THURSDAY, NOVEMBER 26, 1874

THE ENGLISH ARCTIC EXPEDITION

HER Majesty's advisers can by no means be accused of precipitancy in the decision they have recently come to, to send out a new Arctic Expedition; they have certainly waited for "the fulness of the time," which, for the lay mind, may be said only to have been accomplished with the return of the Payer-Weyprecht expedition. We believe that the scientific societies of the country had good grounds for urging upon Government the propriety of fitting out an expedition for Arctic discovery years ago; all who understand the Arctic question, we are sure, will coincide with us in the opinion, that had energetic measures been taken when the subject was first urged upon the attention of Government, the earth's surface around the North Pole would by this time have been on our maps. Still, Government cannot be blamed for this tardiness; it cannot be expected that men who have no occasion to make a special study of scientific questions can see them in the same light as those whose great work in life is scientific investigation; and, moreover, in a country governed as ours is, Ministers, before coming to a decision on any important matter, are bound carefully to feel the country's pulse, not to mention their duty in respect of the country's purse. Her Majesty's advisers have, then, no doubt been, from their point of view, wise in deferring till now their decision that England should once more come to the front in the exploration of the unknown "Polynia;" as they also would have shown themselves extremely unwise and unable to read the country's wishes had they postponed the matter any longer.

That the Ministry have rightly divined the general wish in reference to the part which England should play in Arctic exploration is evident from the all but unanimous approval with which their decision has been met by the press. The unaccountable roar—undignified howl, we had almost said—which, either too late or too soon, fell from the (evidently, in this case, ill-informed) "leading organ," need not be made much of. It was evidently not the result of a candid and comprehensive consideration of the whole question by one competent to decide. Were the objections so bitterly uttered by the *Times* against Arctic exploration to have force, they would equally hold against all abstract scientific investigation whatever, and indeed against all work not undertaken for the lust of gold. Happily, however, it is long since the race has become convinced that "man cannot live by bread alone," and that there is a hunger that will never be appeased so long as a shred of mystery hangs to this earth of ours and to the mighty universe of which it forms part; and there is no danger of man's noblest appetite becoming extinct for lack of material to feed upon. But, indeed, the *Times* article is a puzzling one; it is so inconsistent with its opinions on questions of a similar kind, and with its advanced opinions on scientific questions generally.

As to the propriety of Government undertaking the organisation of an Arctic expedition, we have said so much already on this subject, both directly when the subject was formerly before the public, and indirectly in connection with the advancement of scientific research, that we need not refer to it here again. That any but a Government expedition under naval discipline is inadequate for the work of thorough polar exploration has been practically proved over and over again; what can be accomplished by an expedition so organised, under comparatively favourable circumstances, may be seen in the valuable work already achieved by H.M.S. *Challenger*. For similar reasons we need not refer to the many important advantages to science, and therefore to mankind, which are certain to result from a thorough exploration of the regions and the terrestrial conditions around the pole. For one thing, it is scarcely any exaggeration to say that all the civilised world is looking to Britain for the final unravelling of the Arctic mystery, to complete the work which has already added so considerably to the general sum of her glory: witness Dr. Petermann's letter, vol. xi. p. 39:—

"I do not know," Petermann says, "the views held in England now, but I know that to us outsiders the achievements and work of a man like Sir James Clarke Ross or Livingstone have done more for the prestige of Great Britain than a march to Coomassie, that cost nine millions of pounds sterling. That great explorer, Livingstone, is no more; his work is going to be continued and finished by German and American explorers; we shall also certainly not let the Arctic work rest till it is fully accomplished, but it surely behoves Great Britain now to step in and once more to take the lead."

How keenly the resolution of the Cabinet has been appreciated by naval and scientific men, is shown by the number of competent volunteers which have already come forward for the expedition; so many, indeed, as to make the task of selecting embarrassing; so far as suitable men are concerned, a dozen Arctic expeditions might be efficiently fitted out.

As to the route, herein also has the Government shown its discernment; there can be no doubt that any expedition, one of whose objects is to attempt to reach the pole, is shut up to adopt the Smith's Sound route. Capt. Koldewey's work in 1869-70 proved finally the impossibility of penetrating to the pole between Greenland and Spitzbergen; the recently returned Austro-Hungarian expedition proves that the task is equally hopeless on the Novaya Zemlya side of Spitzbergen; Behring Strait is out of the question. Thus the demonstration that the route by which the *Polaris* accomplished so much is the gateway to the pole, has been completed by the attempt of the Payer-Weyprecht expedition; and thus, no doubt, the Government has shown considerable prudence in delaying its decision until the data were complete, as well as its generous readiness to step in at the right moment. As we said last week, now that the expedition has been decided on, its equipment will be carried out on a thoroughly liberal scale. A note this week tells what has been done by Sir Leopold M'Clintock as to the selection of the vessels which are to carry the expedition, and, as we learn from an evidently authoritative article in Saturday's *Daily News*, the strength of the expedition will probably consist of from 100 to 120 officers and men. Preparations have been already begun, and as the expedition will probably not sail till the month of May next year, we may expect that it will leave our shores more perfectly equipped in every respect than any expedition that has hitherto sailed to the same quarter of

the globe; what Government will do when it takes such work in hand, we have a good example of in the *Challenger* expedition.

There is now such a vast stock of experience in Arctic exploration from which to derive lessons for guidance as to the equipment of the new expedition, that we have every assurance the new expedition will be organised in such a manner as to secure the maximum of efficiency with the minimum of danger and discomfort. But, indeed, Mr. Markham has clearly proved, in his "Threshold of the Unknown Region," that the cry of danger has no foundation whatever, and his statement is only confirmed by the three most recent and by no means adequately equipped expeditions, those of the *Polaris*, the *Germania-Hansa*, and the *Tegetthof*.

It is calculated that the expedition will cost about 30,000*l*. a year, "which," as the *Daily News* justly says, "is surely a very moderate expenditure for an object so important. The officers and men of the expedition will belong exclusively to the Royal Navy; the former will be selected for their scientific qualifications, and will at once enter on the study of the special subject, a knowledge of which the purposes of the expedition demand." No doubt, then, every branch of science on which exploration near the pole of the earth is likely to throw light will have a competent representative on the staff; and here we would urge upon the organisers the great importance of the spectroscopic examination of the aurora in those regions where often it can be studied almost nightly; no doubt there will be some competent man on board to look after this investigation.

From this expedition, then, entered on after the most mature deliberation, and likely to be organised on the most liberal basis, science may expect to reap a rich harvest. To quote the concluding words of the article already referred to: "As the object of the expedition is not merely to reach the pole, there will be no hurried racing to attain that point. The whole phenomena of the polar area is of deep and still mysterious interest. The opportunity now is within reach to lay open to the scientific world a mass of invaluable data relating to the region which lies concealed behind the 80th parallel of latitude and within an area of two million square miles. It may be shown that no such extent of unknown area in any part of the world ever failed to yield results of practical as well as of purely scientific value; and it may be safely urged that, as it is mathematically certain that the area exists, it is impossible that its examination can fail to add largely to the sum of human knowledge."

OBSTACLES TO SCIENTIFIC RESEARCH

SOME remarks with which Prof. M'Nab prefaces a paper "On the Movements of Water in Plants," recently published in the Transactions of the Royal Irish Academy, deserve serious consideration as an instance of the obstacles which exist in the way of scientific research in this country quite apart from the personal difficulties of those who may wish to engage in it. He complains that "the chief difficulty I have had to contend with has been the impossibility of obtaining in Dublin, in the same locality, the two essentials for experimenting, namely, a laboratory and a botanical garden. The appliances of a chemical laboratory must be within easy reach of the plants to be experimented on; if not, then errors are sure to be made; and as much time would necessarily elapse between procuring the plant for experiment and the commencement of the experiment itself, the results obtained would certainly be untrustworthy. In fact, the nearer the plants are to the laboratory the better; the results will be more accurate, and the experiments much more easily performed. . . . A large number of most interesting and valuable experiments might be made if only a few pieces of apparatus could be placed near the plants to be experimented on. A balance, a water-oven, spectroscope, and the like, are essential; while the few chemicals and small pieces of apparatus could easily be had. There can be little doubt that the reason why so few physiological experiments are made in this country is to be looked for in the absence of the necessary laboratory accommodation near our gardens. In Germany and France the agricultural stations supply most of the researches in vegetable physiology. Here, however, all depends on private enterprise; and when there is an observer capable of undertaking experiments, he may not be willing to incur the expense of supplying plants and apparatus."

At the present time there is no place in the whole country where facilities for investigations in Physiological Botany are in any way afforded. Even Vegetable Chemistry is confined to the laboratories at Cirencester and Rothamstead, both private property and with a scope somewhat limited by their immediate relation to agriculture. Besides these it would be hard to mention, even in the whole British Empire, any other place where this kind of research is carried on, unless we except the Government manufactory of cinchona alkaloids under Mr. Broughton's charge on the Nilghiris, which has yielded, incidentally, new information on many interesting points. It is true that the Science Commission has reported in favour of opportunities for the pursuit of investigations in Physiological Botany being afforded in the Royal Gardens at Kew. But there seems but faint hope of anything of the kind being done—or in any adequate way. Even the action of our Universities, munificent as it has been in some directions, has been reactionary in this. As long as Dr. Daubeny was Professor of Botany at Oxford, the small chemical laboratory belonging to Magdalen College, adjacent to the Botanical Garden, was available for purposes of research of this kind. Now it is separated altogether, and used for purposes of college instruction. And it may be added that this laboratory will always be a classical spot as having been the place where the first researches on the relation of light of different degrees of refrangibility to the elimination of oxygen from tissues containing chlorophyll were carried on. Hunt, Draper, and Sachs have arrived at a better knowledge of the subject, but Daubeny was able to show first that the effect is principally due to the influence of rays in the neighbourhood of the yellow portion of the spectrum, and that those of higher refrangibility are practically destitute of any influence in the matter—a result, even now, that it is firmly established far indeed from being *à priori* explicable.

So much has now been clearly worked out in respect to the physical details of the "vital" processes of plants,

that it would be eminently desirable to have in each of our older universities the very simple and moderate accommodation attached to their botanic gardens which is needed, if only for giving students an opportunity of going over for themselves biological phenomena so fundamental in their general character and so comparatively easy to investigate.

THE SECOND GERMAN ARCTIC EXPEDITION

The German Arctic Expedition in 1869-70, *and Narrative of the Wreck of the "Hansa" in the Ice.* By Capt. Koldewey, Commander of the Expedition, assisted by members of the Scientific Staff. With numerous Woodcuts, two Coloured Maps, two Portraits on Steel, and four Chromolithographic Illustrations. Translated and Abridged by the Rev. L. Mercier, M.A. Oxon; and edited by H. W. Bates, F.L.S., Assistant Secretary, R.G.S. (London: Sampson Low and Co., 1874.)

THIS well-told and extremely interesting narrative of the fruitful German expedition to East Greenland in 1869-70 strongly confirms what we have said in our leading article with regard to the necessity of Government undertaking arctic exploration in order that it may be carried on with the greatest efficiency, the wisdom of choosing the route by Smith's Sound, and the valuable results that may be looked for from an expedition organised on a broad and liberal basis and carried out in a thoroughly systematic manner.

This expedition was initiated at Bremen shortly after the return of the first German Arctic Expedition, by Dr. Petermann, Capt. Koldewey, and a few others who are eager to advance the exploration of the polar regions, the object being to penetrate into the still unknown heart of these regions, making the east coast of Greenland the basis of operations. An elaborate plan of exploration was drawn out, which included the solution of nearly all the questions with respect to the arctic regions that yet remain unsolved. The funds were to be raised by public subscription, and the large committee of eminent scientific men who undertook the organisation of the expedition worked enthusiastically to get it set afloat. The scheme was well received by the German public. It was calculated that the whole expenses of the expedition would amount to 10,500*l.*, and we are glad to see that all this was obtained, and even additional expenses paid off after the return of the expedition.

As might be surmised, this sum was adequate for only a modest expedition; it is calculated that our Government expedition will cost at least six times that amount. Two small vessels were procured to carry the members of the expedition, the *Germania* and *Hansa*, the latter to act as tender to the former. The *Germania* was built expressly for the purpose, was a small two-masted screw steamer of 143 tons burden, thoroughly well sheathed and adapted for ice-navigation; for a ship of its size, indeed, it could hardly have been better fitted than it was to struggle with all the dangers of ice-navigation. The *Hansa* was a schooner of 76¾ tons burden, which had been built in 1864; as she was to act as tender to the *Germania*, she does not seem to have been so strongly armed as the latter. The internal fittings, provisioning, and general equipment were all that could be desired, considering the modest sum with which the organisers had to work.

The commander of the expedition was Capt. Koldewey, thirty-two years of age, an experienced arctic navigator and an enthusiast for arctic exploration, who by scientific study had added to his practical qualifications for the command of such an expedition; Capt. Hegemann ruled on board the *Hansa*. The narrative of the expedition contains a brief sketch of the career of each of the scientific members of the expedition, all of whom seem to have been well qualified for their particular work. Physics, astronomy, botany, zoology, geology, and geodesy each had its representative, and on the whole we are bound to say the interests of each department were well cared for. One of the most efficient and hardest working members of the expedition was Lieut. Julius Payer, then twenty-seven years old, and now so famous in connection with the successful Austro-Hungarian expedition. There was an Englishman on board, Dr. Copeland, who, along with Dr. Börgen, undertook astronomical and physical science, as well as geodesy. Dr. Pansch was well qualified to look after the botany; and Prof. Dr. Laube, of Vienna, was zoologist on board the unfortunate *Hansa*. Still, the narrative must forcibly impress any careful reader with the idea that the scientific staff was far from adequate for the work of thorough arctic exploration; officers and men worked heart and soul to carry out the objects of the expedition, and the results obtained are well worth the money expended; but at almost every step it was evident that the work was greatly hampered for want of men.

