Béhague.

## CONTENTS