The two ships, with well-assorted staffs and crews, left Bremerhaven on June 15, 1869, in presence of his Majesty the King of Prussia, who showed the warmest interest in the expedition. They went joyously on their journey, everyone on board in excellent spirits, the scientific staff making what observations were possible on the life and temperature in sea and air. This part of the narrative, as indeed the whole story of the expedition, is told with a most charming simplicity and freshness, which has been well kept up in the English abridged translation. The solitary and rugged Jan Mayen was sighted on July 9, but the almost eternal mist forbade any attempt at landing. Both *Germania* and *Hansa* struck the ice on July 15, the former in 74° 47′ N. lat. and 11° 50′ W. long., and the latter in 74° 57′ N. and 9° 41′ W. The two ships had lost sight of each other on July 10, and did not meet again till the 18th, keeping in sight of each other among the ice till the 20th. On that day the *Germania* signalled to the *Hansa* to come within hail, which unfortunately Capt. Hegemann misunderstood, and kept further off; the two ships did not meet again. Up to this time they had been sailing northwards, mostly in dense fogs, trying to find an opening through which they might penetrate through the ice-line, so as to get as near the land as possible. As no favourable opening could be found, the ships turned southwards, agreeing to meet at Sabine Island. Shortly after the *Hansa* got caught among the ice, with which she continued to struggle heavily, and by August 14 was hopelessly involved in the impenetrable masses. From this time she was at the mercy of the ice, with which she drifted south until Oct. 21, when, in 70° 52′ N. and 21° W., she was crushed between the heavy

floes and sank. Happily, those on board had for some time before begun to fear the worst, and transferred from the *Hansa* to a large floe a considerable proportion of the movables on board, including three good boats. They were, indeed, more fortunate than the nineteen people belonging to the *Polaris*, who found themselves in a similar position, very inadequately provided for. The men of the unfortunate *Hansa* proceeded to make themselves as comfortable as possible on their drifting island of ice, which at first was about seven miles in circumference. Among the stores which were transferred to the ice was a large quantity of coal in well-squared blocks, with which a wonderfully comfortable house was built, surrounded by a sort of snow wall, the space between which and the house was covered over. The story of the life of the *Hansa's* crew on their drifting floe is very well told; and although of course they were not quite so comfortable as if they were sailing in a good ship on a sunny sea, still their hardships appear to have been by no means great—not so great, we think, as those which the officers and crew of the *Germania* had to undergo in carrying on the work of the expedition. No one seems to have been seriously affected in health by the journey, and all kept in wonderfully good spirits. The floe occasionally came to grief, and its dimensions became gradually diminished; in January it suffered such a terrible break-up that a new house had to be built. Neither officers nor men—fifteen in all—gave themselves

FIG. 1.—Regenerated Glacier in Franz-Joseph's Fjord.

up to idleness; observations were being continually made, and this part of the narrative will be found to contain a good deal of valuable information as to the fauna and flora met with, the state of the ice, the currents, and on the geographical and geological features of the land. At last, on May 7, in 61° 12′ N., the company quitted the floe and took to the boats, after having been on the former for 200 days. Even then it was not all plain sailing, as they had often to stay for days on floes, dragging the boats after them. At last, however, they got fairly away, and on June 13 reached the Mission Station of Friederickstha1, near the south point of Greenland, in 60° N. lat., eight months after their little ship went down about 700 miles further north. It is needless to say the fifteen men were most hospitably entertained by the good missionaries. After staying here a short time they went by Lichtenau to Julianshaab, a town further up the west coast of Greenland. Here they were taken on board a ship bound for Copenhagen, which, after visiting Frederickshaab, still further north, started for Europe about the end of July, and landed them in Copenhagen on Sept. 1. During the stay of the *Hansa's* crew in the south-west of Greenland, the officers made many valuable observations on the people and the geology of the country. The natives in these parts are very different in *physique* from those on the west coast, as well as from those who live much further to the north; they bear on their features the unmistakable marks of a large infusion of European, mainly Danish, blood, and in their habits they are altogether more civilised than the genuine aborigines. Dr. Laube

was indefatigable in his investigations on all points of scientific interest, and geographers and antiquaries will be delighted with the latest information respecting the remains of the first Norse colonists, the European discoverers of Greenland ; an illustration is given of what are supposed to be the ruins of Erik Randa's house.

It would be impossible, within the limits of a review, to give any adequate idea of the work of the more fortunate *Germania*. After sailing about among the ice till the 5th of August, she dropped anchor in a small bay on the south of Sabine Island, in about 74½° N., which was ultimately to be her winter harbour. From here an attempt was made to advance northwards, but the task was given up as hopeless, after repeated attempts and the most anxious observation and consultation, and the *Germania* never got further north than 75½°. The ship returned to its first anchorage on the south side of Sabine Island, where she remained from Sept. 13, 1869, to July 22, 1870. The position chosen was a well sheltered one, both on the north and south, and although subjected to fearful storms the stout little steamer bravely weathered the long winter, and left Greenland with nothing wrong but a leaky boiler. The officers and crew seem to have been as comfortable as they could be on board a ship of the *Germania's* accommodation, and nearly the whole winter through they were kept pretty regularly supplied with fresh meat, as the district around abounds with musk-oxen, reindeer, hares, foxes, not to mention seals, fish, and feathered fauna. An observatory was established on shore, and a valuable series of meteorological and magnetic observa-

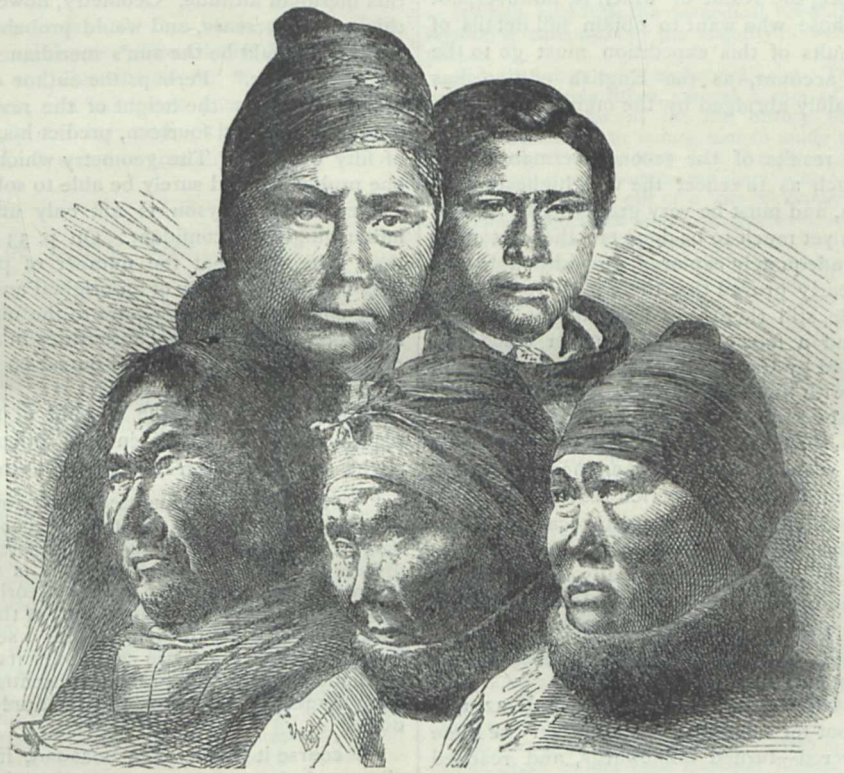

Fig. 2.—Group of Esquimaux.

tions made, as well as observations on the tides and currents. Several sledge journeys were organised in autumn, spring, and summer ; and notwithstanding the great hardships from which those who went on these journeys suffered, from insufficient sledges, want of draught dogs, inadequate shelter, insufficient food, and generally deficient equipment, as well as from the wretched state of the ground, so unfavourable to sledge travelling, a wonderful amount of scientific work was accomplished between Cape Bismark on the north, a little south of the 77th parallel, and the magnificent inlet discovered by the expedition, which indents the coast a little north of 73°, and which has been named Kaiser Franz-Joseph's Fjord. Anyone who compares the map of this stretch of coast which accompanies the volume with previous maps of Greenland will see at once that our geographical knowledge of the East Greenland coast has been largely added to as well as corrected by the expedition. The mountain scenery and glaciers of this stretch of coast are very grand, and attain almost Alpine dimensions and magnificence in the many-armed Franz-Joseph Fjord. Lieut. Payer gives an admirable account of the scenery, geology, and glacial features of the latter, which is well helped out by the engravings and chromolithographs that illustrate his account. One peak, "a pyramid of ice," Payer calls it, rising 11,000 ft. above the sea far to the west of the Fjord, was named after the accomplished geographer Petermann.

But we cannot enter into details. Botanists will find plenty to interest them in these pages, as a very full account is given of the almost incredibly abundant flora of the region ; a whole chapter is devoted to an

account of the habits and appearance of the larger fauna, which is so plentiful that no expedition need suffer from want of food; the geology of the coast and islands was well investigated, and coal was found to abound in some districts; dredging also was occasionally carried on, but with no very fruitful results. Clavering, forty years ago, met with a considerable number of natives in this part of East Greenland; not one is now to be found, though the remains of their huts, burial-places, weapons, and utensils abound. The map shows that careful and frequent soundings were taken, and the book contains some very valuable observations on the nature of the ice of these regions, and especially on the difference between the Greenland glaciers and those of the Alps. We find also that a spectroscopic examination was made of the deep blue light of the ice, the result of which is, however, not given. Indeed, those who want to obtain full details of the scientific results of this expedition must go to the original German account, as the English edition has evidently been mainly abridged by the omission of scientific details.

Altogether, the results of the second German Arctic Expedition are such as to reflect the very highest credit upon its members, and must be very gratifying to its promoters. There is yet much to be done ere the east coast of Greenland is adequately explored, and although this expedition has clearly proved that there is no road to the pole from that side, still there is undoubtedly on the east coast of Greenland a fertile field for further discovery. All this is admitted by Capt. Koldewey in his conclusion, and we coincide with him in believing that if an English expedition to West Greenland through Smith's Sound, and a German one to East Greenland, started at the same time, they would, with our present experience and means of assistance, certainly lead to very rich results. Happily, an English expedition on an adequate scale is being organised; let the German Government emulate the liberality of ours, and send out an equally well-equipped expedition, to continue, if not to complete, the work of the *Germania* on the other side of Greenland. If it so please the Germans, let it be a race to the pole, and let Dr. Petermann be umpire.

The *Germania* left her winter-quarters on July 22, and after coasting about for some time—it was then the large Fjord was discovered—turned homewards, and reached Bremerhaven safely on Sept. 11.

The translation and editing are carefully done, and the numerous and well-executed illustrations add greatly to the value of the work, which well deserves a wide circulation.

DRAYSON'S "PROPER MOTION OF THE FIXED STARS," ETC.

The Cause of the Supposed Proper Motion of the Fixed Stars, and an Explanation of the Apparent Acceleration of the Moon's Mean Motion; with other Geometrical Problems in Astronomy hitherto Unsolved. A Sequel to the Glacial Epoch. By Lieut.-Col. Drayson, R.A., F.R.A.S. (London: Chapman and Hall, 1874.)

THIS book, the author tells us, is a sequel to "The Cause, Date, and Duration of the Last Glacial Epoch," of which we published a short notice last year. The last work was founded on misconception and ignorance, and in this respect the one may fairly be called a sequel to the other. In our remarks on "The Glacial Epoch" we objected to the author's attempt to solve a problem in physical astronomy by geometry alone. The author, however, is unconvinced. His geometry, it is true, is a much more powerful instrument than anything of the same name which we have had the fortune to meet with so far. On p. 4 of the present work he thus compares the powers of observation and geometry:—"Mere observation can never arrive at any result until the whole cycle, and perhaps many cycles, have been observed. For example, if the sun's mid-day altitude were observed on the 1st of January of any year, and again on the 1st of February and 1st of March, observation alone could tell us nothing more than that there was a certain increase in this meridian altitude. Geometry, however, could analyse this rate of increase, and would probably be able to predict what would be the sun's meridian altitude for every day in the year." Perhaps the author could, by his geometry, if he knew the height of the reviewer at the ages of ten, twelve, and fourteen, predict his height at the age of fifty or sixty. The geometry which could solve the one problem would surely be able to solve the other.

Lieut.-Col. Drayson is not only unconvinced; he is unblushingly self-confident. On p. 33 we find: "When, then, it happens that the number of persons capable of judging independently of an original and difficult problem in geometrical astronomy, are to the number who are the mere blind followers of 'authorities in science' as about one to ten thousand, we find ourselves in a considerable minority."

On the other hand, the amount of reliance which he places upon the intelligence of other persons is very slight, as may be seen from the following quotations:—

"To a person unacquainted with geometry there seems nothing unsound in stating that the centre of a circle can vary its distance from the circumference and yet still always remain the centre; and this is the statement now put forward as correct by certain theorists."

"In our work, 'The Cause, &c., of the Glacial Epoch,' we called attention to the fact that it seemed improbable that the centre of a circle could vary its distance from its circumference and yet remain the centre, although it had been agreed during nearly two hundred years that it could do so."

Of course it would seem unsound, improbable, impossible, and absurd to anyone who had formed his ideas of a circle from Euclid's definition; and to us it seems almost inconceivable that anyone can really believe or profess to believe, what the author here and in almost innumerable other passages in his books so confidently asserts, that this absurdity is taught or even thought of. The author certainly never proves that such is the case. The special views of Lieut.-Col. Drayson with reference to the movement of the axis of the earth in space we will let him state for himself:—

"It is here demonstrated that during 230 years we can calculate what the obliquity was to within one second; that is to say, the actual curve traced by the pole of the heavens relative to the pole of the ecliptic during 230 years does not differ one second from the circumference of a circle having a radius of 29° 25′ 47″, and its centre 6° from the pole of the ecliptic. In other words, the curve traced by the pole of the heavens during 230 years *is* part of a circle such as that defined above."

On the previous page we find his opinion of his own exploit, for he there tells us: "This calculation is, perhaps, the most rigid geometrical investigation that has ever been applied to an astronomical problem."

Perhaps our readers will scarcely credit the statement that, notwithstanding this proud confident boasting, there is no *investigation* at all. All the author does is to draw a circle, which of course he can draw through three points, which are different positions of the earth's pole, and then, because his circle always passes within one second of the different positions of the pole for a couple of hundred years, we are asked to take it as proved that the pole always has been and always must be on this circle.

The extreme proximity of two curves for a comparatively short distance is no criterion of their being coincident.

The author, in the preface to this work, makes some strictures on our remarks on "The Glacial Epoch." In these he mistakes our illustrations for arguments, misquotes our objections, and misstates our arguments. It is impossible to reply, and it is perhaps as well; we have already given too much space to this author.

OUR BOOK SHELF

Degli Studi Fisici di Ambrogio Fusinieri: Commemorazione per Enrico dal Pozzo di Mombello, Professore di Fisica nell' Università Libera di Perugia. (Foligno, 1874.)

THIS dry little book gives an account of the works of Fusinieri which related chiefly to endosmose, capillarity, adhesion, and other molecular actions; also to static electricity and to magnetism. He published a work in 1844 on "Molecular Mechanics, and a Repulsive Force in the Ethereal Medium," which we have never seen, but which would surely be of interest now in connection with Mr. Crookes's experiments on repulsion by heat in a vacuum; in 1846, a memoir on Light, Heat, Electricity, Magnetism, and Electro-magnetism; in the following year a memoir on Meteorology; and altogether many small occasional memoirs. The second part of Prof. dal Pozzo's works is a critical inquiry into the work entitled "The Unity of the Physical Forces," published in 1864 in Rome by Father Secchi; and the third part contains some biographical notices of Fusinieri. The book is unillustrated, and has no felicities of style to recommend it; the students of the Free University of Perugia must be devoted scientists if they purchase the book and manage to read from beginning to end of it.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Royal Agricultural Society and the Potato Disease

THE paragraph which appeared in your last week's issue is so far interesting that it amply confirms the expectations of those who have watched the well-meant efforts of the Royal Agricultural Society with respect to the potato disease. I wish to advert to it for two reasons. In the first place, it is interesting to see the way in which a matter of this kind is regarded by so influential a body. Here is a disease annually effecting the destruction of a larger or smaller part of a chief item in the food of the community, which has already produced a famine in one of the three kingdoms, and any year may produce another, and which for the last thirty years has seriously occupied the attention of scientific men throughout Europe. Is it not surprising that the Royal Agricultural Society should think the offer of a 100*l.* prize for an essay in any way an adequate method of dealing with the subject? In the first instance, the time for sending in the essays was actually fixed so as to prevent the competitors from even going over the life history of the fungus during one season before competing. This was pointed out, and the time was prolonged. But though the competition was advertised abroad in the German papers, nothing of any importance was elicited beyond what was already well known.

The Society then determined to offer prizes for disease-proof potatoes. The utter futility of this proceeding was clearly obvious to anyone in the least acquainted with the subject. But it was done, and possibly if the "botanic referee" liked travelling about the three kingdoms, his time was not wasted. But the result is exactly what it was predicted it would be.

Now, it seems to me that this spasmodic and ill-considered way of dealing with a serious subject contrasts, to an extent that it is impossible quite to regard with satisfaction, with the course that would be adopted in such a matter in other countries. It shows, at any rate, how little the methodical scientific method of investigation is understood by the majority of well-informed English people.

And this brings me to my second point. The Society, anxious not to be entirely foiled, offered a sum of money to a well-known investigator of the life history of fungi, Prof. de Bary, of Strasburg, to induce him to study the potato disease. Considering that De Bary had already written an admirable memoir on the *Peronosporeæ*, there was a certain simplicity in supposing that the gift of a sum of money would elicit some additional information which his zeal as a scientific investigator had failed to do. If it does, however (and the history of the *Peronospora infestans* is not perfectly understood), it will be a clear gain; but when we are told that "Prof. de Bary has worked out the scientific questions that occur as to the origin of the disease," and that "it is owing to a fungus (*Peronospora infestans*) which attacks the leaves first, and after absorbing the nutriment of them, utilises the petiole, and thus reaches the tubes" (*sic*), it is necessary to point out that all this and a good deal more was ascertained by the Rev. M. J. Berkeley in this country, and by Montagne in France, and published by the former in a paper contributed to the first volume of the Journal of the Horticultural Society in 1846.

Nov. 20 W. T. THISELTON DYER

Zoological Gardens, Regent's Park

HAVING lately visited some of the Zoological Gardens on the Continent, and on my return compared those in the Regent's Park with the recollection of the former, I have been impressed that the latter appear to stand in need of much improvement.

In the first place, to adapt them to modern ideas of sanitary science, we should consider they are much *too small in area* for the number of inhabitants, especially as several of these are of gigantic size, and many others need naturally much space for exercise.

The *carnivora*, when bred and reared in dens of too small extent, begin to lose their muscular fulness of body, and what muscle remains becomes degenerated, and some members of their litters, reared in captivity, get affected with symptoms of paraplegia, with weakness in the buttocks and posterior limbs.

Proprietors of travelling menageries are in the habit of putting their carnivora and large animals through a series of *gymnastic performances*, which will be doubtless of as great benefit to their health as they are to the human species, and ought therefore to be introduced into our Zoological Gardens.

The *antelope and deer tribes*, being of nomadic disposition, should have much more space allotted to them than there is at present in the Gardens, where should be provided means for grazing and browsing in the open air, in full sunlight, and with free exposure to the winds, to ensure healthy digestion and complete aëration in the lungs.

In a city so well provided with water as London is, one must be surprised at the *scantiness of the supplies* afforded to some quadrupeds and birds, whereby what little exists very soon gets soiled and unfit for bathing and drinking purposes. These basins and ponds are seldom to be seen filled with aught else than ditch water, and are as dirty as horse ponds, whereas there might easily be designed and constructed a plan for a constant supply of fresh water to run in, and the foul water out, and thus ensure purity and cleanliness.

The casual visitor must also enter a protest against the unclean state of the cages of the *Raptorial Birds*, which are splashed all over with ordure, offensive to the sightseer in appearance and smell, and injurious to the health and plumage of the birds themselves.

The *drainage* of the Zoological Gardens is also so defective as to be verging on a public nuisance to the inhabitants of the banks of the Regent's Canal, so that some means must soon be taken for the better disposal of the sewage.

If facilities do not exist for extending the area of the Regent's Park Gardens, from want of power to acquire more ground, then it should become a serious question whether or not a supplementary Garden might be obtained in the suburbs further off. It could scarcely be expected that the subscribers would relinquish the retention of the present position, on account of its advantageous situation in the town for the access of visitors. It is quite possible visitors might be satisfied with much *fewer animals to see*, especially of those unattractive in appearance and habits, and it could easily be decreed that all these might be sent to another garden for scientific purposes alone.

Further, the *second garden* might be appropriated for breeding purposes, and change of air and locality for the usual inhabitants of the old enclosures and dens and cages, when the latter were required to be repaired or disinfected; and finally, it might be used as a *sanatorium* for the sick, and an asylum for the decrepid and disabled members of the stock, when their further exhibition in public is no longer desirable.

The great prevalence of *tubercular and scrofulous diseases* reported to exist amongst the animals should also be cited as indicative of a necessity for increased space and ventilation being required in the gardens, and it is much to be desired that some *statistics* of this class of disorders should be compiled and published for general information, giving details of its greater or less frequency in special classes of quadrupeds, birds, reptiles, and fishes.

VIATOR

IT has often occurred to me that the officers in charge of our Zoological Gardens enjoy exceptional opportunities of ascertaining experimentally the limits of the intellectual and educational capabilities of the animals under their charge, but I am not aware of the existence of any systematic effort to realise the harvest of valuable and interesting information that lies here waiting to be gathered. Is not this an object worthy of the attention of the Zoological Society?

Nov. 17

C. TRAILL

NOTE ON THE DEVELOPMENT OF THE COLUMELLA AURIS IN THE AMPHIBIA*

IN his paper "On the Structure and Development of the Skull of the Common Frog" (Phil. Trans. 1871), Mr. Parker states that, in the fourth stage of the tadpole,† "the hyoid arch has made its second great morphological change; it has coalesced with the mandibular pier in front and with the auditory capsule above (Plate V. Figs. 1—4, and Plate VI. Fig. 8, *s.h.m.*, *i.h.m.*) The upper part, or supra-hyomandibular (*s.h.m.*), is attached to the auditory sac much lower down and more outward than the top of the arch in front. . . . This upper distinct part is small; it answers to only the upper part of the Teleostean hyomandibular; there is a broad sub-bifid upper head answering to the two ichthyic condyles, then a narrow neck, and then behind and below an 'opercular process' (*op.p.*) Below this the two arches are fused together; but the hyoid part is demonstrated just above the commencement of the lower third, by the lunate fossa for the 'styloid condyle' (Plate V. Figs. 2 and 4, *st.h.*)" (pp. 154, 155).

In the sixth stage:—"The supra-hyomandibular (Fig. 3, *s.hm.*) has become a free plate of cartilage of a trifoliate form" (p. 164).

In the seventh stage:—"The 'supra-hyomandibular' losing all relation to the hyoid arch, becomes now part of the middle ear. . . . The *essential* element of the middle ear, the stapes (*st.*), was seen in the fourth stage; the condyles and opercular process of the hyomandibular are now being prepared to form an osseo-cartilaginous chain from the 'membrana tympani' to the stapes. Under these conditions a new nomenclature will be required; and this will be made to depend upon the *stapedial* relationship of the chain, notwithstanding its different morphological origin.

"I shall now call the lobes of this trifoliate plate of cartilage as follows—namely, the antero-superior 'supra-stapedial,' the postero-superior 'medio-stapedial,' and the freed opercular process 'extra-stapedial' (*s.st.*, *m.st.*, *e.st.*)

"The stapes (*st.*) sends no *stalk* forwards to meet the new elements, but they grow towards it; this will be seen in the next stage" (pp. 169, 170).

As the question of the origin of the *columella auris* in the *Vertebrata* is one of considerable morphological importance, I have devoted a good deal of time, during the past summer, to the investigation of the development of this structure in the frog, and it is perhaps some evidence of the difficulty of the inquiry, that my conclusions do not accord with those enunciated by Mr. Parker, in the very excellent and laborious memoir which I have cited.

I find, in the first place, that there is no coalescence of the mandibular with the hyoidean arch, the latter merely becoming articulated with the former.

Secondly, Mr. Parker's "supra-hyomandibular" is simply an outgrowth of the mandibular arch from that elbow or angle which it makes, when the pedicle by which it is attached to the trabecula passes into the downwardly and forwardly inclined suspensorial portion of the arch. This outgrowth attaches itself to the periotic capsule, and, coalescing with it, becomes the *otic process*, or "superior crus of the suspensorium" of the adult frog.

The hyoid arch, seen in the fourth stage, elongates, and its proximal end attaches itself to the periotic capsule, in front of the fenestra ovalis and close to the pedicle of the suspensorium, which position it retains throughout life.

The *columella auris* arises as an outgrowth of a cartilaginous nodule, which appears at the anterior and superior part of the fenestra ovalis, in front of and above the stapes, but in immediate contact with it. It is to be found in frogs and toads which have just lost their tails, in which the gape does not extend further back than the posterior margin of the eye, and which have no tympanic cavity, as a short and slender rod which projects but very slightly beyond the level of the stapes, its free end being continued into fibrous tissue, which runs towards the suspensorium, beneath the portio dura, and represents the suspensorio-stapedial ligament of the *Urodela*.

This rod elongates, and its anterior or free end is carried outwards, in proportion as the tympano-eustachian passage is developed. At the same time, the free end becomes elongated at right angles to the direction of the rod, and gives rise to the "extra-stapedial" portion, which is imbedded in the membrana tympani. Ossification takes place around the periphery of the middle of the rod; thus the medio-stapedial is produced. The inner portion becomes the rounded, or pestle-shaped, supra-stapedial, but retains its primitive place and connections, whence we find it in the adult articulated in a fossa in that part of the periotic capsule which forms the front boundary of the fenestra ovalis, but in close contact with the stapes.

The *columella auris* of the frog, therefore, is certainly not formed by the metamorphosis of any part of either the mandibular or the hyoidean arches, such as they exist in the fourth stage of larval development.

It may be said further, that the *columella* undoubtedly *seems* to be developed from the side walls of the auditory capsule in the same way as the stapes, and some appearances have led me to suspect that it is originally in continuity with the stapes, but I am not quite sure that such is the case. Are we to conclude, therefore, that the colu-

* Read at the meeting of the British Association at Belfast, August 25, 1874, by Prof. T. H. Huxley, F.R.S.

† That is, when there is a branchial aperture only on the left side, and the hind limbs are rudimentary or very small.

mella is a product of the periotic capsule, such as the stapes has been assumed to be?

Here, I think, there is considerable ground for hesitation. It appears to me that the stapes is not so much "cut out" of the cartilaginous periotic capsule as the result of the chondrification of a portion of that capsule which remains unchondrified longer than the rest. Moreover, the *Urodela* all possess a band of ligamentous fibres which extends from the stapes to that part of the suspensorium with which the hyoid is connected, and to the hyoid itself. It is conceivable, and certainly not improbable, that this stapedio-suspensorial ligament represents the dorsal extremity of the hyoidean arch. But the *columella auris*, in its early condition in the frog, so nearly resembles the stapedio-suspensorial ligament partially chondrified, that it is hard to suppose that one is not the homologue of the other; in which case the columella, and even the stapes itself, may, after all, represent the metamorphosed dorsal end of the hyoidean arch or the hyomandibular of a fish. And it must be admitted that the relations of the portio dura nerve to the hyomandibular in such a fish as the Ray, speak strongly in favour of this view.

ON MIRAGE *

II.

WE will now modify our imaginary distribution of density in such a way as to adapt it to a convex earth. To do this we have merely to bend our diagram to the earth's curvature.

The result is shown in Fig. 3 (Plate I.), where the dotted line represents a level line coincident with a stratum of equal density in the earth's atmosphere, and, like any other level line, partaking of the general curvature of the earth. It is of the same length as the dotted line in our first diagram, and ordinates (offsets), equal to those in Fig. 1, are laid off from it, in normal directions, at the same number of equidistant points. The curves thus obtained possess all the properties, as regards foci and images, which we have pointed out as belonging to those of Figs. 1 and 2; and we can now afford to dispense with the difficult physical postulate of a diminution of density downwards from the plane of reference. One of the rays in Fig. 3 is everywhere concave downwards, and therefore the air which it traverses increases in density downwards.

If we suppose the law which gave Figs. 1 and 2 (Plate I.) to hold only on one side of the plane of reference, while on the other side of this plane the density is uniform, we shall have conjugate foci for points in the plane of reference, but for no other points. The conjugate foci will themselves be in the plane of reference, and the distance from any point to its conjugate will be constant. Rays coming to the plane of reference from the side on which the density is uniform will be bent round so as to meet the plane of reference again at a constant distance in advance of the points at which they entered, and the angle of emergence will be equal to the angle of incidence. More generally, whenever there is a layer of air in which the density diminishes very rapidly from one side to the other, while the density elsewhere is comparatively constant, rays entering this variable stratum from the denser side will (if their inclinations to the stratum are not too great) bend round in it and emerge from it again on the same side, as in Figs. 4 and 5. In Fig. 4 the dotted line may be supposed to represent a plane, beneath which the density diminishes more rapidly down to the ground (which is represented by the shading). In Fig. 5 the shading represents a stratum in which the density diminishes rapidly in ascending, the diminution being most rapid at the middle of the stratum. In both cases, the appearance presented to an eye at E will be nearly the same as if the rays had been reflected from a plane mirror behind and parallel to the stratum; I say *nearly* the same, because the position of the equivalent plane mirror will not be precisely the same for rays at different inclinations to the stratum. Objects will thus be seen inverted, without being necessarily either magnified or diminished. Fig. 4 is intended to illustrate the mirage of the desert, and Fig. 5 to illustrate the formation of inverted images in looming. In Fig. 4, tracing the three rays backwards from the observer's eye at E, the lowest of the three at the eye end is bent up just sufficiently to prevent it striking the ground, and then goes away to the sky, so that he will see the sky as if reflected from the ground. The second ray does not pass quite so near the ground, and it goes away to a lower part of the sky. The third ray follows a similar course, not descending quite so near the ground, and going off in a direction more nearly horizontal. We may suppose it to be terminated by a tree, hill, or other tall object, which will accordingly be seen reflected beyond the image of the sky.

Rays a little higher than this will escape the upward bending which has produced these effects, and which is due to the action of a comparatively thin stratum of air near the ground. The same objects which have been seen apparently reflected by the ground will thus be also seen erect in their true positions. The relation between the appearances of the true and the reflected objects is almost precisely the same as if there were a sheet of water occupying the place of the ground; and the flickering of the air as the hotter and colder currents ascend and descend will bear a close resemblance to waves ruffling the surface of the imaginary lake.

The earliest explanation of mirage, I believe, on record is that of Monge (*Ann. de Chim.* xxix. 207), one of the *savans* who accompanied Bonaparte in his expedition to Egypt. The following is the passage in the *Annales*, which purports to be an abstract of a memoir read at a meeting of the Institute, held at Cairo:—

"At sea it often happens that a ship seen from afar appears to be floating in the sky and not to be supported by the water. An analogous effect was witnessed by all the French during the march of the army across the desert. The villages seen in the distance appeared to be built upon an island in the midst of a lake. As the observer approached them, the boundary of the apparent water retreated, and on nearing the village it disappeared, to recommence for the next village. Citizen Monge attributes this effect to the diminution of density of the inferior layer of the atmosphere. This diminution in the desert is produced by the augmentation of temperature, which is the result of the heat communicated by the sun to the sands with which this layer is in immediate contact. . . . In this state of things the rays of light which come from the lower parts of the sky, having arrived at the surface which separates the less dense layer from those which are above, do not penetrate this layer; they are reflected, and thus form in the eye of the observer an image of the sky. He thus sees what looks like a portion of the sky beneath the horizon, and it is this which he takes for water."

The only objection which I think can be taken to this explanation of Monge, is that it seems to imply not a curvature, but an angle, in the course of the rays, just as in the case of what is called *total internal reflection* at the bounding surface of a piece of glass when the angle of incidence exceeds the critical angle.

Now, the formation of an angle (even a very obtuse angle) in a ray would require a perfectly sharp transition from one degree of density to another, instead of the gradual transitions which are more in accordance with our knowledge of the properties of air. We have shown that no such harsh supposition is necessary.

As to the propriety of applying the name *reflection* to

* A Paper read by Prof. J. D. Everett, M.A., D.C.L., before the Belfast Natural History and Philosophical Society. (Continued from p. 52.)

an action such as that represented in Figs. 4 and 5, it is perhaps just as proper as the application of the name *refraction* to the bending of rays which takes place in the atmosphere; the term refraction being primarily employed to denote bending not into a curve but into an angle, at places where a ray passes by a sharp transition from one medium into another.

The shaded region in Fig. 5 represents a portion of the atmosphere in which there is a rapid diminution of density upwards. We may regard it as the region of intermixture, between two portions of air, which differ greatly from each other in density, the denser portion extending downwards to the earth without any very rapid changes, and the rarer portion extending in a similar gradual manner upwards to the clouds. If these two dissimilar portions of air have been only recently brought into proximity, as by the commencement in the upper regions of a wind from some warm quarter, we should expect to find a border tract, where the transition would be unusually rapid, the border tract itself being indefinite in its boundaries above and below, and the transition being most rapid in its central parts. The figure has been drawn to suit these suppositions, and it shows, besides two rays which have been reflected, a third ray which has barely been able to get through.

Anyone who is fresh from the study of optics will be at once struck with the analogy between the behaviour of these rays and of rays passing or endeavouring to pass from water into air; and the analogy is quantitative, as well as qualitative. For—

1. As regards those rays which get through, it can be shown that the total change of direction for a ray of a given incidence depends only on the densities above and below the region of intermixture, and is altogether independent of the thickness of this intermediate region. This is on the assumption that the surfaces of equal density are parallel planes. If, as in the case of air, the extreme relative index of refraction differs but little from unity, the change of direction is proportional to the tangent of the angle of incidence, and is equal to the

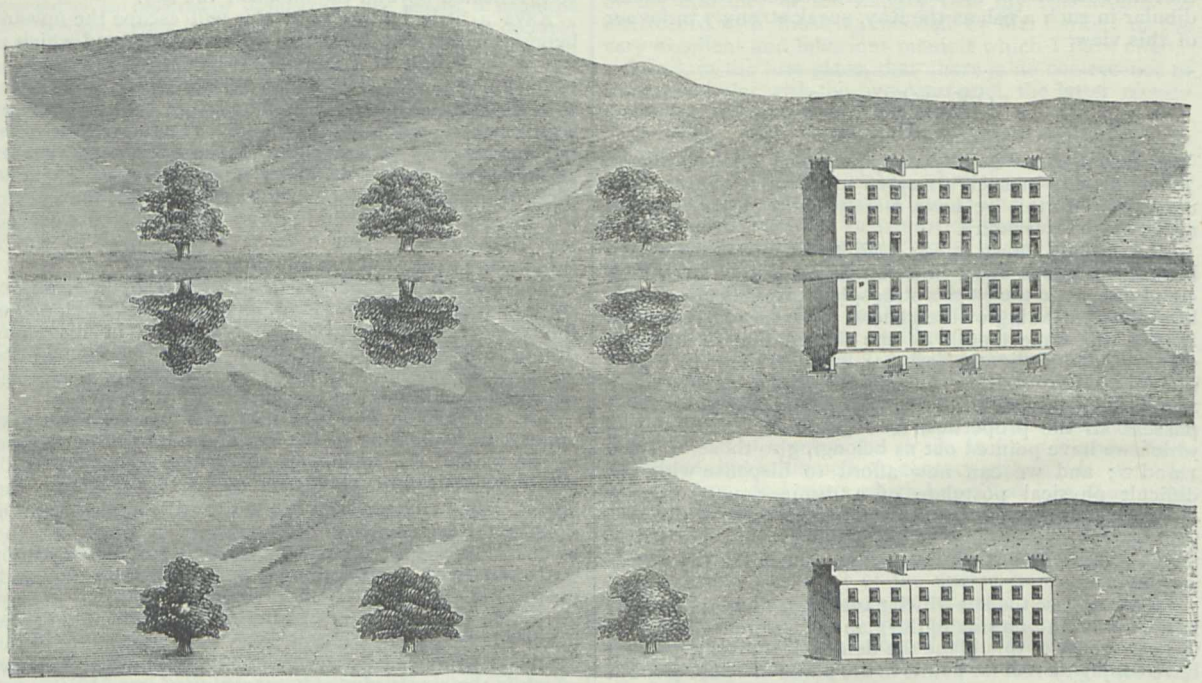

PLATE III.

product of this tangent by $\mu-1$, μ denoting the relative index. This is the law which governs the refraction of rays from the heavenly bodies, in traversing the earth's atmosphere; except when these bodies are so near the horizon that the curvature of the earth and its atmosphere produces a sensible effect.

2. As a consequence of the preceding point of agreement, the critical angle which separates those rays which get through from those which are turned back, is also dependent solely on the comparison of the two extreme densities; that is, on the value of the relative index of refraction.

In the comparatively rare instances in which several inverted images of the same object have been seen in the sky, as in the third figure of Plate II., which represents a elescopic appearance observed by Scoresby, a possible explanation may be found in irregularities of form in the stratum of intermixture, which, instead of being truly horizontal, may be tilted to slightly unequal degrees in different parts, so that it acts, not like *one* plane mirror, but like several plane mirrors slightly inclined to each other. Another, and I think more probable explanation, is the existence of more than one layer of rapid transition.

Whenever an image is inverted, the rays by which it is seen must have crossed; that is to say, the two rays which come to one and the same point of the eye from two neighbouring points of the object must have crossed each other once on the road. If they have crossed twice, the image will be erect; if three times, inverted; and so on.

When all the rays are circular arcs, and their curvatures are all equal, it will be impossible for them to cross, and hence no inverted image can be formed; neither can there in this case be any increase or diminution of apparent size. This is evident from the consideration that a diagram indicating the paths of such rays to the eye only needs to be bent with a curvature equal and opposite to that of the given rays, in order to render all these rays straight; and such bending will not affect the sizes of the images.

If, however, our rays are circular arcs of unequal curvatures, we may have crossing, and may also have magnification or diminution. It is obvious, from Figs. 6 and 7, that to give a magnified virtual image without crossing, the upper ray must be bent downwards more than the lower one; and that if the lower ray be bent down more than the upper, the image seen will be diminished.

These rules must be borne in mind in attempting to explain that very common form of mirage in which distant objects are greatly magnified in their vertical dimensions, without any other change. Fig. 4 may help us to understand how this magnification arises. If we suppose an object to travel along between two of the rays which proceed from the eye, it is clear from the diagram that the object will begin to be sensibly magnified as it enters the region of rapid change, and the magnification will increase as the object nears the intersection of these rays, at which point it becomes infinite, which practically means that, if placed at this point, it will give rise to an appearance of the greatest possible confusion. As it travels further away between the same two rays it will begin to be again recognised by a highly magnified and inverted image. One of the commonest, I believe the commonest, form of mirage in Australia is one in which small bushes at a distance are magnified into trees; and I believe the foregoing to be the correct explanation.

The magnification over water which gives rise to the architectural columns of the Straits of Messina and of the polar regions is more probably to be explained by the action represented in Fig. 6, the region of most rapid change of density being at a height somewhat greater than that of the top of the object, so that the top is greatly elevated by refraction, while the bottom remains nearly in its true place.

The quasi reflection illustrated in Fig. 4 may be produced artificially by carefully depositing alcohol or methylated spirit, to the depth of about an inch, upon water contained in a glass vessel with plane parallel sides. The spirit, though lighter, has a higher index of refraction than the water; and at the place of intermixture of the two liquids we have a gradual but very rapid diminution of index in descending. On bringing the eye close to the vessel, and looking obliquely downwards towards this part of the liquid, very perfect inverted images will be seen. The field of view afforded by this arrangement is, however, extremely limited; and a much finer effect is obtained by the arrangement now before you, in which three liquids are employed, the middle one having the highest index of refraction, while its specific gravity is intermediate between those of the other two. The three liquids are—(1) A strong solution of alum at the bottom; (2) pure water at the top; (3) Scotch whiskey mixed with enough sugar to make its specific gravity intermediate between those of the other two liquids. It is introduced last by means of a pipette.

Plate III. represents the appearance which this arrangement afforded when set up at a window of my house looking towards the mountains.

Every object in the landscape was tripled, the three images being seen at once; and the vertical breadth of the strip of landscape thus tripled at one view extended from the top of the hills down to the houses on the Lisburn road. The figure only shows the more conspicuous objects. When the sun was shining on the front of the row of houses represented, which was nearly half a mile distant, I was able to see distinctly the chimneys and windows, and even to see whether the blinds were up, down, or half-way down. It was easy to fancy that the inverted trees and houses were the reflections of the upper ones in water. But a much more striking effect, as of water, was at the place which is left white in the figure, at the junction of the middle and lower image. This had all the appearance of a calm bay or lake glistening in the sunshine. There are only two natural objects to which this peculiar glistening belongs, with brightness far surpassing that of all the dry and solid parts of a landscape. One of these is water, and the other is the sky. A bit of sky has, in fact, been trapped between two portions of land; and it is a similar trapping of sky in the midst of dry land that produces the irresistible impression of a lake of water in the mind of the traveller in the desert. The middle image is probably formed by rays which have taken a path something like those in Figs. 1, 2, and 3. The highest and lowest image are formed by rays which have only been bent one way.

The arrangement of three liquids just described, which was suggested to me by Prof. Clerk-Maxwell, is extremely effective, but requires much delicacy in its preparation to ensure success.

Triple images of objects below the level of the vessel may be obtained by employing only the two first-mentioned liquids—alum water and pure water, or strong brine and pure water. A little gentle stirring is advantageous whichever arrangement be employed, a glass rod being inserted vertically, passed a few times slowly round the circumferential portion of the liquids, and then withdrawn.

With the two-liquid arrangement I have obtained three spectra, the middle one inverted, by employing as object a horizontal slit in the shutter of a dark room; and very brilliant colour effects were obtained by bringing the eye to the conjugate focus of the slit. A screen held at this conjugate focus, which was at first close behind the vessel of liquid, and slowly receded day by day, received an image of the slit very similar to that which would be formed by a cylindrical lens.

In order to see the three images (or spectra), it was necessary to hold the eye behind the conjugate focus. When it was held in front (that is nearer to the vessel), only two images were seen, sometimes only one, the middle or inverted image being always wanting.

A similar lengthening of focus day by day was observed with the three-liquid arrangement, which would doubtless yield similar colour effects.

*ON THE GEOGRAPHICAL DISTRIBUTION OF THE FALLOW DEER IN PRESENT AND IN PAST TIME**

NATURAL History shares with History the doubtful honour of having not a few chapters which are, to use a well-known expression of Talleyrand, nothing more than "des fables convenues," or which, in fact, contain generally accepted fabrications. To this shadowy side of science Geology gives the largest contributions, but Zoology, especially as regards the habits, habitats, and geographical distribution of animals, is by no means poor in them. Of the Fallow Deer (*Cervus dama*) it is generally stated in all zoological text-books, "It is a native of the Mediterranean area, and was introduced thence into Germany, Scandinavia, and England, after the Crusades." And yet the Fallow Deer was, many thousand years ago, not only an inhabitant of Africa and Western Asia, but also as much at home in Southern Russia, and even in Central Europe and Denmark, as in Italy and Southern France.

My researches into the geographical distribution of the Fallow Deer in former epochs have been caused (like those upon the history of the Domestic Fowl†) by a discovery in the ancient history of the city of Olmütz. In the same formation as the skull of the fowl there spoken of was

* By L. H. Jeitteles. Translated from *Der Zoologische Garten* for August 1874. [I have thought it desirable that this article should be better known, as even in such recent works as Mr. Boyd Dawkins' "Cave Hunting," and the new edition of Bell's "British Quadrupeds," the ancient fable of the Fallow Deer being *indigenous only in Southern Europe* is repeated.—P. L. S.]

† See *Der Zoologische Garten*, bd. xiv. pp. 55 et seq.

found, along with the implements and vessels of the old Bronze period, a piece of an antler, which, from its flattened form and entire want of snags and branches, I concluded at once must be referred to the Fallow Deer. Careful comparison of it with the antlers of the Red Deer, Reindeer, Moose, and Irish Elk, in several museums, as also in rich private collections, confirmed me in this belief. Experienced students of the Cervidæ agreed with me, although certainly a still more weighty authority—Herr Prof. Rütimeyer, of Basel—indicated the possibility of the fragment from Olmütz having belonged to a Red Deer.

In the third article of his "Recherches sur les ossemens fossiles," Cuvier has already mentioned the existence of fossil Fallow Deer. In page 191 (of the 8vo. edition of 1836) he speaks of "bois assez semblables a ceux du Daim, mais d'une très grande taille trouvés dans la vallée de la Somme et en Allemagne." On Plate 167 (Figs. 19*a* and 19*b*) are figured two pieces of antlers from Abbeville, of which 19 *b* certainly belongs to *Cervus dama*. Moreover, Cuvier tells of a drawing sent to him by Autenreith (of which he gives a copy, Pl. 168, Fig. 11), "d'un crâne et d'un merrain y adherent, deposés au cabinet de Stuttgardt; pièces que ce savant rapportait au cerf à bois gigantesques, mais qui me paraissent plutôt se devoir rapporter à le Daim, à cause de la longueur de la partie cylindrique."

Subsequently similar remains of antlers were discovered at Gergovia, near Clermont, in the department of Puy-de-Dôme, and at Polignac, near Le Puy, in the department of Haute-Loire. These are spoken of by Robert under the name *Cervus dama polignacus*, by Pomel as *Cervus somonensis* and *C. Roberti*, and by Gervais (Zool. et Pal. Franc. ed. 2, Paris 1859, p. 145) under the term *Cervus somonensis*, taken from Desmarest.

Gervais says of them that they are "des bois de Daims qui indiquent une espece ou variété bien plus grande que celle dont il a été question ci-dessus" (i.e. *Cervus dama*), and that these horns are "d'un tiers au moins plus grand que ceux du Daim ordinaire."

Georg Jäger, in his "Review of the Fossil Mammals of Wurtemberg,"* mentions numerous discoveries of the remains of Fallow Deer in the caverns and turbaries, as also in the diluvial fresh-water chalk of Wurtemberg. Moreover, Jäger states that in the Museum of Mannheim there is not only a skull of *Bos primigenius*, but also one of *Bos priscus* and of its ally *Bos prisco affinis*, along with a skull of *Cervus dama giganteus*, from the diluvium of the neighbourhood of Mannheim.

In the Museum of Linz, in Upper Austria, are displayed numerous remains of animals from the diluvium of the neighbourhood of Wels, which were dug up at Buchberg, near Wels, when the Elizabeth Railway was made. Besides a fragment of antler of a Red Deer, a molar of *Ursus arctos* (not *U. spelæus*), a fine molar of *Elephas primigenius*, and teeth of the horse, there is in the Linz Museum, labelled as obtained from the railway-cutting, a fine large fragment of an antler which must have belonged to the Fallow Deer. Like the fragment of the Red Deer's antler from the same locality, it is whitened and has a calcined appearance. I examined this interesting specimen several times in 1870 and 1873, and have to thank Herr Kaiserl. Rath Ehrlich, the custos of the museum, for a photograph of it.

In October 1873 I examined personally the formation at Buchberg, and convinced myself of its being truly diluvium. In many places it had been dug into deeply for gravel. The horns and teeth in the museum of Linz were apparently obtained from one of these pits in the diluvium, but lay in the marly layer which is found under the gravel.

Fragments of antlers undoubtedly belonging to the Fallow Deer were discovered in the autumn of 1828 by Dr. Fr. Aug. Wagner in the ash-heap of an old place of sacrifice between the town of Schlieben and the village of Malitzschkendorf, in the circle of Schweinitz in Saxony, in great abundance, along with those of the elk, ox, roe, and sheep.* Dr. Wagner, a physician in practice in Schlieben, made his researches with scientific precision, and determined the remains of the animals with care and exactness, as will be evident from his book, at the bombastic title of which one must not be alarmed. In the determination of the specimens of antlers he was assisted by the distinguished zoologist Prof. Nitzsch, of Halle. The specimen of elk's antler is figured (Tab. v. Figs. 3, 4, 5), but unfortunately none of those of the Fallow Deer. Besides remains of plants and animals, this sacrificial heap supplied bones of various sorts. As regards the Fallow Deer, Wagner writes (p. 34): "At various times in the excavation of the temple were found fragments of antlers which apparently belonged to the Fallow Deer. But as an entire specimen was never put together, nor even such fragments as could make the fact incontrovertible, it remains uncertain whether this species was sacrificed along with *Cervus alces*, and the subject requires further investigation."

Of a *Cervus fossilis damæ affinis*, Alex. v. Nordmann figures five teeth in his "Palæontologie Südrusslands."† But the Fallow Deer was found even further north in the period of the diluvium and in later prehistoric times. For example, in 1871, within the city of Hamburg, and subsequently from one of the arms of the Elbe, there were disinterred numerous upper and lower jaws and fragments which differed only in size from those of the living *Cervus dama*, and the teeth of which were nearly identical. These were associated with remains of the Auerox and another large *Bos*, and with bones of the horse, pig, &c. The remains first discovered lay in compact black peat at a depth of from 20 ft. to 22 ft. among stumps of trees.‡

In the "Bulletins du Congrès International d'Archéologie prehistorique à Copenhague, en 1869,"§ Steenstrup has given a short description of the remains of animals from the kitchen-middens and turbaries of Denmark, which were exhibited in the University Museum on the occasion of the Congress in 1869. Amongst them (pp. 160 *et seq.*) he includes the Fallow Deer, of which the horns and bones are found in the upper peat-layers of Denmark.‖ At the same time he adds, "Cet animal n'est pas originaire du Danemark: il est bien constaté qu'il a été introduit dans le pays pendant le moyen âge."

Of the occurrence of remains of the Fallow Deer in England also there is some evidence given, although with a caution as to the necessity of subsequent more accurate examination, by Owen in his "History of British Fossil Animals and Birds" (London, 1846.) From the peat-moor of Newbury were exhumed "portions of palmated antlers" and teeth "which accord in size with the Fallow Deer" (*op. cit.* p. 483.) Buckland likewise found in the large cavern of Paviland, on the coast of Glamorganshire, along with remains of the mammoth, rhinoceros, and hyæna, various antlers, "some small, others a little palmated." But Owen rightly remarks that these last may have belonged to the Reindeer just as well as to the Fallow Deer. ¶

* Nov. Act. Acad., Cæs. Leop. Car. xxii., pars post. 1850, pp 807, 893, 897, 899, 907.

* Detailed accounts of these discoveries are given in Dr. Wagner's "Ægypter in Deutschland oder die germanisch-sclavischen wo nicht rein germanischen Alterthümer an der Schwartzen Elster." Leipzig: Hartmann, 1833.

† Helsingfors, 1858-60, Pl. xviii. Figs. 4-8.

‡ Dr. K. G. Zimmerman in "Neues Jahrb. f. Mineralogie Geologie u. Palæontologie." Heidelberg, 1872, heit i. p. 26.

§ Copenhagen, 1872.

‖ Le Daim (*Cervus dama*.) Bois et ossements provenants des états supérieurs de la Vourte, *op. cit.* p. 162.

¶ Sir Victor Brooke tells me that in his opinion *Cervus brownii*, Boyd Dawkins, founded on remains from the fresh-water strata at Clacton, is identical with *C. dama*. Mr. Boyd Dawkins acknowledges that the antlers are almost alike in size and form, and apparently only distinguishes his species because *Cervus dama* "has never been found to occur in a fossil state in Northern or Central Europe."—P. L. S.

Among the remains of animals in the Swiss Pile-dwellings also have occurred fragments of horns apparently belonging to the Fallow Deer. Rütimeyer, in his "Fauna der Pfahlbauten der Schweiz," says as follows:—

"A number of flat bits of shed antlers with smooth surface, in the collection of Oberst Schwat, of Biel, found in the Lake of Biel, can, to judge from their dimensions and form, be only referred to the Fallow Deer. Similar bits from Meilen, perfectly agreeing with the abnormal forms which the Fallow Deer's antlers present in aged individuals, can only be referred to this deer. Yet I must remark that no perfect antlers of this animal from the Pile-dwellings have come under my observation, nor even examples of the skull, which, next to the antlers, would give the most certain indications of this deer. Incontrovertible evidence of the spontaneous existence of this deer north of the Alps remains therefore still to be obtained."

On the other hand, there is positive proof of the existence of this deer in the "Terremare" of Italy—the equivalent of the Swiss "Pfahlbauten." In the Museum of Modena are two fragments of antlers, which Prof. Canestrini has spoken of in his "Oggelti trovati nelle terremare del Modenese," and subsequently in Mortillet's "Materiaux pour l'histoire positive et philosophique de de l'homme." In 1870 Dr. Carlo Boni, former director of the Museum of Modena, had the kindness, at my request, to send these fragments to me at Basel (where I passed the winter of 1869-70), for comparison with my specimen from Olmütz, and Prof. Rütimeyer saw them too. He declared, as regards one of them (marked "624 Gorzano"), that it could not certainly be referred otherwise than to *Cervus dama*.

Besides Moravia, the Fallow Deer appears to have existed formerly in the bordering country of Lower Austria. At Pulkau, near Eggenburg, south of the Thaya, was found, in a sacrificial heap of former days examined by Dr. Woldrich, along with ancient vases, stone, bone, and horn implements, remains of the dog, ox, and Red Deer, likewise a fragment of an antler, which was "apparently a frontal snag of the Fallow Deer." *

In the Middle Ages the Fallow Deer still inhabited the woods of Switzerland, as appears from the benedictions of the monk Ekkehard, of St. Gall, of the eleventh century,† and as is shown by the German edition of Gesner's "Thierbuch,"‡ even at a later period. In the latter work it is said, p. 84: "Der gemeine Damhirsch wird an vilen anderen Orten gejagt, auch in den Wäldern d'Helvetieren als bey Lucern offt und vil gefangen: nennen es gemeiniglich Dam, Dämlin od.' Dannhirsch, besser Damhirsch."

In a Latin edition of Gesner's "Historia Animalium,"§ now before me, however, I find no notice of the presence of *Cervus dama* in Switzerland. It is only said (i. p. 308): "Nostra vero dama etiam in Europa capitur, cum alibi tum circa Oceanum Germanicum, ut audio. Germani vulgo vocant dam vel dämlin, vel dannhirtz, vel damhirtz potius; Itali daino, nonnulli danio: Galli dain vel daim: Hispani gamo vel corza."

In both editions of Gesner, moreover, Latin and German, the Fallow Deer is unmistakably figured.

According to the writing on Spekle's map of Alsace, there were Fallow Deer in Wasgau up to 1576.‖

In the neighbourhood of Rome, besides, have been found numerous fragments of Fallow Deers' horns, along with remains of *Hyæna spelæa*, *Cervus tarandus*, and *Rhinoceros megarhinus*, in a Post-pliocene travertine on the heights of Monte delle Gioie.¶

Finally, we may remark that the Fallow Deer appears to be figured upon the Assyrian monuments; and, moreover, so faithfully as not to be mistaken for any other species of deer. We have only to look at Plates xxxv. and liii. of Layard's "Nineveh" to see this. Again, amongst the pictures upon the walls of the Egyptian tombs this species of deer is found. Its hieroglyphical name is Hanen.*

We now come to the present geographical distribution of the Fallow Deer. Occasionally this deer still occurs wild in Western Asia. Tristram notices it as found in Mount Tabor, in Palestine, and in the woods between that mountain and the gorge of the Litany River,† and "met with it once about ten miles west of the Sea of Galilee." Lartet had previously obtained teeth of this deer from the bonebreccia of the Lebanon.‡

In Africa, according to Hartmann, the Fallow Deer is found at the present time in the shrubby desert-valleys and on the edges of the cultivated lands in Tunis, Tripoli, and Barquah, up to the Wadi Nahun.§ Gervais speaks of it as found in the neighbourhood of La Calle, in Algeria. ‖ Loche, in his "History of the Mammals of Algeria," says that it is now rare in that province.

In the Island of Sardinia, in Cetti's time, Fallow Deer were found in enormous quantities in all parts of the island, especially in the plain of Sindia.¶ Not less than 3,000 head were at that time killed every year in Sardinia. It is remarkable that in this island the Fallow Deer is called *Crabolu*, corrupted from *Capriolo*—meaning Roe, which last animal is not found in Sardinia; whereas the Red Deer is met with occasionally, especially in the eastern portion, but attains a much less size here than on the Continent. According to Bonaparte and Cornalia ("Fauna d'Italia") this species of deer is still common in above-named island.

In Spain it seems that the Fallow Deer is seldom found wild at the present time—at least A. E. Brehm, in his "Beitrag zur Zoologischen Geographie Spaniens" in the Berliner Zeitschr. f. Allgemeine Erdkunde (1858, s. 101), can speak from personal observation only of those he met with in parks. On the other hand, Graëlls mentions *Cervus dama* as an inhabitant of the Sierra Guadarrama. The Spaniards of the present day call the animal "Gamo" or "Paleto." According to Buffon (Hist. Nat. tome vi., Paris, 1756, s. 170), the Fallow Deer of Spain in his time was nearly as large as the Red Deer, and had a longer tail than the same animal in other parts of the world. Gérard (Faune Hist. de l'Alsace, s. 327) tells us that this deer is found to this day wild (*á l'état naturel*) in France, in Nivernais, the Cevennes, and in the Alps of Dauphiny. He gives no authority, and Gervais, in his "Zoologie et Paléontologie," says nothing about it.

As for Greece, Blasuis says, in his "Säugethiere Deutschlands," Braunschweig, 1857, s. 455, that Bélon found the Fallow Deer in the Greek Islands. But Erhard does not mention it in his "Fauna of the Cyclades." Von der Mühle, however, speaks of it in his "Beiträgen zur Ornithologie Griechenlands," 1844, s. 1.

From the foregoing data the following conclusions may be formed:—

1. The Fallow Deer lived in prehistoric times, partially in company with other extinct mammals on the Lebanon, in Southern Russia, Italy, France, Upper Austria, Wurtemburg, Baden, Saxony, near Hamburg, and in Denmark. It appears also to have occurred in Switzerland and in England, likewise in Moravia and Lower Austria.

2. Within the historic period it was found in Egypt and Assyria, and even in the later part of the Middle Ages in Switzerland and Alsace.

* See Woldrich in "Mitth. d. Anthrop. Gesellsch. in Wien," bd. iii. pp. 13 and 19, Pl. iv. Fig. 54 (1873).

† "Imbellem damnam faciat benedictio summam," vers. 128 of the "Bened. ad mensas Ekkehardi" in the "Mitth. d. Antiquar. Gesellech. zu Zürich," iii. p iii.

‡ Forer's edition: Heidelberg, 1606.

§ Editio secunda: Francofurti, 1620.

‖ Gérard, "Faune historique de l'Alsace:" Colmar, 1871, p. 328.

¶ Trutat et Cartailhac, "Matériaux pour l'histoire de l'homme," Vme. année 1869, p. 299.

* Hartmann in Brugsch, "Zeitschr. f. Ægypt. Sprache und Alterthumsk." Jahrg. ii p. 21.

† P. Z. S., 1866, p. 86.

‡ Bull. Soc. Geologique, France. Vol. xxii. p. 542.

§ Berliner Zeitschr. f. Erdkunde, 1868, p. 252.

‖ Zool. et Paléontol. Francaise. Ed. ii. p. 145.

¶ "I quadrupedi di Sardegna," 1774, pp. 104, 105.

3. It is still found wild in Western Asia, Northern Africa, and Sardinia, and apparently also in parts of Spain, likewise in Greece, and perhaps also in the Cevennes and parts of Dauphiny.

4. The size and strength of the antlers, as well as the dimensions of the skull, have decreased in the course of time. Skulls of the existing Fallow Deer as well as their antlers are smaller than those of the prehistoric period.

[P.S.—Lord Lilford, whose knowledge of the larger mammals of Southern Europe is very extensive, tells me that he has himself met with Fallow Deer wild in many parts of Sardinia, in Central Spain near Aranjuez, and in the province of Acarnani in Greece.

In December 1864 the Zoological Society received from Mrs. Randal Callander a small dark-coloured Fallow Deer from the Island of Rhodes, where, however, it may have been introduced by the Knights.

Lastly, I have lately received from Mr. P. J. C. Robertson, H.B.M. Vice-consul at Bussorah, the skin and horns of a "Spotted Deer," found wild in that part of Mesopotamia, which must belong either to the Fallow Deer or to a very closely allied species.—P. L. S.]

THE LATE SIR WILLIAM JARDINE

ORNITHOLOGISTS will learn with regret that Sir William Jardine, Bart., died, after a few days' illness, at Sandown, in the Isle of Wight, on Saturday last, the 21st of November, aged 74. The labours of the deceased baronet extend over nearly half a century. In 1825 he commenced, in conjunction with the late Mr. Selby, of Twizell, the publication of the "Illustrations of Ornithology," which seems to have been his earliest contribution to natural history, and almost immediately became recognised as one of the leading zoologists in Scotland, if not in the United Kingdom. In 1833 he undertook a still more important work, "The Naturalist's Library," forty volumes of which appeared in the course of the next ten years, and served to popularise in a most remarkable manner zoological knowledge among classes to whom it had hitherto been forbidden through the high price of illustrated works. With this publication, though its value may have been impaired by the progress of science, Sir William's name will always be identified; for, having as contributors Selby, Swainson, Hamilton Smith, Robert Schomburgk, Duncan, William Macgillivray, and others, he was yet not only the author of a large proportion of the volumes, but to each he prefixed the life of some distinguished naturalist. Of his labours, however, we cannot now speak in detail; it is sufficient to notice his excellent edition of Alexander Wilson's "American Ornithology," the establishment of the "Magazine of Zoology and Botany" (afterwards merged in the "Annals of Natural History"), and of the "Contributions to Ornithology." Sir William's expedition, with his friend Selby, in 1834, to Sutherlandshire—a country then less known to naturalists than Lapland—gave a great impulse to the study of the British fauna and flora, and almost marks an epoch in the history of biology in this island. Though ornithology was his favourite pursuit throughout life, Sir William was not merely an ornithologist—other classes of the animal kingdom had a fair share of his attention, and he was a recognised authority on all points of ichthyology. Botany and geology were also studied by him to advantage, and the science last named he enriched by his splendid "Ichnology of Annandale," the chief materials of which were found on his own ancestral estate. With all this he was keenly addicted to field-sports, and a master equally of the rod and the gun. Sir William married first a daughter of Mr. David Lizars, of Edinburgh, and by her had a numerous family, of whom the eldest daughter was married to the late Hugh Edwin Strickland, F.R.S. After Lady Jardine's death he married the daughter of the Rev. W. Symons, the well-known geologist. Sir William Jardine was a Fellow of the Royal Society and of the Royal Society of Edinburgh, as well as of many other learned bodies, and, until the last few years, was a constant attendant at the meetings of the British Association, in the affairs of which he had interested himself from its foundation.

LECTURES TO WOMEN ON PHYSICAL SCIENCE

II.

Prof. Chrschtschonovitsch, Ph.D. "On the C. G. S.[1] *system of Units." Remarks submitted to the Lecturer by a Student.*

PRIM Doctor of Philosophy
From academic Heidelberg!
Your sum of vital energy
Is not the millionth of an erg.[2]
Your liveliest motion might be reckoned
At one tenth-metre[3] in a second.

"The air," you said, in language fine
Which scientific thought expresses—
"The air (which with a megadyne[4]
On each square centimetre presses)—
The air, and, I may add, the ocean,
Are nought but molecules in motion."

Atoms, you told me, were discrete,
Than you they could not be discreeter,
Who know how many millions meet
Within a cubic millimetre;
They clash together as they fly,
But *you!* you dare not tell me why.

Then, when, in tuning my guitar,
The intervals would not come right,
"This string," you said, "is strained too far,
'Tis forty dynes,[5] at least, too tight."
And then you told me, as I sang,
What over-tones were in my clang.[6]

You gabbled on, but every phrase
Was stiff with scientific shoddy;
The only song you deigned to praise
Was "Gin a body meet a body;"
And even there, you said, collision
Was not described with due precision.

"In the invariable plane,"
You told me, "lay the impulsive couple;"[7]
You seized my hand, you gave me pain,
By torsion of a wrist too supple.
You told me, what that wrench would do;
"'Twould set me twisting round a screw."[8]

[1] C. G. S. system—the system of units founded on the centimetre, gramme, and second. See Report of Committee on Units: Brit. Ass. Report for 1873, p. 222.

[2] Erg—the energy communicated by a dyne acting through a centimetre. See Note 5.

[3] Tenth-metre = 1 metre × 10^{-10}.

[4] Megadyne = 1 dyne × 10^{6}. See Note 5.

[5] Dyne—the force which, acting on a gramme for a second, would generate a velocity of one centimetre per second. The weight of a gramme is about 980 dynes.

[6] See "Sound and Music," by Sedley Taylor, p. 89.

[7] See Poinsot, "Théorie nouvelle de la rotation des corps."

[8] See Prof. Ball on the Theory of Screws: Phil. Trans., 1873.

Were every hair of every tress
Which you, no doubt, imagine mine,
Drawn towards you with its breaking stress,
A stress, say, of a megadyne,
That tension I would sooner suffer
Than meet again with such a duffer! $\frac{dp}{dt}$

NOTES

We understand that the Admiralty have appointed a committee, consisting of Admiral Sir Leopold M'Clintock, Admiral Sherard Osborn, Admiral Richards, and Capt. Evans, the Hydrographer, to advise them on all points connected with the equipment and *personnel* of the Arctic Expedition. The first point has been to select suitable vessels, and last week Sir Leopold M'Clintock proceeded to the northern ports to examine the whalers. It is probable that one steam whaler will be purchased, while a vessel of the *Lyra* class may perhaps be selected for the advanced ship. Both vessels will be strengthened and fitted out at Portsmouth, under the immediate superintendence of Sir Leopold M'Clintock. It is a most fortunate circumstance that the great arctic explorer, the discoverer of arctic sledge travelling, should be Admiral-Superintendent at this juncture, and that the expedition should have the advantage of being equipped, in all its details, under his vigilant supervision. The next point will be the selection of a leader, and we believe that the decision will be formed within a few days. Little doubt is entertained among naval men that the choice will fall upon Commander A. H. Markham, who acquired a knowledge of ice navigation during a cruise in Baffin's Bay and Prince Regent's Inlet last year, and who is universally considered to have all the qualifications for that important post. The number of volunteers among lieutenants, sub-lieutenants, and men is extraordinary, and is daily increasing. The committee will certainly have a wide field for selection.

It is authoritatively announced that the reward of 2,000*l.* offered some years ago by Lady Franklin for the recovery of the official records of her husband's expedition still holds, and that over and above she will be prepared to remunerate anyone who may succeed in recovering them for any outlay to which his research may subject him.

A Physical Observatory is soon to be established in Paris, and a recent vote of the Academy appointing a commission to report on the subject will not be lost. It is said that M. Janssen is to be the head of the establishment, in which solar photography will be practised on a large scale. It is also supposed that the Observatory is to be ready by the time M. Janssen returns from Yokohama with the instruments.

M. Bertrand has been elected perpetual secretary of the Paris Academy of Science by thirty-three votes out of forty-nine. M. Faye had only thirteen votes; the other three were lost. The Chair of the Institute of which M. Bertrand is the president being thus vacated, the vice-president, M. Fremy, will preside over the sittings; M. Bertrand being moreover a member of the Section of Geometry, an election to that section will take place very shortly. He will probably be succeeded by M. Mannheim, his pupil, now a professor in the Polytechnic School and a captain in the Engineers' service. M. Mannheim is well known in England as a mathematician.

The recent election of a perpetual secretary of the Paris Academy of Sciences is the first serious competition since Condorcet was elected to fill the place vacated by the voluntary retirement of De Faudry. It is curious that the Condorcet election took place just a century ago, in 1774. Condorcet was supported by D'Alembert and opposed by Buffon, who supported Bailly, the astronomer. The contest of 1874 is between an astronomer, Faye, and a geometer, Bertrand. Condorcet was regarded as a geometer, as he had written a work on differential calculus. The academical regulations state that at least two-thirds of the members of the Academy must take part in a scrutiny, in order that it may be deemed valid.

The death is announced, on the 10th inst., of Dr. Friedrich Rochleder, Professor of Chemistry in the University of Vienna.

We are glad to notice that Mrs. Annie Mather, of Longridge House, near Berwick-on-Tweed, has handed over to the treasurer of the Newcastle College of Physical Science the munificent sum of 1,000*l.* for the founding of a scholarship or scholarships, to be called "The Charles Mather Scholarship," and to be attached to the College in perpetuity. The details of the examination and the mode of carrying out the bequest are left to be settled by the Council, subject to the approval of the donor or her advisers.

H.R.H. the Duke of Edinburgh has consented to take the chair at a meeting to be held in London on Dec. 7, in promotion of the scheme for the extension of the buildings of Edinburgh University.

The Council of Marlborough College has recently decided to erect a laboratory and science lecture-room. The ground-floor of the building will contain the museum of the Marlborough College Natural History Society. Mr. Street will be the architect.

The German Emperor has conferred on Dr. Samuel Birch, of the British Museum, the Order of the Crown, Second Class, in recognition of Dr. Birch's presidency of the late International Congress of Orientalists.

An inscription has recently been set up at Galluzzo, near Florence, in memory of the late Prof. Donati, who died of cholera rather more than a year ago on his return from the Meteorological Congress at Vienna. In consequence of the strict sanitary laws in force within the city of Florence, the body was buried privately. The interment took place at night, in the small Campo Santo attached to the church of Galluzzo, not far from the new Observatory at Arcetri, in the erection of which the last three years of his life had been expended. The Commune of Galluzzo were anxious to do honour to the illustrious man, and have, at the public expense, erected a marble tablet with the inscription—

Giambattista Donati
Astronomo
nato in P.sa il xvi. di Decembre MDCCCXXVI
scoprì più Comete
studiò con lo spetroscopio perfezionato da lui
la luce stellare
ne chiarì il fenomeno della scintillazione
ebbe il concetto di una meteorologia cosmica
Curò l'edificazione del nuovo Osservatorio
su la collina di Arcetri illustrata da Galileo
del quale continuava la bella scuola
quando immatura morte il xx. di Sett. MDCCCLXXIII
lo chiuse nell' angusta fossa
che il Comune del Galluzzo
onorò di questa Memoria

On the day appointed for its inauguration the rain poured in torrents, but the church of Galluzzo was crowded during the performance of a Requiem Mass, after which the congregation stood around the tomb, where speeches were made, and representatives from the Observatories of Padua and Rome presented garlands of flowers.

At the meeting of the Geographical Society on Monday, Sir Henry Rawlinson, after expressing his gratification at the decision

of Government with regard to an Arctic Expedition, stated that he had that day heard that Col. Gordon was in Gondokoro on Sept. 5, and that he then had the sections of his steamer destined to navigate the Albert N'yanza at Mount Regiaf, below the falls, having full confidence of getting them transported to the smooth waters of the Upper Nile, beyond the falls, in a fortnight from that time.

We are glad to hear that 420 teachers have this year joined the classes of the Charterhouse Teachers' School of Science.

Mr. Bellamy, F.R.C.S, commenced his course on Artistic Anatomy, at South Kensington, on Tuesday the 17th inst.

The Royal Irish Academy has just published No. 9, vol. i., Ser. ii. of its Proceedings, which concludes the volume. This number contains eighteen papers read before the Academy during the last session, among which are several by Prof. Macalister on the myology of the gorilla, the civet, the tayra, and on the anatomy of the rare *Chæropsis libernensis* and *Aonyx leptonyx*; by Mr. Mackintosh, on the myology of the genus Bradypus; by Messrs. Draper and Moss, on the forms of selenium; and by Mr. Hardman, on a substitution of zinc for magnesium in minerals. It is proposed for the future to publish the Scientific Proceedings of the Academy three times each year. The part to appear January 1875, to contain the Proceedings for November and December 1874; that in April 1875, the Proceedings for January, February, and March 1875; and that in July 1875, the remaining portion of the business for the session 1874—75. The Minutes of the Proceedings, to be published each month during the session, will contain the titles of papers read, list of donations, &c.

We have just received an important memoir on the embryology of the Ctenophoræ, by Prof. Alexander Agassiz. Although read before the American Academy of Arts and Sciences in November 1873, this memoir was only published at Cambridge, Mass., early in September last, giving a *résumé* of what was known on the subject, and calling attention to the importance of Allman's contributions to this subject, which, from the want of figures, have been too frequently overlooked. Agassiz describes the different stages in the development of *Idyia roseola*, and when discussing the systematic position of the Ctenophoræ, which can now, from our greater knowledge of their embryology, be treated of more intelligently, he proceeds to criticise "the special interpretation of fanciful affinities and homologies existing only in forms conjured up by Ernst Hæckel's vivid imagination," and concludes that Hæckel's "assumptions, which form the basis of his Gastræa theory, are totally unsupported, and the theory must take its place by the side of other physio-philosophical systems."

The great success of the season in the theatres of Paris is the "Tour du Monde in Eighty Days," a scientific play, written by M. Jules Verne, well known as the author of several fantastical scientific productions. Boxes are let many days in advance and sold at more than double the usual price.

The *Journal of the Society of Arts* states that M. Mège Mouriès, after analysing butter, has succeeded in making it synthetically. This imitation butter, recognised by the Conseil d'Hygiène as indistinguishable from real butter, is finding its way into the Paris markets at half the present price of real butter.

We have received Part II. of vol. vii. of the *Transactions of the Scottish Arboricultural Society*, which contains a number of valuable papers connected with arboriculture.

M. Alix has taken his degree of Doctor by sustaining a *thèse* on the Vol des Oiseaux (the flight of birds). The *thèse* is a large 8vo volume of 380 closely-printed pages, with many plates, and will be published by Victor Mollaux.

Mr. A. W. Chase communicates an interesting fact in connection with an account of the destruction of fish on the Oregon coast by means of the explosion of nitro-glycerine. In this he remarks that some of the fish are killed outright by the explosion, while others appear to be simply stunned; and that in several instances, after having fish apparently dead for half an hour, scaled, the intestines taken out, and prepared for cooking (the head, however, remaining on the body), they began to flop around as briskly as if just taken from the water.

The Municipal Council of Paris has voted that a commemorative medal be given to each aëronaut who conducted a balloon out of Paris during the siege.

The number of adult pupils who are attending the evening lectures established by the Municipal Council of Paris is 14,000, and it is expected that the number will rise to 20,000, in 1875. The number of candidates for the diploma of teacher or keeper of *Salle d'Asyle* is also rapidly enlarging. Last year it was 2,564; this year it is 3,100, both numbers including females. The number of candidates for a certificate of *études primaires* (honours of primary course of education) was 5,028.

Private letters from America announce that the proprietors of the *Great Eastern* are engaged in discussing a most extraordinary proposal. The great ship, it is said, is to be anchored in Philadelphia Harbour during the Centennial Exhibition, and to be made a great floating hotel, where 5,000 persons can be comfortably accommodated.

Siege balloons have been given by the Postal administration to the French War Office, which has established a Balloon Committee. The head of that institution is Col. Laussedat, of the National Engineers. The balloons are now being repaired at the Hôtel des Invalides, by Jules Godard, the youngest member of the celebrated Godard aëronmautical family.

M. Oppolzer has been appointed an Officer in the Legion of Honour for his share in the determination of the Vienna and Bregenz longitude. Two astronomers of the Paris Observatory have been promoted to the Francis-Joseph Order for the same work, one of them having been knighted, and the other, who was already a knight, having been made an Officer.

At the special meeting of the Council of the Victoria (Philosophical) Institute, held preparatory to the commencement of the session in December, Mr. C. Brooke, F.R.S., in the chair, the election of twenty-five members took place. It was stated that papers by the following authors would be announced in a few days:—Professors Challis, Birks, Palmer, Nicholson, and J. W. Dawson; Mr. C. Brooke, F.R.S., Mr. J. Howard, F.R.S., Dr. C. B. Radcliffe, and the Rev. Dr. Irons.

Principal Tulloch, of St. Andrew's University (N.B.), the *British Medical Journal* states, in a recent conference with Provost Cox and Mr. Henderson of Dundee, on a proposal to erect a College for that town, to be affiliated with the University, decided that, for the present, the scheme was impracticable on account of the enormous expense which it would entail, 150,000*l.* at least. In the meantime, courses of lectures under the auspices of the University were arranged to be delivered in Dundee.

We are pleased to see that the *Feuille des Jeunes Naturalistes*, a little scientific serial which was noticed in these columns on its first appearance in 1870, has entered on its fifth year of existence. Founded by M. Ernest Dollfus, of Mulhouse, an enthusiastic young naturalist of eighteen, it has been maintained with unflagging spirit, has met with fair commercial success, and has carried a love for natural history into many French schools, eliciting from some of the older pupils very creditable papers. The number before us contains a touching biography of M. Ernest Dollfus, who died last year. We heartily wish success to a practical and persevering enterprise.

THE new and revised edition of Griffith and Henfrey's "Micrographic Dictionary" is advancing rapidly towards completion, three numbers having been published during the last three months, bringing the work down as far as "Skin;" and it is announced that the publication will now in all probability be continued without intermission till its completion. This is most desirable, considering, in the present state of science, how short a time it takes for a work of this kind to become out of date, and it is already three years since the commencement of the publication of this edition.

A MOVEMENT is on foot at the Cape of Good Hope to introduce salmon and trout into the rivers of that colony; and subscriptions are being made with the view of practically testing the idea. The only obstacle seems to be in the temperature of the water. The latitude of the Cape may be roughly taken at from 28° to 35° S., which is just within the Tropic of Capricorn, and about the same as New South Wales. These latitudes are much lower than the corresponding portions of the northern hemisphere in which trout, and specially salmon, are generally found, and we doubt whether the climate would be found suitable for them. No part of New Zealand is further north than about 35° S.; and it has not yet been proved that salmon will live in the warmer parts of that country. Still, the practical test will be in the transport of salmon to the Cape, and if the experiment succeeds, the acquisition will be well worth the risk.

THERE was a shock of earthquake at Innsprück last Thursday.

STRONG shocks of earthquake were felt on the morning of the 16th inst. at Smyrna.

WE hear that Mr. Alexander Agassiz has just started on an expedition of several months' duration to South America, with the object of exploring and investigating the natural history of Lake Titîcaca, and collecting antiquities from the surrounding country for the Peabody Museum.

WE are informed that in the newly-disposed Indian Museum Dr. Forbes Watson is appointed director; Dr. Birwood, late honorary secretary to the Victoria and Albert Museum, Curator of the Museum and Assistant Reporter on the Products of India; and Mr. F. Moore, who, in conjunction with the late Dr. Horsfield, prepared the catalogue of the mammals and birds of the Museum when it belonged to the East India Company, Assistant Curator together with Dr. Cooke and Lieut. Royle.

THE *Daily Telegraph* of Tuesday contains a long and interesting letter, dated Zanzibar, Oct. 19, from Mr. H. M. Stanley, the joint commissioner of that paper and the *New York Herald* to East Africa, principally in connection with the suppression of the slave trade. The letter consists mainly of an account of Mr. Stanley's journey up one of the ten mouths of the river Rufigi as far as Kisu, fifty miles from the sea. Mr. Stanley gives a glowing account of the river and the country through which it flows, and thinks its value, from a commercial point of view, cannot be too highly estimated. He corrects the accounts of previous travellers, and a map of the delta accompanying the letter professes for the first time to lay down correctly the various channels by which the river discharges its waters.

THE additions to the Zoological Society's Gardens during the past week include two Muntjacs (*Cervulus*?) from Formosa, presented by Mr. W. P. Galton; a Common Kestrel (*Tinnunculus alaudarius*), European, presented by Miss M. Truefitt; a Roseate Cockatoo (*Cacatua roseicapilla*) from Australia, presented by Mr. H. I. Aveling; a Pomerine Skua (*Lestris pomarinus*), European, new to the collection, purchased; a Black-eared Marmoset (*Hapale penicillata*) from South-east Brazil, deposited.

SCIENTIFIC SERIALS

THE *Transactions of the Linnean Society*, vol. xxx., part 2, is almost entirely occupied by Mr. Miers' paper On the Lecythidaceæ. The author prefers Lindley's proposal of erecting this group into a distinct order rather than making it a sub-tribe of Barringtonieæ, itself a tribe of Myrtaceæ, as Bentham and Hooker have done in their "Genera Plantarum." The order will then be characterised by its alternate impunctate leaves, epigynous stamens, petaloid appendage to disc on which the stamens are seated, and peculiar fruits and seeds very different from those of Myrtaceæ, and will consist of the following twelve genera:—*Gustavia*, Linn. (2 sp.); *Couroupita*, Aubl. (9 sp.); *Bertholletia*, H. and Bonpl. (2 sp.); *Lecythis*, Linn. (42 sp.); *Chytroma*, nov. gen. (Lecythis in parte auct., 25 sp.); *Eschweillera*, Mart. (46 sp.); *Jugastrum*, nov. gen. (Lecythis in parte auct., 6 sp.); *Couratari*, Aubl. (8 sp.); *Cariniana*, Casar. (7 sp.); *Allantoma*, nov. gen. (12 sp.); *Grias*, Linn. (4 sp.); and *Cercophora*, nov. gen. (1 sp.) Many of the species are now described for the first time, and the paper is illustrated by thirty-three beautiful plates, illustrative of each of the genera, and of the fruits and seeds of a large number of the species. The part contains also the Rev. O. P. Cambridge's "Systematic List of the Spiders at present known to inhabit Great Britain and Ireland:" 78 genera and 457 species.

THE *Journal of Botany* for the four months, August to November, 1874, contains the following among the more important original papers:—In descriptive phanerogamic botany, Mr. W. P. Hiern contributes Notes on Ebenaceæ, with description of a new species; Dr. H. F. Hance, a description of some Asiatic Corylaceæ; a paper On a small collection of plants from Kinkiang, and another On three new Chinese *Calami*; Mr. J. G. Baker, a paper On the genus *Androcymbium* (Colchicaceæ), with description of seven new species; a description of a new species of *Heleniopsis* (Colchicaceæ) from Formosa; and an article On the *Alliurus* of India, China, and Japan; and Dr. J. Müller describes a number of new Euphorbiaceæ collected by Dr. Lorenz in the Argentine Republic.—In cryptogamic botany, Mr. E. M. Holmes describes and draws a very rare British moss, *Dicranum flagellare*; the Rev. J. M. Crombie also describes and draws a new genus of lichens, *Phycographa*, Nyl., and gives a valuable revision of the British Collemacei.—In geographical and local botany, Miss E. Hodgson gives a sketch of the botany of North or Lake Lancashire; Mr. J. F. Duthie a very interesting paper On the botany of the Maltese Islands in 1874; Mr. T. R. Archer Briggs, Notes on some plants of the neighbourhood of Plymouth; and the editor completes his Botanical Bibliography of the British Counties.—In each number there are also, in addition, a number of short notes and queries, extracts and abstracts of important papers published elsewhere, and reviews of books. The editor continues the extremely useful practice of giving a list of the botanical papers in each month's home and foreign journals.

Astronomische Nachrichten, Nos. 2,010 and 2,011, contain a paper by H. J. H. Groneman, on his theory of the aurora. He goes into the questions of the annual variation and the eleven-year period, together with its height and magnetic effects.—In No. 2,012 there is a letter from Stephen Alexander on the observation of the varying brightness of Jupiter's satellites as seen in transit, and he discusses M. Flammarion's explanation of this phenomenon.—J. G. Galle contributes a paper on the observations of the planet Flora, made by Dr. Gould and contained in this number, and discusses them with reference to their giving a value of the solar parallax.—In No. 2013, Dr. Holetschek gives an hypothetical ephemeris for the planet Peitho (118) from Oct. 7 to Nov. 12, for the purpose of recognising the same.—A. Grützmacher gives position observations of Borrelly's comet, made during August.—Dr. Holetschek has estimated the orbit of Comet I., 1871, and contributes details of the orbit. Its period seems to be 5188 years.—C. T. W. Peters gives time observations on the solar eclipse of Oct. 9, 1874.—J. H. Safford sends his computation of the orbit of Alcmene, and an ephemeris for March and April 1875.

Zeitschrift der Œsterreichischen Gesellschaft für Meteorologie, Nov. 1.—In this number we have the first part of an article by Dr. J. Hann, on the laws of change in temperature of ascending currents of air, and some of the consequences thereof. He observes that although Poisson's equation, by means of which we may reckon the loss of temperature of ascending air by expan-

sion, has long been known, it has not been made full use of in discussing atmospheric phenomena, such, for example, as the rainfall on mountain slopes. The works of Sir W. Thomson, Reye, and Peslin bring us important information regarding the movements of ascending air, for they deduce from the mechanical theory of heat the laws of variation of temperature in ascending and descending dry and moist currents. Calculating in the first instance the fall of temperature in ascending currents where no condensation of moisture takes place, the following result is obtained :—For every 100 metres rise, nearly exactly 1° C. is lost, whatever the original level and temperature may have been ; and conversely for descending currents. If any vapour be present, as long as it is not condensed, it reduces this rate only to a very slight extent. As to the relation between pressure and temperature, a fall of 20 mm. would be accompanied by a decrease of 2·1° C., but since such a fall takes something like twenty-four hours at least, changes of this kind are probably overborne and hidden by simultaneous changes depending on other causes. Secondly, he calculates the loss of temperature in ascending currents becoming saturated and continually losing by condensation part of their moisture. This quantity differs greatly with the amount of vapour originally in the air, and therefore with the temperature at which the air becomes saturated. By means of a formula arrived at by Dr. Hann, a table has been constructed, showing the calculated loss of heat at various pressures, heights, and temperatures. An ascending column of air obeys the law for dry air until it reaches the dew-point ; after this the table should be consulted. Supposing a current at 10° C. to impinge on a mountain slope and rise to the summit, 2,600 metres high, if moist, it loses 14·8° C. ; if dry, 26°. But in descending the lee side it gains, whether moist or dry, 26°. If it was saturated at the mountain top, it will be relatively very dry after its descent ; and if originally moist, about 10° warmer than it was on the windward side.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, Nov. 19.—Dr. G. J. Allman, F.R.S., president, in the chair.—Mr. Daniel Hanbury exhibited specimens of the rose cultivated on the southern slopes of the Balkan for the production of attar of roses, which Mr. J. G. Baker stated to be probably a variety of *R. damascena*.—The President then read a paper on *Stephanoscyphus mirabilis*, the type of a new order of Hydrozoa. The author described a remarkable organism which occurs imbedded in sponges on the southern shores of France. It forms composite colonies which have a general resemblance to a campanularian hydroid, with its cup-like hydrothecæ or so-called polype cells, opening on the surface of the sponge, and, when the animal extends itself, giving exit to a beautiful crown of tentacles. It has, however, though a true hydrozoon, no immediate relation with the campanularians or with any other hitherto recognised order of Hydrozoa ; for the hydrothecæ-like receptacles are occupied not by a hydranth or polypite, but by a body which has all the essential characters of a Medusa ; and the tentacles which are displayed when the animal extends itself are really the marginal tentacles of a Medusa. It is, further, provided with the radiating and circular canals of a true Medusa. The animal is essentially a composite colony of medusiform zooids included in a system of chitinous tubes, from which, like a campanularian hydroid, each zooid has the power of extending itself, and within which it can again retreat. The author regarded the *Stephanoscyphus mirabilis* as the type of a new order of Hydrozoa, to which he assigned the name of "Thecomedusæ." He regarded Stephanoscyphus as affording a convincing proof of the homology on which he had formerly insisted in parallelising the tentacles of a hydranth with the radiating canals of a Medusa. An interesting discussion followed, in which Prof. Busk, Dr. Murie, and others bore testimony to the great importance of Prof. Allman's discovery.—Dr. Masters read a "Monograph of Durioneæ." The paper contains an enumeration of the genera and species of the tribe Durioneæ, together with descriptions of the new species found by Beccari in Borneo, &c. It is accompanied by some remarks on the morphology and geographical distribution of the group. In both respects the group is very distinct. The peculiar scaly pubescence, the compound stamens, the (in some cases) very peculiar anthers, and the muricate fruits, all constitute remarkable features. The question of "divided" or "compound" stamens, which has of late been re-discussed by Chatin, is alluded to, with the result that the author adheres to his previously expressed views on the subject—views, moreover, supported by those of Payer, Sachs, Baillon, Van Tieghem, and others. The nature of the petals in Malvales in general is also touched on ; sometimes these appear to be autonomous organs, while in other cases they seem to form part and parcel of the staminal phalanges. (For fruit of the Durioneæ as an esculent, see Wallace, and "Treasury of Botany," art. "Durio.")

Chemical Society, Nov. 19.—Prof. Odling, F.R.S., president, in the chair.—Dr. C. R. A. Wright read a paper on the action of organic acids and their anhydrides on the natural alkaloids, Part II., by himself and Mr. Beckett ; being a continuation of that which he brought before the Society at the last meeting.—Prof. W. K. Clifford then made a communication On general equations of chemical reactions, proving mathematically, from the kinetic theory of gases, the generally adopted method for expressing chemical reactions. An interesting discussion ensued, after which the following papers were read :—On propionic coumarin, and some of its derivatives, by W. H. Perkin, F.R.S. ; On the composition of autunite, by Prof. A. H. Church ; and the action of bromine on protocatechuic acid, gallic acid, and tannin, by J. Stenhouse, F.R.S.

Zoological Society, Nov. 17.—Mr. George Busk, F.R.S., in the chair.—The Secretary exhibited on behalf of the Rev. J. S. Whitmee an egg of *Pareudiastes pacificus*, and an accompanying egg of the Samoan Porphyrio.—A communication was read from Sir Victor Brooke, Bart., containing some remarks on the identity of a certain deer in the Society's collection, which had been determined as *Cervus savannarum*.—A series of eggs of Megapodes (*Megapodius*) transmitted by Mr. John Brazier, was exhibited. These had been obtained from different islands of the Solomon group.—Mr. R. B. Sharpe also exhibited some Megapodes' eggs from the southern part of New Guinea.—Prof. Mivart read a paper on the axial skeleton of the Struthionidæ, and pointed out that judging, by the characters of the axial skeleton, the Emeu presents the least differential type ; from which Rhea diverges most on the one hand and Apteryx on the other ; that the resemblance between Dromæus and Casuarius is exceedingly close, while the axial skeleton of Dinornis is intermediate between that of Casuarius and Apteryx ; its affinities, however, with the existing New Zealand form very decidedly predominating.—A communication was read from Major H. H. Godwin-Austen, describing five new species of Helicidæ, of the sub-genus Plectopylis, from the Khasi and Naga Hills, from Darjeeling and from the Burmese region.—Mr. R. Bowdler Sharpe read a paper on the larks of Southern Africa, in which an attempt was made to reduce into order the numerous genera and species of this difficult group.—A communication was read from Dr. J. Anderson, pointing out that his *Macacus brunneus* was truly distinct from *M. arctoides* of Geoffr. St. Hilaire.—A communication was read from the Count Turati and Dr. T. Salvadori, describing a new Trogon of the genus Pharomacrus, proposed to be called *P. xanthogaster*.—Dr. Albert Günther read a description of a new species of kangaroo from North-west Australia, proposed to be called *Halmaturus apicalis*.—Mr. P. L. Sclater read a notice of some specimens of the Black Wolf of Thibet, now or lately living in the Society's menagerie.—Mr. H. E. Dresser exhibited eggs of the various European species of Hypolais, together with those of *Acrocephalus streperus* and *A. palustris*, and pointed out that these two groups (Hypolais and Acrocephalus) approach each other in their eggs as well as in other characters, the two nearest allied in each group being *Hypolais rama* and *Acrocephalus palustris*.—Mr. W. T. Blanford read a notice of two new Uromasticine lizards from Mesopotamia and Southern Persia, proposed to be called *Uromastix microlepis* and *Centrotrachelus loricatus*.—A second paper by Mr. Blanford contained descriptions of two new species of ichneumon, and of a hare collected by Mr. F. Day in Sind, and new to the Indian fauna. One of the former and the hare were believed to be new to science, and were called *Herpestes ferrugineus* and *Lepus dayanus*.

Meteorological Society, Nov. 18.—Dr. R. J. Mann, president, in the chair.—The President read a "Report concerning the meeting of the Conference on Maritime Meteorology in London, August 31, 1874," which he had attended as the representative of the society.—At the request of the president, Mr. R. H. Scott gave a brief account of the recent meeting of the Permanent Committee of the Vienna Congress at Utrecht.—The following papers were then read :—On the weather of thirteen

springs, by R. Strachan, F.M.S.—Table for facilitating the determination of the dew-point from observations of the dry and wet bulb thermometers, by William Marriott, assistant secretary. The chief feature of this table is, that it gives, for the difference between the readings of the dry and wet bulb thermometers, the amount to be subtracted from the reading of the *wet* thermometer instead of from that of the *dry*, as is necessary with the other tables now in use; thus effecting a saving of time of more than one-third of that required by the ordinary method.—On the heat and damp which accompany cyclones, by the Hon. Ralph Abercromby, F.M.S.

Royal Horticultural Society, Nov. 11.—Scientific Committee.—A. Murray, F.L.S., in the chair.—Specimens of the Coffee Fungus (*Hemileia vastatrix*) were shown, and an extract from a letter of Dr. Thwaites on the same subject was read, in which it was stated that the periodicity of the worst phase of the disease had now been demonstrated. Flowers of sulphur, Dr. Thwaites thought, would be a useful but impracticable remedy. The filaments produced by the spores of *Hemileia* penetrate the stomata of the leaf from the outside. It was difficult before to understand what should determine the outbreak of the disease in certain parts of the leaves, the intermediate parts seeming to be quite free from it.—The Rev. M. J. Berkeley showed roots of apple affected with American blight, *Eriosoma lanigera*.—Pears were sent by Mr. H. Webb, the cracking of which Mr. Berkeley attributed to *Spilocæa pomi*, Fr., which he regarded as a state of *Helminthosporium pyrorum*.—Dr. Gilbert contributed, on the part of J. B. Lawes, F.R.S., a note on the occurrence of fungi on the various plots devoted to experiments with different manures on permanent meadow-land at Rothamstead, Herts. The general conclusion appeared to be that fungi flourished the best where the development of the grasses was the least, and where the limited growth of these was due to a deficient supply for their requirements of nitrogen or of potash, or of both. The dry substance of fungi appears to consist of from $\frac{1}{4}$ to $\frac{1}{5}$ of albuminoids, yet, as in the case of the highly nitrogenous leguminous crops, direct nitrogenous manures, such as ammonia salts or sodium nitrate, do not seem to be specially favourable to their growth. The dry substance of fungi contains 8 to 10 per cent. of ash, of which 80 per cent. is potassium phosphate. Yet the greatest development of fungi was on plots on which, measured by the requirements of grasses, potash was relatively deficient.—Dr. Voelcker stated that fairy rings occur on poor pastures, and the best mode of extirpating them consists in the application of nitrogenous manures.—Mr. Renny thought that rank-growing grass was not nearly so favourable for the growth of fungi as old pasture or common.

Entomological Society, Nov. 2.—Sir Sidney Smith Saunders, president, in the chair.—Mr. Stevens exhibited three specimens of *Deiopeia pulchella* taken at Arundel and Deal. Prof. Westwood remarked that the late Lieutenant-General Hearsey had found this insect very destructive to gardens in India.—Mr. Bond exhibited specimens of rare Lepidoptera; amongst them were *Sesia culiciformis* (with yellow bands), *Limacodes asellus*, *Nola albulalis*, and *Pterophorus rhododactylus*.—Mr. Jenner Weir exhibited specimens of *Mantis religiosa*, with some egg-cases taken by himself at Meran, in Tyrol.—Mr. McLachlan exhibited a printer's block (such as is used for printing posters), attacked by a species of Anobium, and he was informed that the insect was causing serious damage to the printer's stock. The wood was believed to be pear-tree. He had recommended soaking them in carbolic acid and water.—Dr. Sharp communicated "Descriptions of some new genera and species of Pselaphidæ and Scydmænidæ from Australia and New Zealand." He added some remarks respecting the importance of gaining a knowledge of the New Zealand fauna, and commented on the probable extinction of many of the species at no very distant period.—Mr. Darwin communicated some remarks by Mrs. Barber, of Griqualand, South Africa, on the larva of *Papilio nireus*, and especially with regard to the colour of the pupa in connection with the objects on which it was placed, it appearing to assume a protective resemblance to the leaves or other adjacent objects. A discussion took place between several of the members as to whether, as suggested by Mrs. Barber, some photographic influences might be at work; but Mr. Meldola stated that no known substance retained, permanently, the colour reflected on it by adjacent objects; but that there was no difficulty in believing that larvæ might become affected in colour by the colouring matter of the food-plant, since chlorophyll in an unaltered condition had been found in the tissues of green larvæ.—Mr. Ogier Ward sent some notes on a spider's nest found in a quarry at Poissy, near the Seine, with some remarks thereon by Mr. C. O. Waterhouse.—Mr. Butler communicated "Descriptions of three new species and a new genus of Diurnal Lepidoptera from West Africa, in the collection of Mr. Andrew Swanzy."—Mr. C. O. Waterhouse read "Notes on Australian Coleoptera, with descriptions of new species."—Mr. Kirby contributed a review of Boisduval's "Monographie des Agaristidées, published in the *Revue et Magasin de Zoologie*, 1874."—The Rev. R. P. Murray communicated "Descriptions of some new species of Butterflies belonging to the genus Lycæna."

Nov. 16.—J. W. Dunning, M.A., F.L.S., the vice-president, in the chair.—Mr. Higgins exhibited some rare specimens of Cetoniidæ from Borneo, viz., *Lomaptera Higginsii*, O. Janson, and a remarkable Dynastiform insect, named by Count Castelnau *Westwoodia Howittii*; also two smaller specimens, which had been supposed to be females of the last-named species, but were more probably those of an unknown species.—The Secretary exhibited a collection of fine species of Lepidoptera sent by Mr. W. D. Gooch from Natal for determination.—The Rev. O. Pickard-Cambridge sent a note on the curious spider's nest exhibited at the last meeting. It was unknown to him, and had it not been for a remark in Mr. Ward's letter implying that the nest he found belonged to a geometrical web, he should have conjectured that it was the work of an *Agelena*. If, however, the nest was appurtenant to a geometrical web, it must belong to a spider of the family Epëirides. He did not think the sand in the nest was at all designed as ballast, but as a protection from the rays of the sun and also from parasites. Mr. Smith remarked that the mud coating of the nest of *Agelena brunnea* did not preserve that species from parasites, as he had often bred a species of *Pezomachus* from the nests, and he believed, in those cases, the eggs were attacked before the mud coating was added.—Mr. Champion exhibited some rare species of British Coleoptera, viz., *Apion Ryei*, *Abdera triguttata*, *Lymexylon navale*, *Athous subfuscus*, *Silvanus similis*, and *Apion sanguineum*.

Institution of Civil Engineers, Nov. 10.—Mr. Thos. E. Harrison, president, in the chair.—"On the Nágpūr Water-works; with observations on the rainfall, the flow from the ground, and evaporation at Nágpūr; and on the fluctuation of rainfall in India and in other places," by Mr. Alex. R. Binnie, M. Inst., C.E. From a study of the records of rainfall at Calcutta, Bombay, Madras, Nágpūr, Mauritius, Barbadoes, Adelaide, Hobart Town, Cape Town, New York, Rome, Greenwich, New Bedford, U.S., and Prague, the author deduced that the fluctuations were similar in kind, and that they only differed slightly in amount.

MANCHESTER

Literary and Philosophical Society, Nov. 3.—Rev. Wm. Gaskell, vice-president, in the chair.—On the corrosion of leaden hot-water cisterns, by Prof. H. E. Roscoe, F.R.S.—On an improvement of the Bunsen burner for spectrum analysis, by Mr. F. Kingdon, assistant in the Physical Laboratory, Owens College. The students in the Physical Laboratory of Owens College having occasionally experienced some difficulty in obtaining the spectra of some salts with the ordinary Bunsen, through apparently a deficiency of pressure in the gas, it occurred to me that the amount of light even at this deficient temperature might be increased by multiplying the number of luminous points. This is accomplished by broadening out the flame of the Bunsen, that is, causing the gas to issue through a narrow slit instead of a round hole. We have, so far, only made a rough experiment, the slit being about $\frac{1}{8}$ in. long and $\frac{1}{4}$ in. wide. The result is, as expected, a more brilliant spectrum.—Some notes on Pasigraphy, by Mr. Henry H. Howorth, F.S.A.—On the existence of a lunar atmosphere, by Mr. David Winstanley.

GLASGOW

Geological Society, Nov. 12.—Mr. A. E. Wünsch, vice-president, in the chair.—The Chairman gave a preliminary notice of an interesting discovery which had recently been made in Arran, during a joint exploration of the northern part of the island, in company with Mr. James Thomson, F.G.S. In the course of their examination of those large masses of red sandstone adjoining the carboniferous series of Arran, whose age and geological position have hitherto been doubtful, they came upon a bed of conglomerate of highly glacial

aspect, enclosing angular fragments of various schistose, volcanic, and limestone rocks; and in the latter Mr. Thomson detected the familiar aspect of carboniferous shells and corals. Having once obtained this clue, it was not difficult to find other beds at higher and lower levels, containing similar traces of carboniferous fossils, thus fixing these massive beds of sandstone as undoubtedly of Lower Permian age.—Mr. J. Young, F.G.S., read a joint paper by himself and Mr. David Robertson, F.G.S., on the Polyzoa and other minute organisms found in the carboniferous limestone shale at Hairmyres, East Kilbride.—Mr. D. Bell described some remarkable glacial mounds seen in the neighbourhood of Balquhidder, on the line of railway between Callander and Killin. At Kinsg-Lubnaig and Callander. Mr. Bell next called attention to another series of mounds presenting similar features, which occur in the "side-glen" called "Glen Buckie," or the Calair Burn, that opens out southward from Balquhidder and leads on to Glenfinlas in the Trossachs. He then referred to some points connected with the silting up of lakes, as presented by Loch Lubnaig and Loch Voil, which were once in all probability united.

BOSTON, U.S.

Natural History Society, March 4.—The president in the chair.—Mr. Bouvé introduced the subject of Dr. Genth's theory of the metamorphism of corundum, which has lately been published, and explained the meaning of the terms "metamorphism" and "pseudomorphism" as used in mineralogy.—Dr. T. Sterry Hunt then spoke on Dr. Genth's researches on corundum and its associated minerals. The speaker, while praising the industry and chemical skill displayed in the paper of Dr. Genth, insisted upon the importance of some clear definitions as to replacement, alteration, and association in the mineral kingdom, for the lack of which he conceived the learned author, in common with many others, had fallen into errors, and had been led to conclusions wholly untenable. He then explained the nature of pseudomorphs. He had not only carefully studied Dr. Genth's paper, but through the courtesy of that gentleman had examined with him the extensive collection of specimens upon which the conclusions announced by Dr. Genth had been based, and while bearing testimony to his accuracy and skill as a chemist and mineralogist, maintained that all of the phenomena in question were nothing more than examples of association and envelopment. All the facts regarding the corundum-bearing veins described by Dr Genth have their parallels in the granitic veins with beryl and tourmaline, so common in Montalban, or White Mountain rocks of North America, and in the calcareous veinstones, with apatite, pyroxene, phlogopite, and graphite, of the Laurentian rocks, both of which classes of veins have elsewhere been described by the author.

PARIS

Academy of Sciences, Nov. 9.—M. Bertrand in the chair.—A telegraphic despatch from M. Janssen, announcing the safe arrival of the Transit of Venus Expedition at Nagasaki, was read.—M. Alph. de Candolle presented a copy of his Report for 1873-74, published as president of the Physical and Natural History Society of Geneva.—The following papers were read:—Researches on the dissociation of crystalline salts, by MM. P. A. Favre and C. A. Valson.—Method employed in seeking the substance the most efficacious against Phylloxera at the viticultural station of Cognac, by M. Max Cornu.—Memoir on the secular inequalities of the major axes of the planetary orbits, by M. Emile Mathieu.—On some geometrical constructions applicable to mirrors and lenses, by M. J. Lissajous.—Preparation and properties of dioxymaleic acid, by M. E. Bourgoin. This acid is prepared by heating Kekule's bibromomaleic acid with silver oxides and water—

$$C_8H_2Br_2O_8 + 2H_2O_2 = 2HBr + C_8H_4O_{12}$$

The new acid is colourlesss crystalline, soluble in water and alcohol, hardly soluble in ether. It presents the triple character of a dibasic acid, a diatomic alcohol, and an unsaturated acid. Its isomer, "tricarbonic acid," obtained from cyanoform, is a tribasic acid.—Trial of comparison between the principal systems of aërial navigation, by M. Duroy de Briugnac.—On the volcanoes of the Isle of Java and their relation with the pentagonal ridge, by M. Alexis Perrey.—Studies relating to Phylloxera. Experiments made on branches of vines immersed in water holding various substances in solution, by M. A. Baudrimont.—A letter from Mdme. Janssen was read, giving details of the effects of the recent typhoon at Hong Kong.—On a formula for transforming elliptic functions, by M. Brioschi.—On the laws of the vibratory motion of tuning-forks; second note by M. E. Mercadier.—On electrostatic induction currents, by M. Neyreneuf.—Action of the electric current on the organs of sensation, by Dr. T. L. Phipson.—Reply to recent note by M. Gernez on supersaturation, by M. Lecoq de Boisbaudran.—New observations relating to the circular compass, by M. E. Duchemin.—Bisulphide of carbon and nitric oxide lamp; application to photography, by MM. B. Delachanal and A. Mermet. The photographic intensity of this lamp is stated to be superior to that of magnesium, to be twice as great as that of the oxyhydrogen light, and three times as great as the electric light. Unlike the electric and magnesium lights, the flame is steady and not liable to sudden extinction.—On the chemical nature of the substances which in the organism give the cross by polarisation, by MM. Dastre and Morat.—Note relating to the inundations of the valley of the Po in 1872, by M. Dausse.—At the beginning of the meeting M. Leverrier presented to the Academy chaps. xix. and xx. of his "Recherches Astronomiques," and a complete theory of the motions of Uranus.

Geographical Society, Nov. 4.—M. Delesse, president.—The Secretary announced that the Abbé Petitot, a missionary who has explored the Mackenzie River, has prepared a map of that little known region.—A letter was read from M. de Lesseps, who states that he has by no means given up the project of a Trans-Asiatic railway. His son has been exploring the Himalayas, and reports on the different routes by which the iron road could be carried.—M. Foucher de Careil presented the Society with a copy of his work entitled "Leibnitz and Peter the Great." The author points out three geographical discoveries which he declares are due to Leibnitz. He shows that it was by his advice that Peter the Great sent out the expedition under Behring, the discoverer of the strait which bears his name. The author also mentions three memoirs by Leibnitz on the determination of longitude according to the variation of the compass, a discovery with which Gauss was credited nearly a century later.—M. Simonin gave details of a journey which he made through the north of the United States, and especially in the region of the Great Lakes.

BOOKS AND PAMPHLETS RECEIVED

BRITISH.—A Course of Qualitative Chemical Analysis: Wm. G. Valentin. new edition (J. and A. Churchill).—Histology and Histo-Chemistry of Man: Heinrich Frey. Translated by Arthur E. J. Barker (J. and A. Churchill).—Post-Tertiary Entomostraca of Scotland: G. S. Brady, C.M.Z.S., Rev. H. W. Crosskey, F.G.S., and David Robertson, F.G.S. (Palæontological Society).—Bacon's Thoughts, Philosophical and Medical: John Dowson, M.D. (H. K Lewis).—Erasmus Darwin: John Dowson, M.D. (H. K Lewis).—Journal of the Society of Telegraph Engineers: Major Frank Bolton and Geo. E. Preece (Spon).—Dental Pathology and Surgery: S. J. A. Salter, M.B, F.R.S. (Longmans).—Doctrine of Energy: D. D. Heath, M.A. (Longmans).—Manchester Historical Recorder (John Heywood, Manchester).

AMERICAN.—Report of the Commissioner of Agriculture, 1872 (Washington, U.S.)—Bulletin of the Buffalo Society of Natural Sciences (Warren, Johnson, and Co., Buffalo, U.S.)—Catalogue of Plants (Army Department, Washington, U.S.)—Report of Ornithological Specimens (Washington, U.S.)

FOREIGN.—Cours de Géologie Comparée: Stanislaus Meunier (Firmin Didot and Co.)—Experimentalphysik: Dr. Adolf F. Weinhold (Leipzig).—Degli Studi Fisici di Ambrogio Fusinieri (Foligno).—Uber die Abhängigkeit des Klimatischen characters der Winde: Dr. W. Köppen (St. Petersburg).

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